Southern Sandoval County Arroyo Flood Control Authority

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Ph (505) 892-RAIN (7246) • Fax (505) 892-7241

December 1, 2022

U.S. EPA, Region 6
Water Quality Protection Division
Operations Support Service (6WQ-O)
1445 Ross Avenue
Dallas, Texas 75202-2733

RE: 2022 Annual Report, NPDES Permit No. NMR04A001

To whom it may concern:

The Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) is pleased to submit the 2022 Annual Report for NPDES Permit No. NMR04A000. SSCAFCA's permit tracking number, as assigned in our letter from EPA "Coverage under Middle Rio Grande (MRG) Watershed Based Municipal Sewer Separate Storm Sewer System General Permit (NPDES No. NMR04A000) is NMR04A001. This permit has been administratively continued for this reporting period. This report covers the period from July 1, 2021 to June 30, 2022.

Materials contained within this transmittal include: 1) our Annual Report compiled using the EPA's suggested Annual Report Format; 2) a 2022 Annual Report Supplement; 3) the volume of trash removed from SSCAFCA-owned facilities and the volume of sediment removed from SSCAFCA's facilities; 4) the Arroyo Classroom 2022 report; 5) the River Xchange 2022 report; 6) annual report for Watershed Stewards senior outreach program; 7) the Summary of Outcomes Report for the Mid Rio Grande Stormwater Quality Team; 8) a summary of dry weather sampling for eColi completed by BEMP during the reporting period; 9) the letter to EPA from permittees regarding administrative continuance of this permit; and 10) a memorandum developed on behalf of the Compliance Monitoring Cooperative for discussing the status of compliance monitoring for this permit. A copy of the memorandum of understanding between SSCAFCA and AMAFCA as well as the letter from EPA authorizing this action are included in this report.

If you have any further questions, please feel free to contact John Stomp at jstomp@sscafca.com or at 505-892-7246.

Sincerely,

David Gatterman, PE
Executive Engineer
SSCAFCA

2022 Annual Report

Reporting Period – July 1, 2021 – June 30, 2022

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Annual Report Format

National Pollutant Discharge Elimination System Stormwater Program
MS4 Annual Report Form

Check box if you are submitting an individual Annual Report with cooperative program elements ☑

Check box if you are submitting an individual Annual Report with individual program elements ☐

Check box if this is a new name, address, etc. ☐

1. MS4(s) Information

Name of MS4: Southern Sandoval County Arroyo Flood Control Authority

Name of Contact Person (First): John
(Last): Stomp
(Title): Field Engineer

Telephone (including area code): 505-892-7246
E-mail: jstomp@sscafca.com

Mailing Address: 1041 Commercial Dr. SE

City: Rio Rancho
State: NM
ZIP code: 87124

What size population does your MS4(s) serve? 101,103
NPDES number:

What is the reporting period for this report? (mm/dd/yyyy) From Jul 1, 2021 to Jun 30, 2022

2. Water Quality Priorities

A. Does your MS4(s) discharge to waters listed as impaired on a state 303(d) list? ☑ Yes ☐ No

B. If yes, identify each impaired water, the impairment, whether a TMDL has been approved by EPA for each, and whether the TMDL assigns a wasteload allocation to your MS4(s). Use a new line for each impairment, and attach additional pages as necessary.

Impaired Water	Impairment	Approved TMDL	TMDL assigns WLA to MS4
Rio Grande, HUC 13020203	eColi	☑ Yes ☐ No	☑ Yes ☐ No
Rio Grande, HUC 13020203	PCB in fish tissue	☐ Yes ☑ No	☐ Yes ☑ No
Rio Grande, HUC 13020203	PCB in water column	☐ Yes ☑ No	☐ Yes ☑ No
Rio Grande, HUC 13020203	Gross Alpha	☐ Yes ☑ No	☐ Yes ☑ No

2. B. Continued

Impaired Water	Impairment	Approved TMDL	TMDL assigns WLA to MS4
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No

C. What specific sources contributing to the impairment(s) are you targeting in your stormwater program?

D. Do you discharge to any high-quality waters (e.g., Tier 2, Tier 3, outstanding natural resource waters, or other state or federal designation)? ☐ Yes ☑ No

E. Are you implementing additional specific provisions to ensure their continued integrity? ☐ Yes ☑ No

3. Public Education and Public Participation

A. Is your public education program targeting specific pollutants and sources of those pollutants? ☑ Yes ☐ No

B. If yes, what are the specific sources and/or pollutants addressed by your public education program?

Pet Waste, flotables, illicit discharges

C. Note specific successful outcome(s) (e.g., quantified reduction in fertilizer use; NOT tasks, events, publications) fully or partially attributable to your public education program during this reporting period.

See outcomes report from the Middle Rio Grande Storm Water Quality Team

D. Do you have an advisory committee or other body comprised of the public and other stakeholders that provides regular input on your stormwater program? ☐ Yes ☑ No

4. Construction

A. Do you have an ordinance or other regulatory mechanism stipulating:

- Erosion and sediment control requirements? ☑ Yes ☐ No
- Other construction waste control requirements? ☑ Yes ☐ No
- Requirement to submit construction plans for review? ☑ Yes ☐ No
- MS4 enforcement authority? ☑ Yes ☐ No

B. Do you have written procedures for:

- Reviewing construction plans? ☑ Yes ☐ No
- Performing inspections? ☑ Yes ☐ No
- Responding to violations? ☑ Yes ☐ No

C. Identify the number of active construction sites $\geq$ 1 acre in operation in your jurisdiction at any time during the reporting period. 2

D. How many of the sites identified in 4.C did you inspect during this reporting period? 2

E. Describe, on average, the frequency with which your program conducts construction site inspections.

All SSCAFCA-owned sites are inspected by SSCAFCA personnel at a minimum weekly. Qualified contractors inspect the

F. Do you prioritize certain construction sites for more frequent inspections? ☐ Yes ☑ No

If Yes, based on what criteria? [ ]

G. ~~Identify which of the following types of enforcement actions you used during the reporting period for construction~~ activities, indicate the number of actions, or note those for which you do not have authority:

☐ Yes	Notice of violation		No Authority	☑
☐ Yes	Administrative fines		No Authority	☑
☐ Yes	Stop Work Orders		No Authority	☑
☐ Yes	Civil penalties		No Authority	☑
☐ Yes	Criminal actions		No Authority	☑
☐ Yes	Administrative orders		No Authority	☑
☑ Yes	Other	Contractual mechanisms for		

H. Do you use an electronic tool (e.g., GIS, data base, spreadsheet) to track the locations, inspection results, and enforcement actions of active construction sites in your jurisdiction? ☐ Yes ☑ No

I. What are the 3 most common types of violations documented during this reporting period?

No violations noted. SSCAFCA has stop work authority on SSCAFCA-owned projects

J. How often do municipal employees receive training on the construction program? As needed

5. Illicit Discharge Elimination

A. Have you completed a map of all outfalls and receiving waters of your storm sewer system? ☑ Yes ☐ No

B. Have you completed a map of all storm drain pipes and other conveyances in the storm sewer system? ☑ Yes ☐ No

C. Identify the number of outfalls in your storm sewer system. 8

D. Do you have documented procedures, including frequency, for screening outfalls? ☑ Yes ☐ No

E. Of the outfalls identified in 5.C, how many were screened for dry weather discharges during this reporting period?

8

F. Of the outfalls identified in 5.C, how many have been screened for dry weather discharges at any time since you obtained MS4 permit coverage? 8

G. What is your frequency for screening outfalls for illicit discharges? Describe any variation based on size/type.

All SSCAFCA facilities are inspected at a minimum twice per year (pre and post monsoon) for a condition of facility assess

H. Do you have an ordinance or other regulatory mechanism that effectively prohibits illicit discharges? ☐ Yes ☑ No

I. Do you have an ordinance or other regulatory mechanism that provides authority for you to take enforcement action and/or recover costs for addressing illicit discharges? ☐ Yes ☑ No

J. During this reporting period, how many illicit discharges/illegal connections have you discovered? 0

K. Of those illicit discharges/illegal connections that have been discovered or reported, how many have been eliminated? 0

L. How often do municipal employees receive training on the illicit discharge program? As needed

6. Stormwater Management for Municipal Operations

A. Have stormwater pollution prevention plans (or an equivalent plan) been developed for:

	Yes	No
All public parks, ball fields, other recreational facilities and other open spaces	☐	☑
All municipal construction activities, including those disturbing less than 1 acre	☐	☑
All municipal turf grass/landscape management activities	☐	☑
All municipal vehicle fueling, operation and maintenance activities	☐	☑
All municipal maintenance yards	☐	☑
All municipal waste handling and disposal areas	☐	☑

Other

B. Are stormwater inspections conducted at these facilities? ☐ Yes ☑ No

C. If Yes, at what frequency are inspections conducted? N/A

D. List activities for which operating procedures or management practices specific to stormwater management have been developed (e.g., road repairs, catch basin cleaning).

Pre and post monsoon inspection and cleaning of flood control facilities

E. Do you prioritize certain municipal activities and/or facilities for more frequent inspection? ☑ Yes ☐ No

F. If Yes, which activities and/or facilities receive most frequent inspections? Dams, ponds, sediment control facilities

G. Do all municipal employees and contractors overseeing planning and implementation of stormwater-related activities receive comprehensive training on stormwater management? ☑ Yes ☐ No

H. If yes, do you also provide regular updates and refreshers? ☑ Yes ☐ No

I. If so, how frequently and/or under what circumstances? All technical staff are encouraged to seek training on storm

7. Long-term (Post-Construction) Stormwater Measures

A. Do you have an ordinance or other regulatory mechanism to require:

	Yes	No
Site plan reviews for stormwater/water quality of all new and re-development projects?	☑	☐
Long-term operation and maintenance of stormwater management controls?	☑	☐
Retrofitting to incorporate long-term stormwater management controls?	☑	☐

B. If you have retrofit requirements, what are the circumstances/criteria?

For all SSCAFCA-owned projects, all site plan reviews

C What are your criteria for determining which new/re-development stormwater plans you will review (e.g., all projects, projects disturbing greater than one acre, etc.)?

All SSCAFCA-owned projects are reviewed.

D. Do you require water quality or quantity design standards or performance standards, either directly or by reference to a state or other standard, be met for new development and re-development? ☑ Yes ☐ No

E. Do these performance or design standards require that pre-development hydrology be met for:

Flow volumes	☐ Yes	☑ No
Peak discharge rates	☑ Yes	☐ No
Discharge frequency	☐ Yes	☑ No
Flow duration	☐ Yes	☑ No

F. Please provide the URL/reference where all post-construction stormwater management standards can be found.

Watershed management plans are located at: https://www.sscafca.org/resources/watershed-management-plans/

G. How many development and redevelopment project plans were reviewed during the reporting period to assess impacts to water quality and receiving stream protection? 65

H. How many of the plans identified in 7.G were approved? 5

I. How many privately owned permanent stormwater management practices/facilities were inspected during the reporting period? 0

J. How many of the practices/facilities identified in I were found to have inadequate maintenance? 0

K. How long do you give operators to remedy any operation and maintenance deficiencies identified during inspections? N/A

L. Do you have authority to take enforcement action for failure to properly operate and maintain stormwater practices/facilities? ☐ Yes ☑ No

M. How many formal enforcement actions (i.e., more than a verbal or written warning) were taken for failure to adequately operate and/or maintain stormwater management practices? 0

N. Do you use an electronic tool (e.g., GIS, database, spreadsheet) to track post-construction BMPs, inspections and maintenance? ☑ Yes ☐ No

O. Do all municipal departments and/or staff (as relevant) have access to this tracking system? ☑ Yes ☐ No

P. How often do municipal employees receive training on the post-construction program? As needed

8. Program Resources

A. What was the annual expenditure to implement MS4 permit requirements this reporting period? 68,048

B. What is next year's budget for implementing the requirements of your MS4 NPDES permit? 80,000

C. This year what is/are your source(s) of funding for the stormwater program, and annual revenue (amount or percentage) derived from each?

Source	Amount $	OR %
Property tax mil levy		100

D. How many FTEs does your municipality devote to the stormwater program (specifically for implementing the stormwater program; not municipal employees with other primary responsibilities)? 1.5

E. Do you share program implementation responsibilities with any other entities? ☑ Yes ☐ No

Entity	Activity/Task/Responsibility	Your Oversight/Accountability Mechanism
See Attached	Storm Water Quality Team	Signed Agreement
See Attached	Compliance Monitoring Cooperative	Signed Agreement
See Attached	Technical Advisory Group	Signed Agreement

9. Evaluating/Measuring Progress

A. What indicators do you use to evaluate the overall effectiveness of your stormwater management program, how long have you been tracking them, and at what frequency? These are not measurable goals for individual management practices or tasks, but large-scale or long-term metrics for the overall program, such as macroinvertebrate community indices, measures of effective impervious cover in the watershed, indicators of in-stream hydrologic stability, etc.

Indicator	Began Tracking (year)	Frequency	Number of Locations
Example: E. coli	2003	Weekly April–September	20
Various (EPA approved analyte list)	2016	Qualifying Events (up to 7)	2
Various (EPA approved analyte list)	2014	Wet season, annually	8
Please refer to attached Annual Report			
or SSCAFCA website for additional			
information			

B. What environmental quality trends have you documented over the duration of your stormwater program? Reports or summaries can be attached electronically, or provide the URL to where they may be found on the Web.

10. Additional Information

Please attach any additional information on the performance of your MS4 program, including information required in Parts I.C and III.B. If providing clarification to any of the questions on this form, please provide the question number (e.g., 2C) in your response.

Certification Statement and Signature

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

☑ Yes ☐ No

Federal regulations require this application to be signed as follows: **For a municipal, State, Federal, or other public facility**: by either a principal executive or ranking elected official.

Signature	Name of Certifying Official, Title	Date (mm/dd/yyyy)
[signature]	DAVID GATTERMAN	12/01/2022

October 5, 2022

2022 Annual Report Supplement (Reporting period 7/1/21 – 6/30/22)
NPDES Permit NMR04A001
Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)

This document is being provided as a supplement to the form that was provided by the EPA as the format for the Annual Report. The supplement is being used to provide more explanation to responses provided in the Annual Report form where specific circumstances of SSCAFCA's status require more information to be provided than is allowed on the form. Additionally, responses to permit required

Section 1, NPDES Number: The pdf form provided by the EPA does not allow for non-numeric data entry in this field. The NPDES number for our permit is NMR04A001

Section 4.A, "Do you have an ordinance or other regulatory mechanism stipulating: erosion control requirements; other construction waste control requirements; requirement to submit construction plans for review; and, MS4 enforcement authority?"

> *Response:* On the form, SSCAFCA has indicated "yes" to all of these program elements. It should be noted that SSCAFCA only has jurisdictional authority over SSCAFCA-owned projects. The indication of "yes" on the Annual Report shall be in the context of SSCAFCA-owned projects only.

Section 4.B, "Do you have written procedures for: reviewing construction plans; performing inspections; and, responding to violations?"

> *Response:* On the form, SSCAFCA has indicated "yes" to all of these program elements. It should be noted that SSCAFCA only has jurisdictional authority over SSCAFCA-owned projects. The indication of "yes" on the Annual Report shall be in the context of SSCAFCA-owned projects only.

Section 4.C, "Identify the number of active construction sites > 1 acre in operation in your jurisdiction at any time during the reporting period"

> *Response:* The number indicated in the provided box is the number of active SSCAFCA construction projects during the reporting year. Since SSCAFCA does not have jurisdictional authority over private development, that type of activity is not covered in our reporting of active construction sites.

Section 4.F, "Do you prioritize certain construction sites for more frequent inspections?"

> *Response:* On the form, SSCAFCA has indicated "no" to this program element. Since SSCAFCA only has jurisdiction over SSCAFCA-owned projects, SSCAFCA inspects these projects with the same priority.

Section 4.H, "Do you use an electronic tool (e.g. GIS, data base, spreadsheet) to track locations, inspection results, and enforcement actions of active construction sites in your jurisdiction?"

> *Response:* On the form, SSCAFCA has indicated "no" to this program element. Since SSCAFCA only has jurisdiction over SSCAFCA-owned projects and since there are relatively few of these projects underway at any one time, the usage of an electronic means of tracking was deemed to be not necessary and would provide more burden than assistance with regard to tracking these program items.

Section 4.I, "What are the 3 most common types of violations documented during the reporting period?"

Response: During the reporting period, SSCAFCA had two active SSCAFCA-owned construction projects. These projects were inspected by SSCAFCA personnel and contractor personnel frequently and no violations were identified during the project.

Section 6.A, "Have stormwater pollution prevention plans (or an equivalent plan) been developed for: All public parks, ball fields, other recreational facilities and other open spaces; all municipal construction activities including those disturbing less than 1 acre; all municipal turf grass/landscape management activities; all municipal vehicle fueling, operation, and maintenance activities; all municipal maintenance yards; and all municipal waste handling and disposal areas?"

Response: On the form, SSCAFCA has indicated "no" to these program elements. SSCAFCA does not currently own or operate any of the types of facilities indicated in the Annual Report form.

Section 6.B, "Are stormwater inspections conducted at these facilities?"

Response: On the form, SSCAFCA has indicated "no" to this program element. Since SSCAFCA does not own or operate any of these facility types, no inspections have occurred.

Section 7.A, "Do you have an ordinance or other regulatory mechanism to require: Site plan reviews for stormwater/water quality of all new and re-development projects; long-term operation and maintenance of stormwater management controls; retrofitting to incorporate long-term stormwater management criteria?"

Response: On the form, SSCAFCA has indicated "yes" on all program elements. SSCAFCA does not have jurisdiction outside of SSCAFCA-owned projects. SSCAFCA does have internal polices directing staff with regard to the program elements. However, SSCAFCA does participate in some plan reviews with the City of Rio Rancho for those developments that may impact SSCAFCA facilities. During this annual report year, SSCAFCA reviewed 65 development plans meeting these criteria and identified Low Impact Development opportunities for 5 of these plans.

Section 7.D, "Do you require water quality or quantity design standards or performance standards, either directly or by reference to a state or other standard, be met for new development and re-development?"

Response: On the form, SSCAFCA has indicated "yes" on this program element. On SSCAFCA-owned projects, SSCAFCA is required by State Law, to abide by the 96 hour rule, requiring all flood control facilities to discharge all detained stormwater within 96 hours. Therefore, all SSCAFCA flood control projects drain within 96 hours.

Section 7.E, "Do these performance or design standards require that pre-development hydrology be met for: flow volumes; peak discharge rates; discharge frequency; and, flow duration?"

Response: On the form, SSCAFCA has indicated "no" on all program elements except for Peak

Discharge Rates. SSCAFCA-owned projects are flood control projects that generate little to no excess stormwater on site as the vast majority (>99%) of these projects are not constructed from impermeable materials. These projects are constructed to manage up-stream flows from development and attenuate the hydrograph so that stormwater can be conveyed safely through downstream facilities. However, SSCAFCA-owned projects are designed to provide for attenuation of stormwater hydrographs from upstream and discharge at historical levels to the greatest extent practicable.

Section 7.G, "How many development and redevelopment project plans were reviewed during the reporting period to assess impacts to water quality and receiving stream protection?"

Response: SSCAFCA reviews development plans in conjunction with the City of Rio Rancho. No assessment of impacts to water quality due to development are not required by the City of Rio Rancho and SSCAFCA does not have regulatory authority to require these. The number indicated is the number of plans that was reviewed by SSCAFCA during the reporting year, including numerous resubmittals.

Section 7.H, "How many of the plans identified in 7.G were approved?

Response: SSCAFCA does not have authority to approve or not approve development plans, however, of the 65 submittals, 5 were ultimately "approved" to where there were no further comments.

Section 7.I, "How many privately owned permanent stormwater management practices/facilities were inspected during the reporting period?"

Response: On the form, SSCAFCA has indicated "0" for this program element. SSCAFCA does not have statutory authority to regulate private development, including regulation of post-development conditions.

Section 7.J, "How many practices/facilities identified in I were found to have inadequate maintenance?"

Response: On the form, SSCAFCA has indicated "0" for this program element. SSCAFCA does not have statutory authority to regulate private development or post-construction conditions in private development. However, SSCAFCA facilities inspected for routine maintenance during the reporting cycle had maintenance needs identified and carried out.

Section 7.L, "Do you have authority to take enforcement action for failure to property operate and maintain stormwater practices/facilities?"

Response: On the form, SSCAFCA has indicated "No" for this program element. SSCAFCA does not have statutory authority to regulate private development or post-construction conditions in private development.

Section 7.N, "Do you use an electronic tool (e.g. GIS, database, spreadsheet) to track post-construction BMPs, inspections, and maintenance?"

Response: On the form, SSCAFCA has indicated "Yes" for this program element. SSCAFCA uses a spreadsheet for reporting maintenance activities to the U.S. Army Corps of Engineers (USACE) as part of the Letter of Permission for maintenance work within the Waters of the United States. SSCAFCA facilities are, for the most part, considered Waters of the United States by the USACE. SSCAFCA also uses electronic inspection forms and a database on maintenance activities for SSCAFCA-owned facilities.

Section 8.A, "What was the annual expenditure to implement the MS4 permit requirements this reporting period?"

Response: On the form, SSCAFCA has indicated a value of $68,048. This funding went toward, dues to the Stormwater Quality Team, expenditures for operating the Arroyo Classroom program in Sandoval County through Cuidad Soil and Water Conservation District, SSCAFCA's contribution to the Compliance Monitoring Cooperative, funding for Senior Citizen outreach program (aka Watershed Stewards), sponsorship of the Xeriscape conference in Albuquerque, purchase or "Poop Fairy" signs, and sponsorship of the Children's Water Festival in Rio Rancho.

Section 8.B, "What is next year's budget for implementing the requirements of your MS4 NPDES permit?"

Response: On the form, SSCAFCA has indicated a value of $80,000. This amount does not include salaries for personnel working on permit compliance issues. There are no projected capital outlay projects targeted at stormwater quality during the 2021-2022 reporting year, hence the reduced number.

October 5, 2022

Facility ID	Watershed	Faclity Name	Latitude	Longitude	Size of Structure (ac)	Length of channels (LF)	Sediment Capacity (CYDS)	Sediment Removed (2022)	Sediment Removal on Earthen Structures	Sediment Removal on Concrete Structures	Erosion Repair and Control	Concrete Repairs	Vegetation Removal/ Management	Manual Trash Removal	Access Control	Bank Restoration	Bags Removed
BA_P0016	La Barranca	Campus Dam aka Upper SLO Dam	35.320872	-106.685623	24		20000		X		X	X	X	X	X	X	
BL_P0003	Black Arroyo	Gateway Pond	35.220651	-106.696681	5.65		800-1200		X		X	X	X	X	X	X	
BL_P0004	Black Arroyo	Tract 17 Pond	35.229243	-106.689473	15.9		20000		X		X	X	X	X	X	X	12
BL_P0006	Black Arroyo	Sugar Channel	35.251406	-106.709973	1.09	3180	3000		X		X		X	X		X	
BL_P0008	Black Arroyo	East Branch Cabezon Channel	35.225510	-106.682751	1.4	1700	40800			X		X	X	X	X		
BL_P0009	Black Arroyo	Trevino Channel (Golf Course to Nickla	35.244348	-106.682540	3.79	1560	8500		X		X		X	X		X	
BL_P0013	Black Arroyo	Sunset Pond & Aldaba Storm Drain	35.261292	-106.711816	5.2		17600		X		X		X	X	X	X	
BL_P0014	Black Arroyo	Ivory Channel	35.243570	-106.713069	0.45	1322	13872		X	X		X	X	X		X	5
BL_P0015	Black Arroyo	Stallion Channel (powerline easement t	35.251489	-106.690107	5.46	2779	12000		X		X		X	X		X	
BL_P0016	Black Arroyo	Stallion Channel (Western Hills to Nickl	35.243476	-106.685574	8.7	3000	20000		X		X		X	X		X	
BL_P0020	Black Arroyo	West Nicklaus Channel (Bogie to Lema)	35.252091	-106.684151	0.94	1100	2500		X		X		X	X		X	
BL_P0021	Black Arroyo	West Nicklaus Channel (Lema to Fairwa	35.249020	-106.684741	1.11	1233	2600		X		X		X	X		X	2
BL_P0022	Black Arroyo	West Nicklaus Channel (Fairway to Cas	35.245777	-106.683746	0.94	1070	2500		X		X		X	X		X	2
BL_P0028	Black Arroyo	West Branch Cabezon Channel	35.219805	-106.686956	14.4	4650	46000			X		X	X	X	X		
BL_P0029	Black Arroyo	Arkansas Channel	35.248559	-106.714724	1.03	4000	1800		X		X		X	X		X	
BL_P0030	Black Arroyo	Rodeo Channel	35.244514	-106.718362	0.66	2860	1200		X		X		X	X		X	
BL_P0031	Black Arroyo	Pecos Channel	35.242861	-106.715212	0.45	1950	900		X		X		X	X		X	
BL_P0032	Black Arroyo	Baltic Channel	35.249277	-106.714133	0.56	2450	1100		X		X		X	X		X	
BL_P0033	Black Arroyo	Bali Channel	35.252893	-106.713577	0.26	1130	600		X		X		X	X		X	
BL_P0034	Black Arroyo	Spur Channel	35.242249	-106.708942	0.31	578	750			X	X	X	X	X	X	X	
BL_P0035	Black Arroyo	Lisbon Channel (Tulip to Tarpon)	35.255490	-106.703876	1.48	4300	5500		X		X		X	X	X	X	
BL_P0036	Black Arroyo	Lisbon Channel (Tarpoon to Southern)	35.245675	-106.708782	1.7	4930	6000		X		X		X	X	X	X	
BL_P0037	Black Arroyo	Lisbon Channel (Southern to Black Arro	35.240557	-106.703944	1.16	1262	4000		X		X		X	X	X	X	
BL_P0038	Black Arroyo	Black Arroyo Wildlife Park	35.233904	-106.700376	77.88		70000				X		X	X	X	X	50
BL_P0039	Black Arroyo	Landing Trail Pond	35.260668	-106.717698	0.91		3000		X		X		X	X	X		
BL_P0040	Black Arroyo	Athens Court Channel						25 Cy	X				X			X	
CA P0013															X		
CA_P0008	Callabacillas	Redwood Pond	35.242594	-106.739582	0.61		980		X		X		X	X	X	X	
CO_P0002	Coronado	Bosque de Bernalillo Water Quality Fa	35.319993	-106.563053	0.25		300		X		X		X	X	X	X	

X = activity authorized by LOP
Highligted = activity completed this reporting year

Facility ID	Watershed	Faclity Name	Latitude	Longitude	Size of Structure (ac)	Length of channels (LF)	Sediment Capacity (CYDS)	Sediment Removed (2022)	Sediment Removal on Earthen Structures	Sediment Removal on Concrete Structures	Erosion Repair and Control	Concrete Repairs	Vegetation Removal/ Management	Manual Trash Removal	Access Control	Bank Restoration	Bags Removed
CO_P0005	Coronado	Joiner Pond Unit 20 Industrial Park	35.321786	-106.570976	5.74		400			X	X	X	X	X	X		
CW_P0009	Corrales	Lower Tree Farm Pond	35.222049	-106.641367	1.57		800		X		X		X	X	X		
CW_P0010	Corrales	Upper Tree Farm Pond	35.226728	-106.650958	1.01		600		X		X		X	X	X		
CW_P0011	Corrales	Urban Pond - Stephanie Rd	35.234689	-106.652281	0.95		600		X		X		X	X	X		
CW_P0012	Corrales	Upper Urban Pond	35.233181	-106.646225	6.63		1200		X		X	X	X	X	X		
CW_P0013	Corrales	Lower Urban Pond	35.226974	-106.636145	0.79		600		X		X		X	X	X		
MO_P0002	Montoyas	Sportsplex Dam	35.259111	-106.666789	33.48		44500		X		X	X	X	X	X	X	
MO_P0012	Montoyas	Harvey Jones Channel Corrales Rd to Ri	35.260526	-106.598557	6.98	5067	77450		X	X	X	X	X	X	X		
MO_P0015	Montoyas	Corrales Heights Dam	35.249818	-106.635630	35		15000		X	X	X	X	X	X	X	X	
MO_P0017	Montoyas	Lomitas Negras NM528 to DCC Inlet	35.271609	-106.613651	28		45673		X	X	X	X	X	X	X	X	
MO_P0021	Montoyas	Lower Montoyas water quality facility	35.256684	-106.617011	35000	30	66000		X	X	X	X	X	X	X		
MO_P0029	Montoyas	Lower Montoyas Water Quality Facility	35.256494	-106.629590	8.91	2155	70000		X		X		X	X	X	X	
MO_P0036	Montoyas	Ponce de Leon trib Montoyas Arroyo t	35.322955	-106.717630	67.3		70000			X	X	X	X	X			
MO_P0037	Montoyas	Dulcelina Curtis Channel	35.260966	-106.613483	2.33	5088	38100			X		X		X	X		
MO_P0039	Montoyas	Northern Blvd Sedimentation Basin	35.274924	-106.688748	4.56		23000		X		X		X	X			
MO_P0040	Montoyas	Harvey Jones Channel Inlet to Corrales	35.256798	-106.613094	8.06		39000			X		X		X	X		
MO_P0041	Montoyas	Sierra Norte Channel North Hills	35.281164	-106.699006	0.62	1350	2000		X	X	X	X	X	X	X	X	
MO_P0042	Montoyas	Acadia Court Pond	35.259117	-106.671311	1.2		1900		X		X		X	X	X		
MO_P0043	Montoyas	Loma Pinon Loop Pond	35.284188	-106.717072	0.33		530		X		X		X	X	X		
MO_P0044	Montoyas	Lark Pond High Range Subdivision	35.289114	-106.662772	0.98		1600		X		X		X	X	X		
MO_P0045	Montoyas	Sundt Pond	35.258251	-106.642470	2.57		2500		X		X		X	X	X		
MO_P0046	Montoyas	Pam's Pond	35.250144	-106.631979	0.26		1200		X		X		X	X	X		
MO_P0047	Montoyas	Pond 116	35.250102	-106.634471	1.61		800		X		X	X	X	X	X		
MO_P0048	Montoyas	Cielo Norte Pond and Outfall Michelle	35.299483	-106.712313	1.03		850		X		X	X	X	X	X	X	
MO_P0049	Montoyas	Wilpett Pond 1 Northern Meadows	35.323468	-106.711123	2.37		2500		X		X		X	X	X		
MO_P0050	Montoyas	Wilpett Pond 2 Northern Meadows	35.321380	-106.710509	1.5		1200		X		X		X	X	X		
MO_P0051	Montoyas	Wilpett Pond 3 Northern Meadows	35.320616	-106.710077	2.52		2700		X		X		X	X	X		
MO_P0052	Montoyas	Wilpett Pond 4 Northern Meadows	35.318456	-106.708595	2.22		2500		X		X		X	X	X		
MO_P0053	Montoyas	Wilpett Pond 5 Northern Meadows	35.316833	-106.707385	2.51		2500		X		X		X	X	X		

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MO_P0054	Montoyas	Wilpett Pond 6 Northern Meadows	35.315284	-106.707316	4.98		5000		X		X		X	X	X		
MO_P0055	Montoyas	Clear Creek Pond Northern Meadows	35.315695	-106.715154	1.6		800		X		X		X	X	X		
MO_P0056	Montoyas	Desert Willow Pond Northern Meadow	35.321171	-106.714204	2.36		1600		X		X		X	X	X		
MO_P0057	Montoyas	Flat Iron Pond Northern Meadows	35.313492	-106.714876	3.22		1800		X		X		X	X	X		
MO_P0058	Montoyas	Havasua Falls Pond Northern Meadows	35.316248	-106.713345	1.18		1500		X		X		X	X	X		
MO_P0059	Montoyas	James Road Pond Northern Meadows	35.322175	-106.720300	1.22		1500		X		X		X	X	X		
MO_P0060	Montoyas	Sunny Meadows Pond	35.318801	-106.720709	1.18		800		X		X		X	X	X		
MO_P0061	Montoyas	28th Ave Pond	35.307022	-106.709698	1		4800		X		X		X	X	X		
MO_P0062	Montoyas	King Blvd Pond Northern Meadows	35.312955	-106.711838	5		5500		X		X		X	X	X		
MO_P0063	Montoyas	Marlow Meadows Pond	35.307913	-106.712119	4.7		22700		X		X		X	X	X		
MO_P0064	Montoyas	Tin Cup Pond	35.311663	-106.713648	3.4		16000		X		X		X	X	X		
mo_p0065													X				
MO_P0066	Montoyas	Ocotillo Hills East Pond	35.267900	-106.677953	0.15		500		X		X		X	X	X		
MO_P0067	Montoyas	Ocotillo Hills West Pond	35.267908	-106.678527	0.17		550		X		X		X	X	X		
MO_P0069	Montoyas	4 to 1 Pipeline	35.245495	-106.636559	0.46	3354	750			X		X		X	X		
MO_P0071	Montoyas	Walter Road Pond	35.322201	-106.723567	4.15		13400		X		X		X	X	X		
MO_P0072	Montoyas	26th Ave Pond	35.302387	-106.712152	1		3200		X		X		X	X	X		
MO_P0073	Montoyas	25th Ave Pond	35.300723	-106.712281	0.36		1100		X		X		X	X	X		
MO_P0074	Montoyas	Inca Pond	35.288374	-106.657375	0.62		2500		X		X		X	X	X		
MO_P0075	Montoyas	Serene Pond	35.318206	-106.727441	0.5		2000		X		X		X	X	X		
MO_P0076	Montoyas	Rio Oso Pond	35.266785	-106.616322	0.5		2000		X		X		X	X	X		
MO_P0077	Montoyas	Perfecto Lopez Pond	35.245848	-106.635074	0.75		2400		X		X		X	X	X		
MO_P0078	Montoyas	Tierra De Corrales Pond	35.264012	-106.617028	1.21		5000		X		X		X	X	X		
MO_P0079	Montoyas	Copperton Pond	35.301774	-106.702868	1.31		4000		X		X		X	X	X		
MO_P0080	Montoyas	Angel Pond	35.253493	-106.627705	0.19		600		X		X		X	X	X		
MO_P0081	Montoyas	Jade Pond	35.263207	-106.684255	0.1		325		X		X		X	X	X		
NM_P0003	Montoyas	Roskos Field Pond	35.223746	-106.661941	0.7		4000		X	X	X	X	X	X			2
RA_P0001	Montoyas	Rainbow Pond	35.253985	-106.729518					X		X	X	X	X	X	X	
RA_P0002	Rainbow	Rainbow Channel (Vancouver to Pecos	35.247800	-106.728182	2.26	2705			X		X	X	X	X		X	

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RA_P0003	Rainbow	Salitillo Diversion	35.218479	-106.717603	0.16		500			X	X	X	X	X			
VE_P0010	Venada	Enchanted Hills Dam	35.321979	-106.582643	8.55		14000		X	X	X	X	X	X	X	X	
VE_P0012	Venada	Lower Venada Arroyo NM528 to Rio G	35.313362	-106.571413	11.1		44000		X		X	X	X	X			
VE_P0013	Venada	Santiago Channel	35.311675	-106.577173	2.5	2670			X	X	X	X	X	X		X	
VE_P0018	Venada	Mariposa Pond #1	35.349415	-106.692243	3.55		17000		X		X		X	X	X		
VE_P0019	Venada	Mariposa Pond #2	35.351503	-106.689550	5.58		25000		X		X		X	X			
VE_P0020	Venada	Mariposa Pond #3	35.354348	-106.685870	2.14		10500		X		X		X	X			
VE_P0021	Venada	Mariposa Pond #4	35.355679	-106.684053	1.96		9000		X		X		X	X			
VE_P0022	Venada	Mariposa Pond #5	35.357274	-106.682077	2.23		10000		X		X		X	X			
VE_P0023	Venada	Mariposa Pond #6	35.359242	-106.679212	2.23		10000		X		X		X	X			
VE_P0024	Venada	Encantado Channel North	35.337223	-106.585103	12.5		8000			X		X		X	X	X	
VE_P0025	Venada	Chayote Pond	35.349148	-106.617460	4.48		12000	100 Cy	X		X		X	X	X		
VE_P0026	Venada	Santa Fe Hills Pond	35.344920	-106.601035	4.85		12000	150 CY	X		X		X	X	X		
VE_P0027	Venada	Sprint Pond	35.333895	-106.581728	9.05		15000		X		X		X	X	X		
VE_P0028	Venada	Encantado Channel South	35.329451	-106.576815	5.58	4860	25000			X		X		X	X	X	
VE_P0030	Venada	Encantado Pipeline North	35.343257	-106.598384		4521	10000			X		X		X	X		
WC_P0004	Willow Creek	Nacelle Pond	35.32	-106.60		0.50	2,000.00		X		X		X	X	X		

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Trash and IDDE removal report:

During the 2022 reporting year, 73 30-gallon trash bags worth of trash was removed from SSCAFCA-owned facilities. This volume is similar to the previous year due to the fact that the monsoon season was limited, resulting in less runoff to our facilities.

Facilty ID	Facility Name	# Bags
NM_P0003	Roskos Field Pond	2
BL_P0038	Black Arroyo Wildlife Park	50
BL_P0021	West Nicklaus Channel (Lema to Fairway)	2
BL_P0022	West Nicklaus Channel (Fairway to Casper)	2
BL_P0014	Ivory Channel	5
BL_P0004	Tract 17 Pond	12
		73

Arroyo Classroom

2021-2022 final report

submitted by
Erin Blaz, CSWCD
June 2022

SUMMARY

The Arroyo Classroom program utilizes our natural arroyos as outdoor classrooms and brings local animals into the classroom to motivate 3rd graders to respect the arroyos as important wildlife habitat. Orilla Consulting, LLC developed the program in 2012 and initially implemented the program for 7 classes at Maggie Cordova Elementary in Rio Rancho. In 2013, the program grew to serve 20 classes. On July 1st, 2015, Orilla Consulting, LLC transferred the program to Ciudad Soil and Water Conservation District as part of the larger education and outreach efforts we are involved in throughout Bernalillo and Sandoval Counties. In the 2021-2022 school year, we served 31 classes within Rio Rancho Public Schools, reaching approximately 32 teachers and 638 students. Funding was provided for 35 classes, however one school did not follow through on the registration process. Communication was made until December of 2021, but it was clear there were significant obstacles to getting the school onboard. Beyond that, Arroyo Classroom had a successful year and continued to bring important watershed education to local schools.

Participating Schools

SCHOOL * Title 1 school	**Number of classes**	**Number of Students**
Enchanted Hills Elem.	5	122
Martin Luther King Elem.*	5	114
Sandia Vista Elem.	6	134
Maggie Cordova Elem.*	5	106
Puesta del Sol Elem.*	5	89
Colinas del Norte*	5	73
TOTALS	**31**	**638**

Sponsor

- Southern Sandoval County Arroyo and Flood Control Authority (SSCAFCA)

Sponsor provided a total of $19,300.63 in cash.

Deliverables:

All presentations were offered virtually or in-person and completed.

- Watershed Presentations: 31:31
- Arroyo Walk: 30:31
- Bird Presentation: 31:31
- Reptile Presentations: 31:31

Program Description

Essential Questions: What is a watershed and how does water move across it? What important functions do arroyos provide for humans and other creatures? In what ways can we enjoy arroyos safely and learn new things?

- Students characterize arroyos as ecosystems as well as drains
- Students identify arroyo features that support wildlife
- Students describe the plants, animals, birds and insects that depend on the arroyo ecosystem
- Students explain the ways in which arroyos receive water and the dangers of arroyos
- Students recite the rules for arroyo safety

The program consists of a four-part series of lessons, based on grade-level science standards and addressing areas of interest to SSCAFCA, such as bats, burrowing owls, ATV use, pet waste, and arroyo safety. Erin Blaz delivered two of the lessons – an introductory lesson about watersheds, and either an in person arroyo walk or a virtual arroyo walk that tours an arroyo via Google Earth. Hawks Aloft, Inc. provided the virtual bird presentations as they were prepared to and experienced in delivering virtual presentations with live birds. All lessons were adapted for the virtual setting.

This year the virtual watershed lesson expounded on the water cycle and aimed for students to recognize how water moves across hard (impermeable) or soft (permeable) surfaces. Students made predictions about how water sprayed on a sponge and a stone tile (both at an angle) would move differently to represent the function of a watershed. Then we added more to the stone tile to elaborate on the built environment, including buildings, cars and dogs. Finally, we added “pollution” using similar materials to the enviroscape to create oil, dog poop, pesticide and construction waste. In summary, this lesson introduced the concept of a watershed to students, demonstrated how surface water becomes polluted through various human impacts, and discussed the importance of keeping our arroyos clean.

The virtual arroyo walk this year began with a google earth tour of an arroyo to observe its pathway through Rio Rancho, any visible human impacts and demonstrate the draining power of arroyos into the Rio Grande. We also observed tire tracks in the arroyos and talked about not using motorized vehicles in arroyos, as they are not permitted or allowed in the arroyos, and discussed the impacts of illegal use of arroyos. We observed where the mouth of the arroyo meets the Rio Grande and observed that there was not any kind of infrastructure to clean the water as it enters the river on this particular arroyo. All classrooms received a link to SSCAFCA's Arroyo Safety video as a follow-up to the final presentation.

The in-person Arroyo Walk was approved and completed with 17 total classes. This lesson is about the unique adaptations of arroyo animals and plants, incorporates a walk out to a nearby arroyo from the school and extensive discussion about arroyo safety. The walk starts with a safety discussion about the difference between concrete-lined channels and sandy-bottomed arroyos, and emphasizes that it is never safe to go into concrete-lined channels, while sandy-bottomed arroyos can be visited when there are no clouds in the sky. Students searched for evidence of animals living in the arroyo banks, learned about how lizards and other cold-blooded animals are adapted to the desert environment by moving about to regulate their temperature. They also looked for certain adaptations of desert plants to minimize water loss in the desert. This year, students were extremely excited to go on the walking field trip, as many schools only approved the field trips in spring. A few classes even had a gray fox sighting in a stand of Elms in a drainage area used for the walking field trip.

Top left- Gray fox in Elm spotted by students at Puesta del Sol. Middle top and bottom: Students from Puesta read thermometers to learn about reptile adaptations. Right top and bottom: Students from Colinas look for wildlife evidence on Arroyo.

Evaluation

Teacher feedback for 2021-2022 was collected from 18 participating teachers. Teachers overwhelmingly say they choose to participate in Arroyo Classroom to teach about local ecology and conservation issues, incorporate more science in the classroom, to offer experiential learning opportunities and to offer learning opportunities that connect to the community. They find the presentations to be uniquely engaging and meaningful for their students, however, across the board, teachers requested for the return to in-person learning. Teacher's find that Arroyo Classroom is complementary to other 3rd grade units of study such as life cycles and animal and plant adaptations. Teachers cite that the program is particularly helpful in achieving or developing the following skills: critical thinking and program solving, communication, assessing and analyzing information, and curiosity/imagination.

Highlights from teacher feedback:

What are the greatest learning outcomes for your class as participants in Arroyo Classroom?

- "That students can take what they learned and apply it to their daily lives."
- "Students truly enjoy learning about their environment, animals and how to actively educate others."
- "My class really seemed to learn the most about how the water system within Albuquerque worked."
- "My class has become more aware of how humans can impact wildlife. They remember the animals we have learned about and are determined to keep the environment clean for them."
- "They learned a lot about their local area from habitats for rivers to arroyos."
- "Most of my students could share that the arroyos were important animal and plant habitats and that they had a responsibility to keep them clean, free of pollution and that it wasn't an area for off roading."
- "My students are more aware of their environment and are more knowledgeable."
- "They learn about arroyo safety and also about the local animals. They grow their understanding in conservation as well."
- "That they learn about the environment around them and are more aware of how to take care of it."
- "Students understand their place in protecting our arroyos."
- "Learning about the environment in which my students live. Being able to take what they learn and see it around their houses and school."

Survey Summary

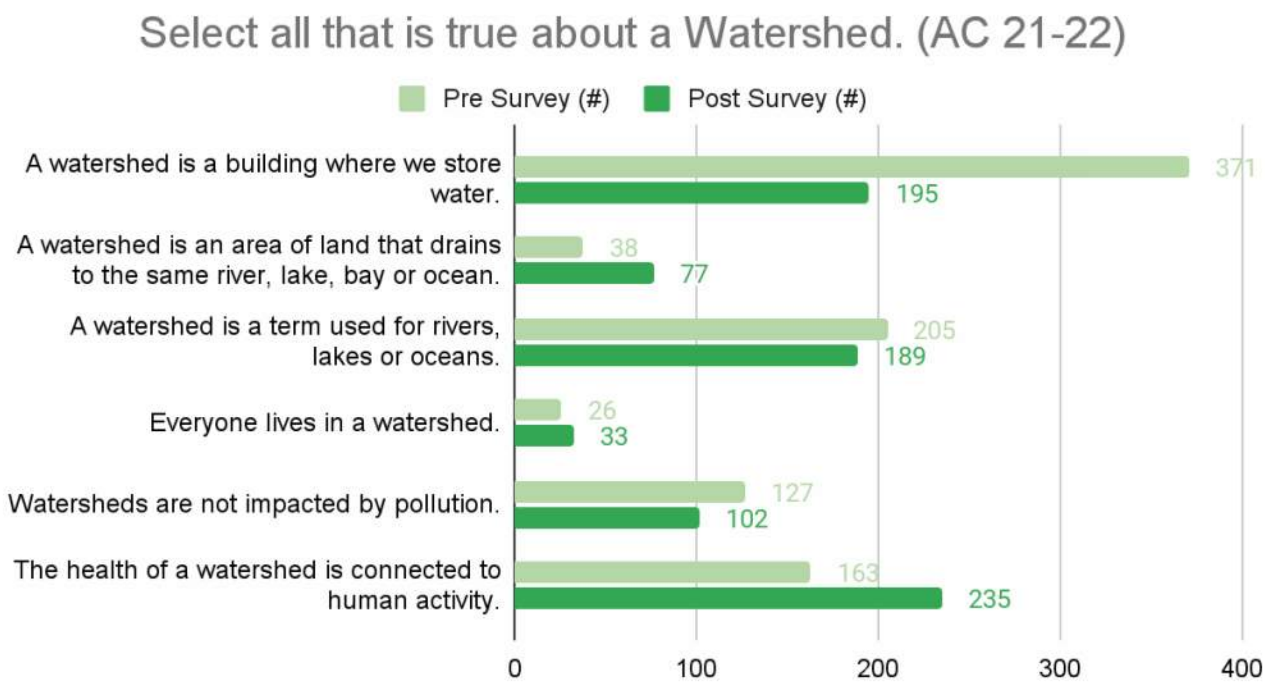
This is the third year that we've administered the pre and post surveys for Arroyo Classroom. Due to some changes in the program content for this year's virtual program, such as the availability of certain species and specimens offered by our presenters for their virtual presentations, we made some adjustments to the pre and post survey to reflect the content of the program. The survey questions were slightly more generalized and used a "check all the apply" format to address different learning

objectives.

This year we had 605 pre-survey responses and 492 post-survey responses. This we formatted the survey responses by total number of responses, rather than percentages.

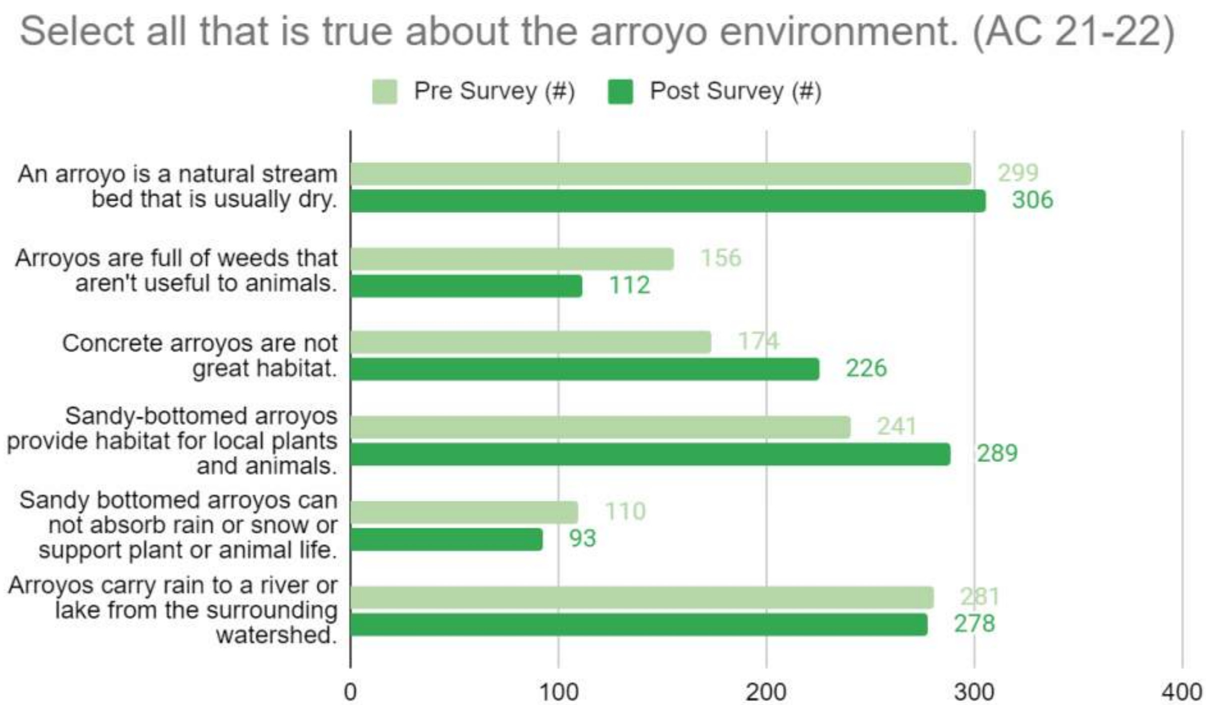
Survey Metrics:

Item 1 Watersheds



Comments
This year we do see an increase in correctly defining a watershed (an area of land that drains to the same waterbody) and a decrease in the wrong answer (a building that stores water) but not a lot of students choose the correct definition of a watershed. More students seem to understand that watershed health is connected to human activity, with almost 50% of students choosing this response. This is an important success as ultimately we want them to see themselves as a part of the watershed and that their actions matter.

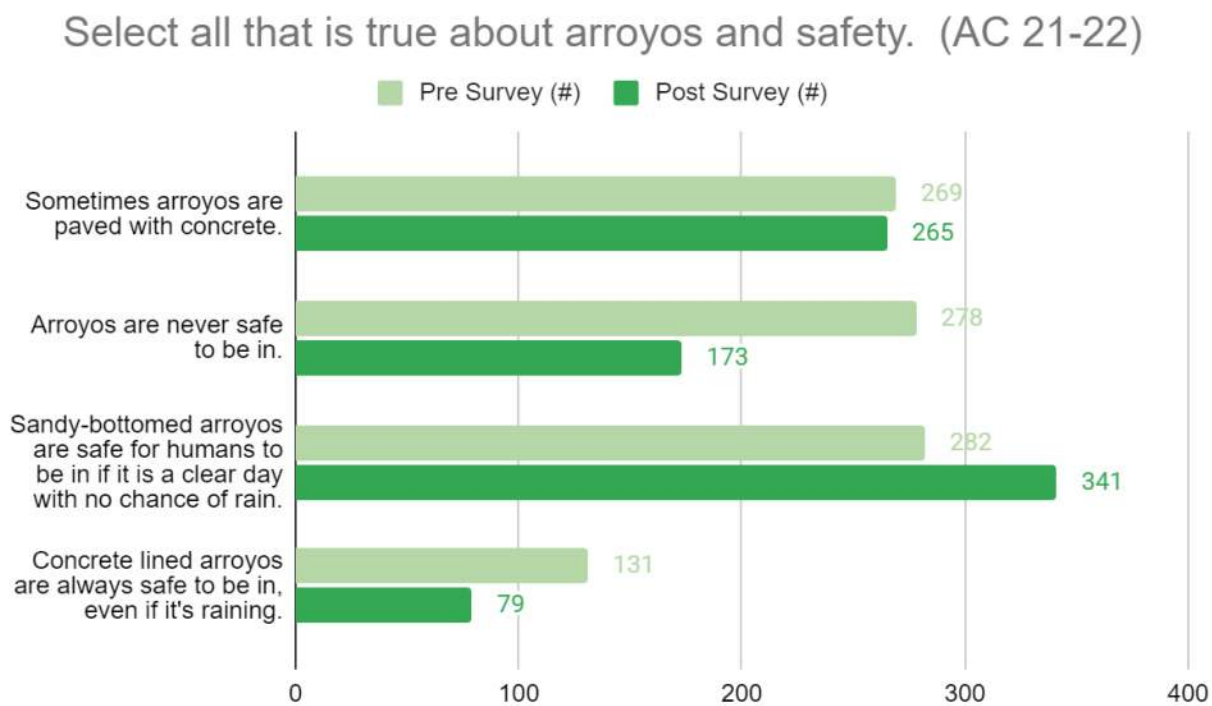
Item 2 Arroyo Function and Environment



Comments

Based on pre and post answers, it looks like the students already know what arroyos are or can easily assume based on "natural stream bed" and "carry rain" responses. There wasn't much movement from pre to post test. However, with an increase in responses about habitat and concrete arroyos not being beneficial to animals, along with a decrease in the question about weeds, students did demonstrate more knowledge about arroyos post program.

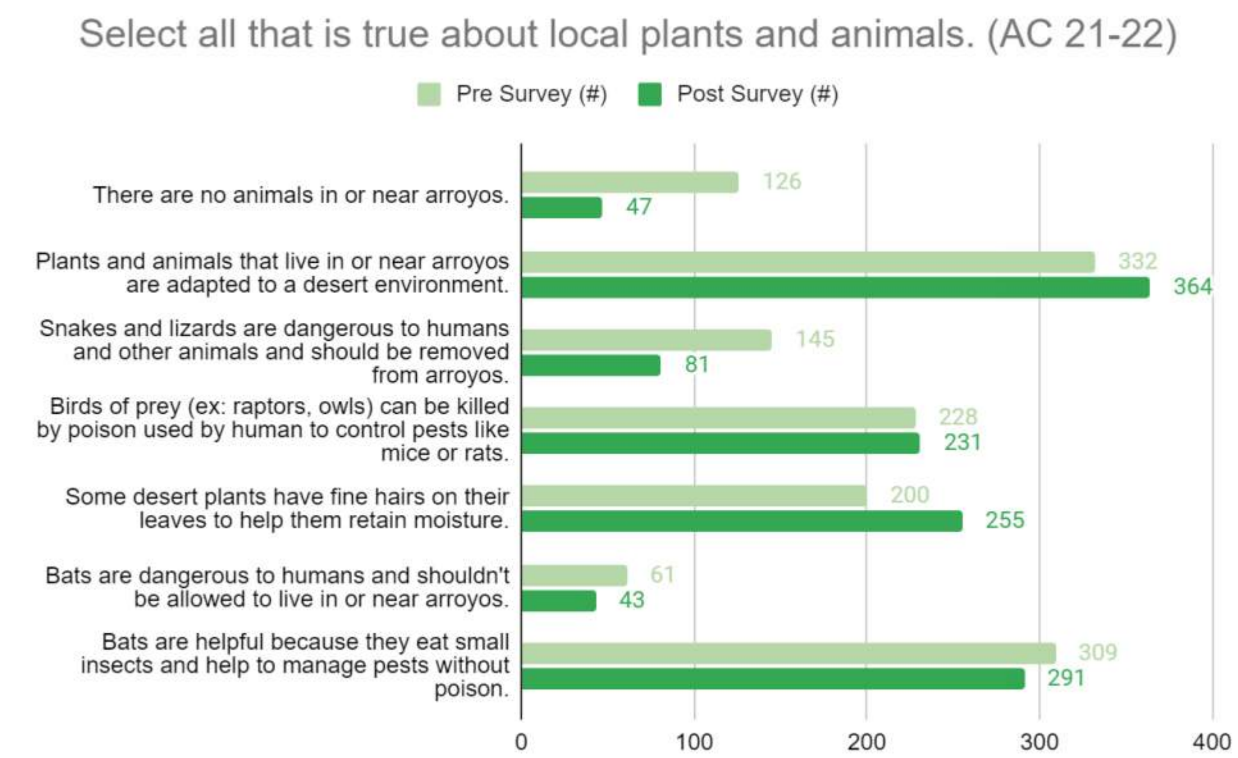
Item 3 Arroyo Safety



Comments

Positive outcomes of this graph are that more students understand the specifics of arroyo safety, demonstrated by a decrease in answers "arroyos are never safe" and an increase in "arroyos can be safe when there is no chance of rain." However, cultural beliefs and folklore may continue the narrative that arroyos or ditches are never safe to be in, as La Llorona might come for you!

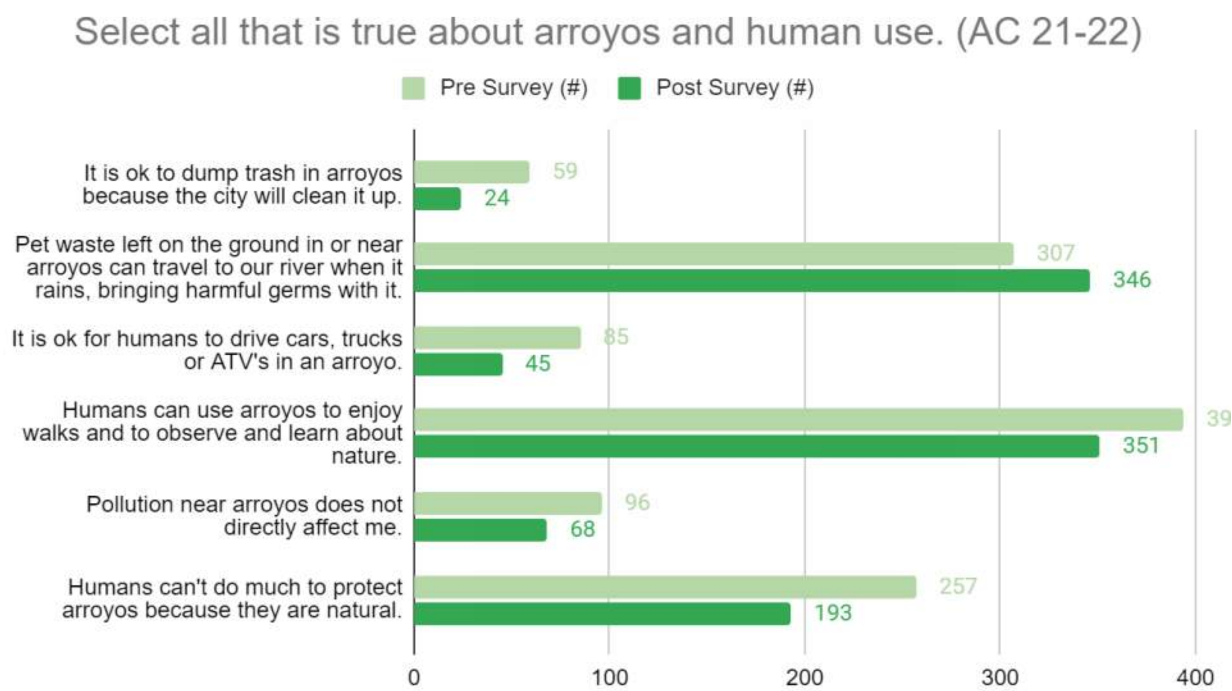
Item 4



Comments

Generally positive outcomes are displayed from these results. Possibly since the 3rd grade curriculum covers adaptations and habitats students are already primed to answer correctly on the pre-survey.

Item 5 Arroyos and Human Use



Comments

Positive outcomes for this question sequence are that there was an increase in students answering more correctly about pet waste as a river contaminant.

Appendix A

Lesson Plans (Ciudad SWCD delivered lessons)

Activity Guide for 3rd Grade – Building a Watershed

1. What are we trying to teach students in this activity?

A watershed is an area of land where all the water flows (or sheds) into a common body of water. We live in the Middle Rio Grande watershed. A natural watershed has many permeable surfaces that help to clean water. Human's build a lot of hard-scapes. As water moves downhill, it carries sediments and other materials to the river. Water is a precious resource and we can help improve the quality of the river by picking up after our pets and not littering or throwing trash on the ground.

2. How can we tie this activity to our teaching goals:

Learning Objectives	Methods
We all live in a watershed. A healthy watershed keeps water clean.	Using models to demonstrate: ● elements of a "watershed" and how natural watersheds help to clean water and move water around. ● Humans have impacts on the watershed (i.e. Hardscapes, Pollution)
The amount of permeable and impermeable surfaces in an area impact the watershed.	We observe and make claims about: ● What happens as water moves across "Hard" vs "Soft" surfaces ● The proportion of hard and soft surfaces around us. ● How this may impact our watershed.
Pollution increases in human environments. What we can do about it.	Using models we aim to demonstrate: ● Water can be polluted in human areas and is harder to clean with impermeable surfaces. All this polluted water flows to the river. Through discussion we: ● Talk about the importance of being responsible and how caring for the watershed in this way not only protects the water, but also helps the people and plants and animals that depend on the water as well. ● Picking up after our pets and minimizing our trash, and the trash on the ground helps keep our river clean

3. How can we tie this activity to standards?

Performance Expectation	
5-ESS2 Earth's Systems	**Disciplinary Core Ideas**

3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the world.	**ESS2.C:** The roles of water in Earth's surface processes **ESS2.D:** Weather and climate
5-ESS3 Earth and Human Activity	
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	**ESS3.A**: Natural resources **ESS3.B**: Natural hazards **ESS3.C**: Human impact on Earth systems

What we do (Science and Engineering Practices)	**How we think (Crosscutting Concepts)**
Developing and Using Models Analysing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Systems and Systems Models Stability and Change

4. How should this activity be organized?

Supplies:

- Large Sponge
- Baking tray
- Filter model (2 liter bottle, upside down with cotton ball, sand, rocks, leaf litter)
- Spray bottle with colored water
- hard surface (flat piece of tile, stone, concrete)
- Slideshow

I. Introduction *(5 minutes)*: **Hi everyone, I'm ------- and I'm here from a program called Arroyo Classroom - a program where you get to learn about your local environment. We are going to learn about your local environment and what you can do to protect and conserve it (Define conservation). You can ask what kids do to help the environment as an ice-breaker.**

Open Presentation

1. **Ask if they know what an Arroyo is. Picture on 1st slide.**
   An **Arroyo** is a dry stream bed. We don't get a lot of rain here, but water can flow here when it rains. Arroyos flow to the Rio Grande. Arroyo's are a part of the watershed, but we will define that shortly.
2. First, let's get a discussion going:
   - How many of you used water before you came to school? How did you use it? Where do you think all this water comes from?
   - Where do you get your water? How is it cleaned? (Rio Rancho = Aquifer)
   - Can we all agree it is important to have clean water for all (including plants and animals)?

II. What is a Watershed? What role does it play in the water cycle? (20 min)

Part A: *(5 minutes)* We are going to learn about how the land around us helps to clean water.

1. **Review the Water Cycle - precipitation, evaporation, condensation (water cycle dance video)**
   - **Important to remember water can't be created or destroyed. We are drinking the same water dinosaurs used. We have to keep what we have clean.**

Part B: *(5 minutes)*

2. **Introduce the Watershed**
   - **What is Watershed video**
   - Anywhere water falls on land is a watershed. What isn't absorbed will continue to run or shed downhill until it collects in a body of water. A watershed is an area of land that drains to the same body of water.
   - Watershed has different names based on the body of water water ends up in. We live in the **Middle Rio Grande Watershed.** Write down the name of our watershed.

STOP PRESENTATION

Part C: *(10 minutes)*

3. **Natural Watershed Helps to Clean Water. Ask students, before each demo what they think will happen and why? What evidence or prior experiences inform them?**
   - Absorbs- permeable surfaces (spray water on sponge)

        - Moves and Collects Water- (saturation of sponge) Arroyos, Wetlands, Rivers
            - Wetlands attract water loving plants that help filter and clean the water
        - What happens to water that soaks in the ground- Filter demonstration - connect it to the aquifer.

Learning Objective: Permeable surfaces are important for filtering and cleaning water, and slowing it down.

- **Human impacts** - less natural features in watersheds, more impermeable surfaces, density of pollution
    - Demonstrate water sprayed on hard surface
    - Water doesn't absorb and it moves faster.

4. Compare water in a concrete arroyo and sand-bottomed arroyo, which moves faster?

Learning Objective: Concrete Arroyos are never safe. Sandy bottomed arroyos are ok to go in if no chance of rain.

III. Activity: What is the proportion of permeable to impermeable surfaces outside our home or school? *(10 minutes)*

1. **Observe outside -** look at the ground. How much is covered by surfaces that can absorb water like soil, sand, dirt, grass, small rocks, etc. How much is covered by hard surfaces- pavement (driveways, streets, etc). Talk about compacted soils.
2. **Guess the percentage of hard vs soft based on observations.** Students create their own pie chart- labeled Hard and Soft.
3. **What claims can we make about our watershed? What evidence supports our claims**

IV. What's In the Water?

(10 minutes)

1. **Discuss pollutants. Discuss what happens to polluted water.**
   Experiment with how "pollutants" might travel through their watersheds.
    - What is pollution?
    - What forms of pollution exist in our city? Discuss each pollutant:
        - Plastic
        - Factories
        - Motor Oil (suggest a tray under or cat litter to clean it up)
        - Fertilizers (use recommended amount) - eutrophication
        - Herbicides or Pesticides (use recommended amount)
        - Dog Waste
        - Construction Erosion/Sediment

Learning Objective: With more hard surfaces - water moves faster, picks up pollutants and heads to Rio Grande without being cleaned.

V. Conclusion (10min)

- <u>What do you think this means for our watershed - the Middle Rio Grande?</u>

The water we drink comes from our watershed. Animals and plants also depend on this water. That's why it's important that we try not to pollute either the water or the land. Anything that pollutes the land will eventually wind up in the water.

- <u>What might be ways we could reduce pollution in our watershed?</u>

By picking up trash and picking up dog poop if we have dogs.

Activity Guide for 3rd Grade – Virtual Arroyo Walk

1. What are we trying to teach students in this activity?

Arroyos function as an important flood control measure and are essential landforms in the upland desert of Rio Rancho. Arroyos are also habitat to plants that have specific adaptations for living in a desert environment that experiences infrequent flooding. We can protect arroyos as habitat and take care of them so they help with flood control.

2. How can we tie this activity to our teaching goals:

Learning Objectives (Students will be able to:)	Methods
Describe arroyos function as flood control.	Using visual models (google earth and drone fly-overs) to demonstrate: ● Arroyos are caused by water flows from precipitation. ● Arroyos are dry when there is no precipitation. ● Arroyos lead to a larger water source- the Rio Grande
Describe who arroyos are habitat for.	Using their experience from previous Arroyo Classroom presentations: ● Student recall animals that live in or near arroyos Using models of different climates: ● Students can state plant needs in an arid climate
Desert plants have adaptations that allow them to survive in a climate with a great temperature range, high solar impact and little precipitation. Name a local plant species	Using models we aim to demonstrate: ● Various plant adaptations such as deep vs wide roots, small leaves, fine hairs and spines. Through discussion we: ● Explore how plants can survive in the desert climate, unique traits of cactus, name a specific native plant- Four Wing Saltbush and some ways to identify and find it.

3. How can we tie this activity to standards?

Performance Expectation	
5-ESS2 Earth's Systems	**Disciplinary Core Ideas**
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the	**ESS2.C:** The roles of water in Earth's surface processes **ESS2.D:** Weather and climate

world.	
5-ESS3 Earth and Human Activity	
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	**ESS3.A**: Natural resources **ESS3.B**: Natural hazards **ESS3.C**: Human impact on Earth systems

What we do (Science and Engineering Practices)	How we think (Crosscutting Concepts)
Developing and Using Models Analysing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Systems and Systems Models Stability and Change

4. How should this activity be organized?

Materials:

- **Google Earth maps slideshow of arroyo in Rio Rancho**
- **Native Plant and Desert Adaptation slideshow**

I. **Introduction**: This is our final presentation for Arroyo Classroom. Today we are going to learn more about the geography of arroyos and native plants that live in arroyos. Icebreaker: What have you learned so far?

II. **Google Earth Arroyo Tour**
   A. Introduce map and landmarks (Albuquerque, Rio Rancho, Sandia Mountains, Have students recall the name of our river)
   B. Review Watershed: discuss where the water flows to from different points in the land, begin to draw attention to arroyos on the map.
   C. Upper Watershed: Discuss how the arroyos are converging from smaller arroyos, note the area around the arroyo has roads but isn't developed yet. Remind students how

important our voices can be to help share what we've learned in Arroyo Classroom so everyone who lives here and might eventually live here can do their part in caring for our environment.

D. Middle Watershed: Point out that there is more housing, development and hard (impermeable) surfaces at this point in the watershed. Bring their attention to the tire tracks in the arroyo.
   - What are these tracks from?
   - What might the impact be from driving motorized vehicles in the arroyos?
   - Share that it is illegal and why. Discuss other options for those kinds of activities where it is legal.

E. Lower Watershed: Show the mouth of the arroyo meeting the Rio Grande
   - Ask: Do you see anything in place that would remove garbage?
   - Poll students: 1. Who has seen trash in an arroyo? 2. Who has seen trash larger than a television or microwave? 3. Who has seen trash larger than a couch?
   - What can we do to help keep our arroyos clean and safe for all?

III. Adaptations of native and drought-tolerant plants

A. Introduce desert plants, share some fun facts about Yucca - state flower, edible roots - yucca fries.

B. Compare climates - show side-by-side of a tropical climate (dense vegetation, cloudy, waterfall) vs. arid climate (sparse vegetation, sunny, no water). Talk about how plant's needs are different in these climates.

C. Plant Adaptations
   i. Dormancy
   ii. Root systems (tap root or surface)
   iii. Small leaves
   iv. Fine hairs on plants

D. Cactus
   i. True or False Game
   ii. Why do Cacti have spines video
   iii. Photosynthesis and stomata

E. Four Wing Saltbush
   i. Adaptations and traditional uses of fourwing saltbush.

Arroyo Classroom Scavenger Hunt

Draw or describe each finding, such as size, color, shapes, texture, smells, location and more. You can even write questions you have about what you found! Please respect the wildlife and take an adult. Good luck!

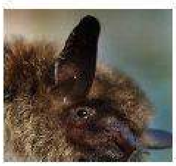
- ❏ Wild animals tracks
- ❏ A plant without leaves
- ❏ A rock that feels warm or cold
- ❏ Cactus
- ❏ A plant with a color other than brown or green. What color?
- ❏ A wild animal on the ground
- ❏ A narrow leaf on a plant
- ❏ A hole in the ground made by an animal
- ❏ A bird in the sky

Appendix B
Supplemental Materials

-SSCAFCA Activity Book and Educational Videos:

KNOW YOUR ARROYOS
ENJOY • RESPECT • PROTECT

-SSCAFCA handouts:



Did you know?

SSCAFCA protects our community from flooding and erosion caused by big rain storms, and works to keep stormwater clean. Stormwater flows down arroyos into the Rio Grande.

Bugs like to live in stagnant water that collects in ponds and low places in the arroyos. Insects like mosquitoes can carry diseases that make us sick.

Brought to you by:

SSCAFCA

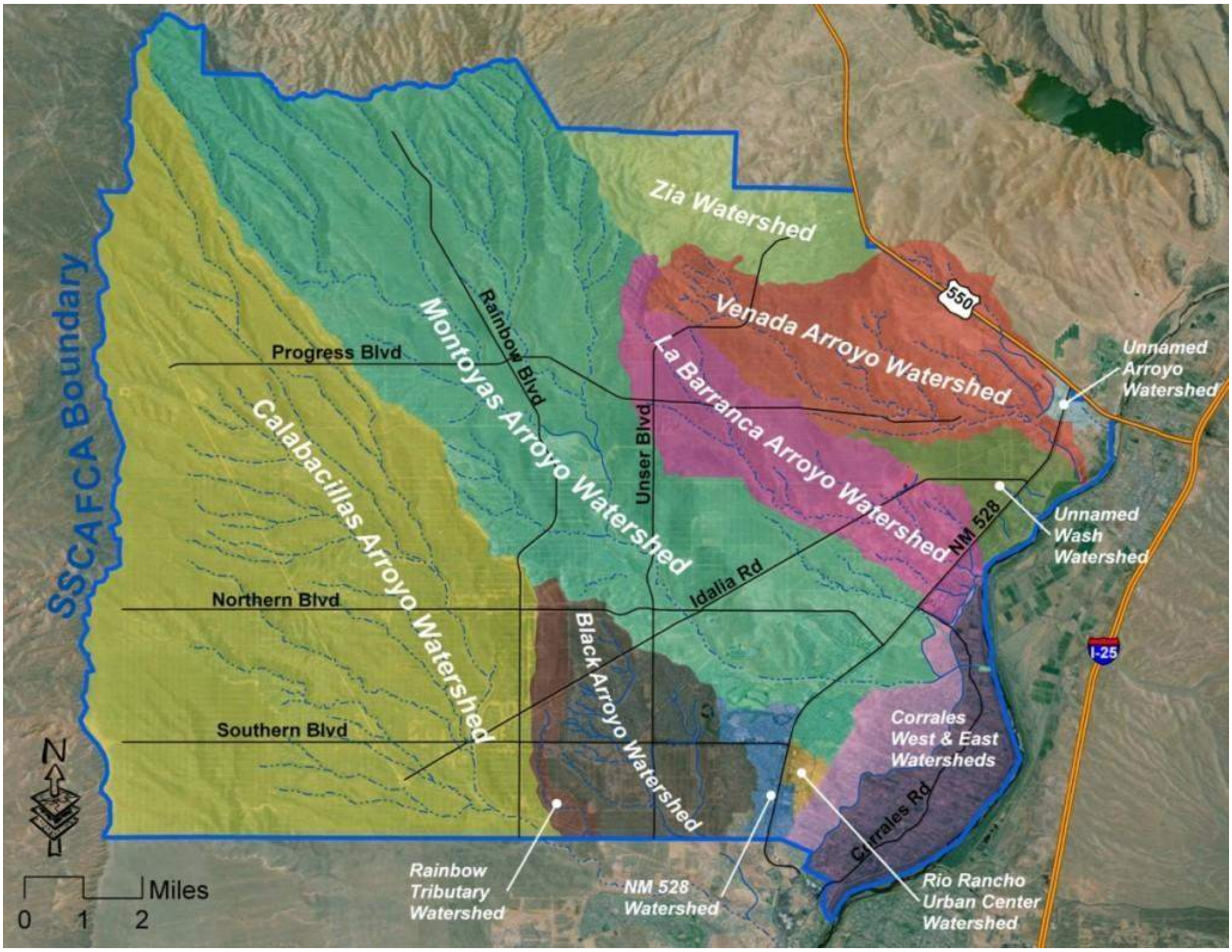
SOUTHERN SANDOVAL COUNTY ARROYO FLOOD CONTROL AUTHORITY

Almost all U.S. bats feed exclusively on bugs, and 1 bat can eat between 600 and 1,000 mosquitoes and other insect pests in just one hour. One bat can eat its own weight in insects in a single night!

SSCAFCA provides bat houses to encourage bats to make their homes near our arroyos, and especially near detention ponds where stormwater runoff is captured and allowed to slowly drain.

The more we help bats, the more pests they eat, so we don't have to spray pesticide that could wash down to the Rio Grande and pollute it.

SSCAFCA watershed map:



Arroyo Safety Video:
Arroyo Safety

Making Meaningful Connections by Integrating Water Resources Topics with Language Arts & Science

2022 Report

Presented by
Ciudad Soil & Water Conservation District
Erin Blaz, Education Manager
Saleema Robinson, Assistant Education Coordinator

June 2022

CONTENTS

SUMMARY

This year, funding enabled 39 NM classes (866 students and 41 teachers) to participate in a combination of *virtual and in-person programming* RiverXchange® program. 38 classes were funded for the program, but 39 were placed in the program considering the likelihood that not all bus and substitute funding was going to be used due to the uncertainty of field trip approval and substitute availability. Eight of the fourteen schools we served were Title 1. All program costs and coordination are provided free of charge to teachers. The program required $56,218.89 in cash and generated a total match valued at $67,351.11 in the form of in-kind contributions including teacher workshop attendance, presenter time and preparation for virtual presentations, as well as volunteer time from students and adults on the field trips to plant 495 trees in the bosque. Student Capstone Projects reached at total of 3,090 community members about stormwater and watershed health related topics.

RiverXchange® continued to have a successful year, even in light of the on-going global pandemic. One of the challenges this year was managing diverse policies for presentations and field trips across schools and presenter preferences and capacity. The result of these variations meant that students experienced varying levels of contact with the program. For example Rio Rancho schools primarily had video presentations and virtual field trips with live presenters, while one Rio Rancho school actually went on a field trip to Candelaria Nature Preserve. APS students primarily had virtual presentations with a live presenter and almost all APS schools did pole planting. However, in evaluating the program metrics both districts demonstrated knowledge gains and improvements in positive water conservation behaviors and attitudes.

Another significant change to the program this year was the evolution from blogging to the Capstone Project. With the inundation of technology and virtual learning in schools as a result of the global pandemic, it was time to rethink the goals of the blogging component and determine if they really support making meaningful connections for students in water resource education. The goal of the Capstone Project was to pilot a language arts component that would support making meaningful connections with students' immediate community- such as the larger school community or neighborhood. Results from the Capstone Project are shared further on in this report. In summary, much of the work we see is similar to the work that was posted on the blog, except many of the teachers that were able to integrate the Capstone Project challenged their classes to share their work with other classes at the school or even the school administration. This meant the work wasn't going into a digital void where only RiverXchange® staff would view it, but that it rippled out to more local students and adults!

In addition last year RiverXchange®, Bosque Ecological Monitoring Program and Valencia SWCD staff met monthly to discuss watershed and stormwater education collaboration opportunities, such as program continuity across grades and program assessment strategies. This effort continues to help support and improve core aspects of our programs and outreach.

RiverXchange® has demonstrated that its collaborative efforts with partner agencies to bring effective presentations to schools, funding structure to support teacher professional development and field

trips, and management by the Ciudad Soil and Water Conservation District, has allowed it to be not only resilient during times of uncertainty but a valuable resources for teacher and students alike. In fact, RiverXchange® has emerged as a strengthened program that will continue to evolve for years to come and improve how it engages our local community with watershed health and stewardship.

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 optional 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 K12 water resources outreach in NM since 2007, the RiverXchange program creators 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, they continued to find that upper elementary students had little or no understanding of major water resources topics unless the teacher specifically integrated a wide range of water topics into the curriculum. For this reason, as well as successful festival work with upper elementary students, this age level was selected as the focus for the RiverXchange program.

RiverXchange was created to provide a free program that is fun, interesting, and easy to integrate into the normal curriculum. The hope was to motivate participants to explore water resources topics in depth. The program was originally designed to be 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. Today RiverXchange runs over the course of 3-4 months, as a response to the challenges of implementing a year-long curriculum with the ongoing demands on teachers and students time and requirements for testing and other curriculum.

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 tele-conferencing to present what they had learned.

After the pilot project, RiverXchange transitioned to a web-based technology called a wiki. This enabled the program 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 classroom guest speakers were introduced to reduce teacher workload and bring up-to-date technical information into the classroom. In 2017, the program switched to a blogging platform called Kidblog and in 2021 Kidblog rebranded to Fanschool. Due to the inundation of technology from virtual learning in the global pandemic and the continued barriers to connecting classes on Kidblog/Fanschool, RiverXchange piloted integrating a Capstone Project into the

program instead of the blog in 2021-2022.

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. In 2020, ownership and the trademark registration of RiverXchange® was transferred fully to Ciudad Soil and Water Conservation.

Since 2007, we have served over 20,166 students!

This year, the program featured the following components:

- Optional standards-based curriculum including hands on science, math, and social studies lessons, as well as writing assignments
- Teacher training on curriculum and Capstone Project implementation
- Ongoing motivational support and Capstone Project monitoring
- End of year teacher survey
- Pre and post student surveys
- Coordination of at least four guest speakers into the classroom
- Coordination of a virtual field trip or in person field trip to the local river or important watershed feature
- Field trip leadership and activity planning

2021-2022 PROGRAM OVERVIEW

I. Program Management and Financial Support

The program timeframe was July 1, 2020 through June 30, 2021. All components including fundraising, design, planning, implementation, and analysis were carried out by employees and contractors of Ciudad Soil & Water Conservation District, including:

Erin Blaz
Jenny Lloyd-Strovas
Astrid Hueglin
Saleema Robinson

SPONSORS

- Southern Sandoval County Arroyo and Flood Control Authority (SSCAFCA)
- Middle Rio Grande Stormwater Quality Team (MRGSQT)

Sponsors provided a total of $56,218.89 in cash.
MRGSQT - $38,532.98 | SSCAFCA - $17,683.04

Program expenses included:

- Technology services
- Office and educational supplies
- Teacher workshop materials and food
- Coordination services (planning, implementing and assessing all program components)
- Bus funding
- Substitute funding

IN-KIND PARTNERS

- Albuquerque Water Utility Authority
- City of Albuquerque – Open Space Division
- City of Rio Rancho – Environmental Programs Office
- City of Rio Rancho — Parks, Recreation and Community Services Department
- Sandia Labs
- Sandoval County Cooperative Extension
- Bernalillo County Cooperative Extension
- Rio Grande Return

In-Kind contributions totaled $67,351.11

In-kind contributions included virtual guest speaker coordination, prep and presentation time. The City of Albuquerque significantly increased their match this year by including a pre-lesson kit and/presentation to classrooms. Additionally, in-kind match was able to return to a pre-2020 range due to the allowance of pole planting field trips, where student and adult time and trees are counted as match through volunteer time and materials.

PARTICIPANT SELECTION

All 39 participating NM classes were fifth grade classes, distributed as follows:

FUNDER	MRGSQT		SSCAFCA	
	SCHOOL - Number of classes	Number of Students	SCHOOL - Number of classes	Number of Students

*Title 1 school	La Mesa* - 4	92	Colinas del Norte* - 5	109
	Valle Vista* - 3	53	MLK* - 4	98
	Duranes* - 1	19	Sandia Vista - 4	92
	Seven Bar - 3	79		
	John Baker- 3	67		
	Zia- 2	40		
	Monte Vista - 2	52		
	Cochiti* - 2	27		
	North Valley Academy - 2	52		
	Manzano Mesa* - 3	61		
	Maggie Cordova* - 1	25		
TOTALS	**26 classes**	**567**	**13 classes**	**299**
RX Total Classes	**39 classes**	**RX Total Students**	**866 students**	

PRESENTATION TOTALS

Program presentations were completed as follows:

Agriculture: 39/39
Stormwater: 39/39
Wastewater: 39/39

Drinking Water: 39/39
Landfill Presentation: 14/14 (Rio Rancho only)

Field Trips

Virtual: 14/14

Pole Planting: 21/21

Candelaria Nature Preserve: 4/4

I. Program Components

The core curriculum of RiverXchange® is delivered through a series of in-class presentations provided by our partner agencies that are guided by the “Big Water Questions” that aim to build an understanding of watershed health. Additionally the field trip, in partnership with City of Albuquerque Open Space, has remained a core component of our program by offering students the opportunity to participate directly in a restoration project to understand the value of action and stewardship as a community effort. The field trip also offers an opportunity for participating students, who come from diverse backgrounds and have varied relationships with the outdoors, a chance to connect with an important, local watershed feature and build a connection to their local river. Furthermore, beyond the core components of RiverXchange®, the program also supports a more robust understanding of watershed health through teacher facilitation of the Capstone Projects and other additional lessons that are demonstrated at the teacher workshop. Extensive resources can be found on the RiverXchange® website but we have found teachers are at their capacity often don’t utilize those resources. Each year we continue working on developing a more streamlined program.

A review of this year’s program components follows.

PARTNER AGENCY PRESENTATIONS

APS

The Water Utility Authority has a new presenter, Rhea Trotman, who is replacing Theresa Dunn - the long time WUA educator for RiverXchange. Ms. Trotman provided the drinking water and wastewater presentations. Brittany Johnson at Bernalillo County Coop Ext. provided the virtual agriculture presentation. The stormwater presentation will continue to be offered via a video recording from Sandia Labs.

RRPS

The city of Rio Rancho offered pre-recorded videos of their drinking water, wastewater and landfill presentations as this year's presentations. Students will also receive the stormwater video from Sandia Labs. The agriculture presentation will be offered virtually by Steve Lucero and Nicole Lujan from the Sandoval County Coop Ext.

Field Trip Pre-lesson

City of Albuquerque Open Space Division Educator Ellie Althoff provided significant support to students understanding the "why" behind planting cottonwoods and willows in the Bosque by offering a River of Change Kit (a model and lesson derived from the Bosque Education Guide). This kit and lesson was provided to classes for their own use or as an in-person presentation with Ellie to explore the first two segments of the lesson - Rio Bravo and Rio Manso - which discuss the pre-settlement ecology of the Middle Rio Grande and flood control impacts due colonization and non-native settlement of the Middle Rio Grande Valley. The final segment of this lesson called Rio Nuevo, where students are prompted to consider the possible restoration and mitigation strategies for flood control impacts on the ecosystem, was completed either on site at the field trip or during the virtual field trip presentation.

FIELD TRIPS

POLE PLANTING

A total of 417 students and 56 adults attended pole planting field trips from APS schools. With the support of Albuquerque Open Space, 495 total trees were planted in an area of the Bosque just north of I-40 on the east side of the Rio Grande. Images of students pole planting are in Appendix XXXX.

VIRTUAL FIELD TRIPS

This year we continued to offer virtual field trips for schools that were not allowed to go on in-person field trips. City of Albuquerque Open Space generously contributed another educator, Ellie Althoff to join Erin Blaz in facilitating these field trips. The virtual field trip spanned 1.45 hours and explored evidence of the flora and fauna in the existing riparian ecosystem, identification of invasive species, strategies for managing forest health and the Rio Nuevo activity.

CANDELARIA NATURE PRESERVE (CNP)

In March, Martin Luther King Elementary School notified RiverXchange® staff that they were just approved for in-person field trips. Pole planting does not have demonstrated success rates into the warming spring months, so we had to come up with field trip location and activities that would work in April. As Ciudad SWCD is now the land manager of Candelaria Nature Preserve in partnership with COA OSD and Rio Grande Return, we collaborated to deliver two field trip dates to serve four classes at this site. Students were able to contribute some hands-on work by mulching berms alongside basins created for nucleated habitats, as well as nature journaling to envision the future of CNP as an agricultural land converted to wildlife habitat, and the Rio Nuevo activity. Wildlife Biologist Kyle Faig also gave a wildlife talk to students. The event was a great success!










Top row: Ellie Althoff and Kyle Bality from Open Space teaching students to pole plant properly. Middle rows - students from various schools planting in varying weather. Bottom 3 pictures: Field trips to Candelaria Nature Preserve


CAPSTONE PROJECT

This year RiverXchange piloted a new approach to maintain the language arts component that has been meaningful to teachers across the years and to strive to achieve a new kind of meaningful connection between RiverXchange students and their community. The coordination budget that has been used in the past for blog support and evaluation went to supporting teachers in the process of completing this capstone project and acquiring documentation of their class projects. The criteria for the capstone project are:

- (1) Students create something new that teaches other about what they learned in RiverXchange
- (2) Students communicate what they learned beyond their classroom in their community (i.e. other classes at school, your neighborhood or city)
- (3) Students design a stewardship project of their own that includes aspects of conservation and sustainability in their community.

Teachers were asked to update staff on their projects in December and March and to share the context of the project as well as who the project would reach and impact. In April teachers submitted their projects via email to staff and 6 classes were awarded with pizza parties to celebrate their project completion. In total, student capstone projects reached 3,090 community members about stormwater and watershed health topics.

RIVERXCHANGE COMMUNITY DAY

As a strategy to both motivate and celebrate the Capstone Projects, staff offered a Community Day at the end of the year where the class projects were highlighted. The event was held on April 23 in conjunction with the Earth Day Celebration at Agri-nature Center in Los Ranchos. The event was publicized to all RiverXchange® classes and families were encouraged to attend.

TEACHER WORKSHOP

Teacher workshops were held Sept 24, 2021 and October 1st, 2021 at the Open Space Visitor Center with RiverXchange facilitators Jenny Lloyd-Strovas and Erin Blaz. The teacher workshops were highly successful, with 19 participants on the 9/24 and 15 participants on 10/1. We found that there were a lot of new teachers this year, not only new to RiverXchange but also new to the field of teaching. The RiverXchange program was introduced and reviewed, with many returning teachers expressing their appreciation for and confidence in the program. The capstone project was introduced, was well-received, and teachers spent time working in groups to plan their projects. We ran through a few teaching strategies for lessons about the watershed using a 3-D model of the Middle Rio Grande Watershed for integrating geographical mapping and layering of life zones, historical development, biological features, etc, with the final layer demonstrating pollution on our watershed model. City of Albuquerque Open Space education staff ran through activities that supported the field trip learning objectives and reviewed the field trip experience and pre-lesson. Dyane Sonier of Rio Rancho Parks, Rec and Community Service introduced

resources and materials available to teachers on the Rio Rancho workshop date (Oct 1). Teachers enjoyed lunch overlooking migrating birds and explored the visitor center. Everyone left with swag-bags!

Teachers from Valle Vista, MLK, Colinas del Norte and Maggie Cordova map the middle Rio Grande Watershed. (top left and center). Dyane Sonier presents CoRR education programs (top right). Teachers rain on their polluted watershed model of the MRG (middle left). Teachers share their capstone project ideas (middle center). Teachers from Duranes and Zia brainstorm capstone projects together (middle left).

II. EVALUATION

TEACHER FEEDBACK

Teacher feedback is an invaluable resource for program evaluation and it continues to help us understand what teachers value and where we can improve. This year's feedback continues to reinforce that RiverXchange® remains relevant and impactful in curriculum and content. Feedback demonstrates the RiverXchange program is highly valued by teachers for its ability to provide hands-on and experiential activities that expose students to local watershed issues, reconnect them to the natural world, and demonstrate career opportunities in the science and conservation fields. RiverXchange continues to be a valuable curriculum that teachers use to stimulate the personal and collective growth of their students by encouraging them to use teamwork, adaptability, and communication skills to engage in and build an understanding in complex and new topics. In addition, the capstone project has provided an additional opportunity for teachers and students to engage their greater school community in project based learning that occurs in the program through education, research, and community service. Feedback also demonstrates the RiverXchange continues to be valued for its ability to bring hands-on science in the classroom and teach about water resources issues, while addressing both Common Core English Language Arts Standards and Next Generation Science Standards.

Additionally, when asked to share what successes teachers and the students had with integrating the capstone project, teachers reported that students really enjoyed using the capstone to engage with RiverXchange by creating deeper connections to water issues through direct action and demonstration. Teachers described how their students used the project to educate others about environmental issues,

organize campus-wide clean-ups, and build interactive models to demonstrate key watershed science concepts.

Lastly, when asked how RiverXchange could be improved to support teachers in future years, teachers reported difficulty with virtual programming due to COVID and a desire to return to more in person presentations and field trips next year. Teachers also indicated that more physical supplies for hands-on learning and greater support for the capstone project would help them with supporting their students in meeting program objectives.

Below are a few highlights from the teachers:

What are the greatest learning outcomes for your class as participants in RiverXchange?

The exposure to the environmental issues and understanding the environmental issues in the state of New Mexico. - Detrick, Colinas Del Norte

Seeing career opportunities outside of what they know. Giving them the chance to interact with environments that they may not have. - Shafer, Maggie Cordova

Understanding the science of conservation and the importance of valuing life. - Hodges, MLK

My students are more aware of how their behaviors impact the environment.- Granstrom, Seven Bar

I think the hands-on learning approach is the greatest learning outcome. -Filkins, MLK

Please share any feedback you have concerning your experience with the program this year.

RiverXchange was extremely successful because my students were enthusiastic to learn about several ways to take care of our natural resources. Example: fixing water leaks, conserving energy by turning off lights and technology, picking up their animal's waste. - Sanchez, Duranes

This has been a wonderful and helpful way to teach about our local water system. It makes a difference if students can see the river itself and know they have a part to play in keeping the Rio Grande! - Beer, Cochiti

We love the program and would like to continue participating in it, hopefully doing it entirely in person for the following school year. - Ceballos, La Mesa

I would like to see a more streamlined, organized program. Having the presentations in person would be best as well. - Marquez, John Baker

Each year, it seems the program continues to improve. The resources and activities were invaluable.- Turrietta, MLK

Great job and thank you for everything you did for us RiverXchange! - Hornbecker, Colinas Del Norte

CAPSTONE PROJECT

In RiverXchange, our goal is that students not only understand their local watershed but that they use their voice to advocate for conservation and proper management of our watershed in their community. This year we integrated the capstone projects to provide a fun and engaging opportunity for students to learn about and advocate for their watershed.

To provide a variety of opportunities for teachers to meet the capstone project requirements, teachers selected from 3 different capstone project levels, each with its own set of criteria. Each level is tied to a particular level of engagement achieved by each class's capstone project. The different levels are described below.

Level 1: In RiverXchange, we want students to be as aware of their local watershed as they are about other environmental issues like climate change. Through creating hands-on projects, students are able to demonstrate what they learn in a fun and tangible way.

- Criteria: Create something new that teaches others about what you learned

Level 2: RiverXchange was founded on the idea that learning is more powerful when students make meaningful connections between their local ecosystem and themselves and then communicate what they learn with others.

- Criteria: Create something new that teaches others about what you learned, Communicate what you learned with your community

Level 3: What sets RiverXchange Excellence projects apart from the others is that they have a stewardship component along with a communication component. We want to support and celebrate classrooms that take education outdoors and convert what they learn into a hands-on, community-based project.

- Criteria: Create something new that teaches others about what you learned, Communicate what you learned with your community, Design a stewardship project that includes aspects of conservation and sustainability in your local community

Engagement

Of the teachers that completed the capstone, most projects addressed criteria 1&2, while only a few extended to criteria 3. Being that this was the first year of integrating capstone projects, staff understood the need to create a laddered system of capstone project engagement for the teachers and students. Having multiple levels of engagement facilitated various kinds of participation based on teacher and student interest and capacity- from presentations and posters to campus-wide clean ups. Some teachers used the capstone project to assess if students achieved the NM Stem Ready/Next Generation Science Standards. Students were engaged by the different capstone projects offered by their teachers, practicing skills in leadership, stewardship, and teamwork. One teacher expressed how the capstone project gave the students the chance to use their talents in new ways.

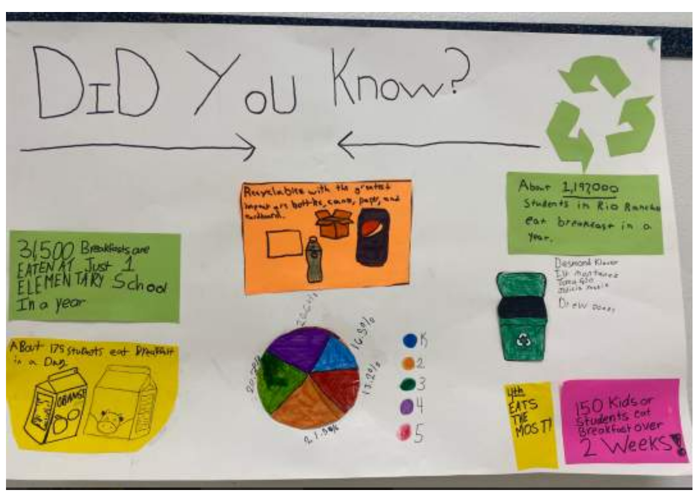
Beyond the impact to the students, the projects engaged the local community. When asked who in the community the class capstone project reached, teachers shared that often the entire 5th grade, students' families, or in some cases the whole school were reached during the course of the project. Students also expressed wanting to increase their reach to the greater public.

The challenging circumstances of virtual learning the last couple of years made it difficult for some teachers to complete the capstone project with their students. Some teachers expressed how their students had fallen behind in particular content areas and they weren't able to focus on the project due to the extra effort needed to bring students back to grade-level knowledge. One teacher requested additional support in designing and carrying out the capstone project.

Overall, the majority of teachers appreciated the hands-on and outdoor education focus of the capstone project criteria and felt their students gained meaningful experiences in the process.

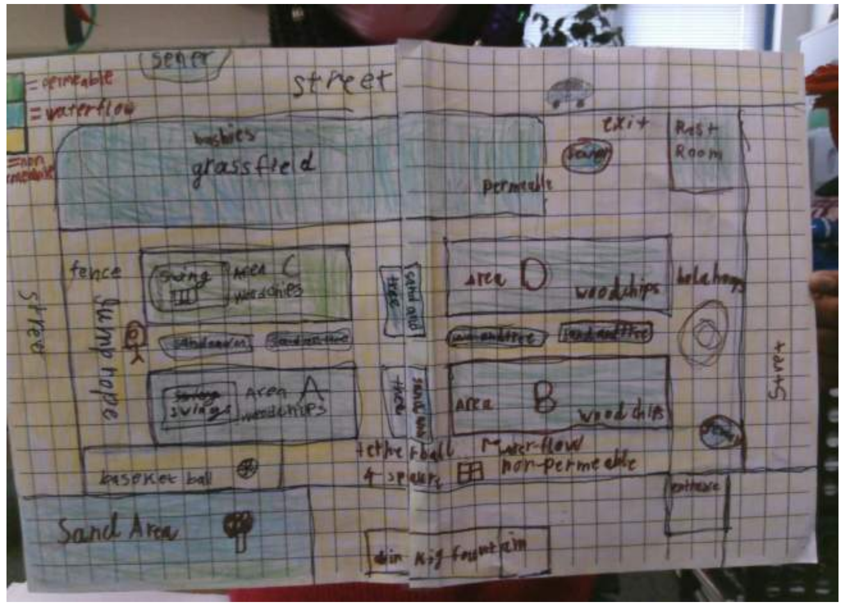
Capstone Project Images

Campus Clean Up- Whole team, Cochiti Elementary

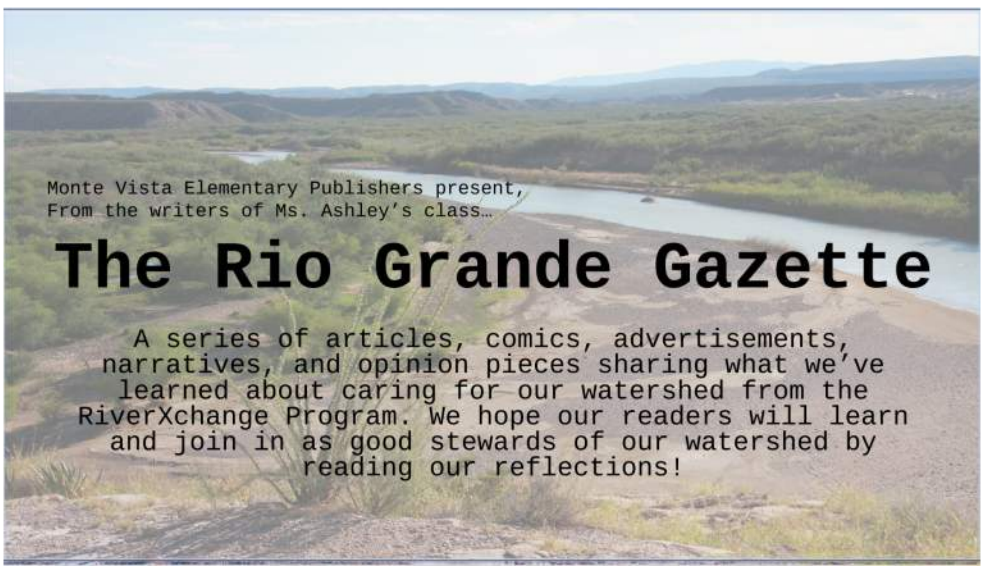


Recycling Project and Posters- Schapekahm, MLK

Green City Design- Chacon, Zia



Watershed mapping - Ackerman, La Mesa



The Rio Grande Gazette, Whole team, Monte Vista

Plantings using recycled plastic bottles- Gold, La Mesa

STUDENT SURVEYS

A key component of RiverXchange is its 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 observing the work submitted via the Capstone Projects. The survey includes questions that relate to environmental attitudes and behaviors as well as knowledge gained relating to our learning objectives.

Pre/Post Behavior Survey

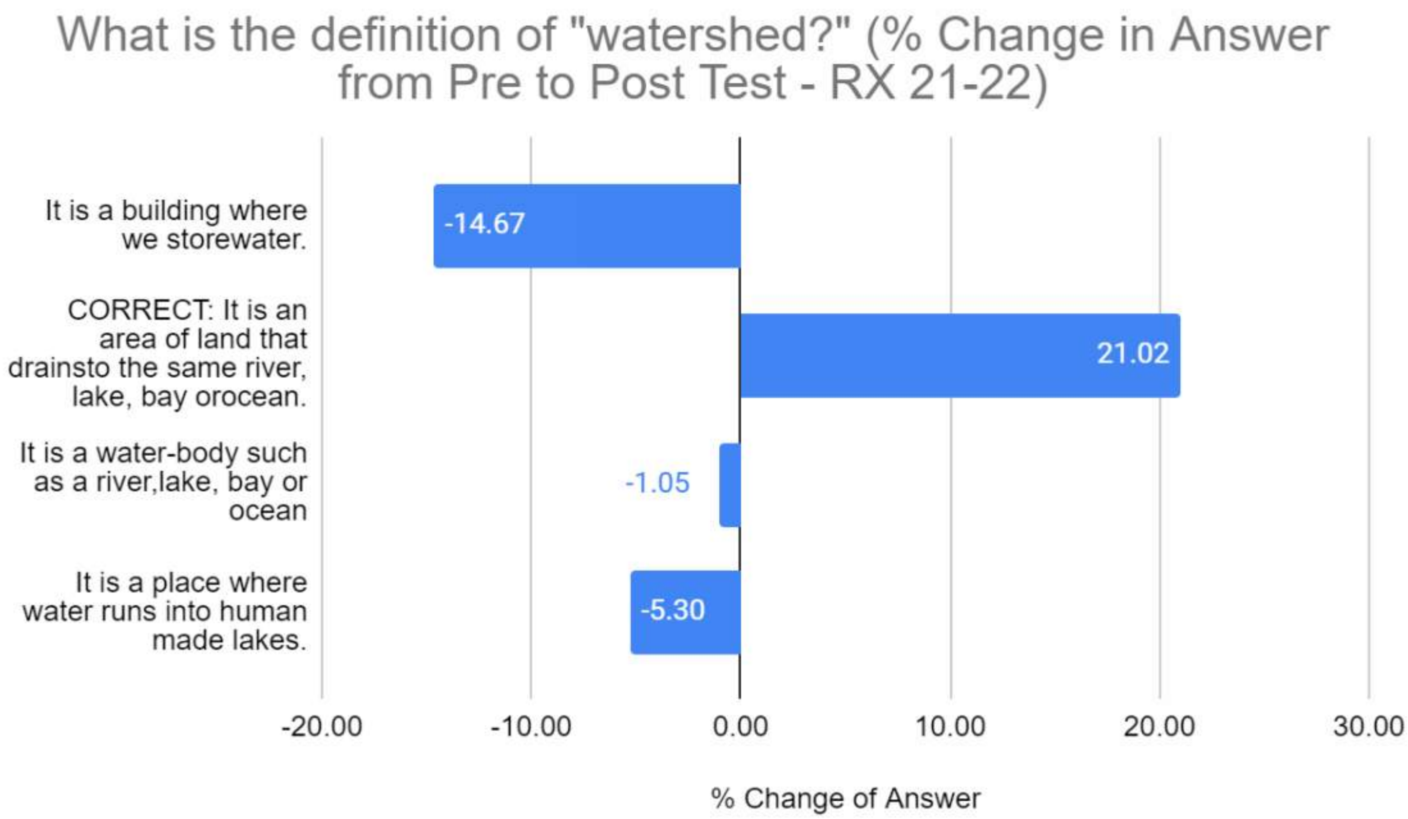
In order to quantify the learning outcomes achieved through RiverXchange, we ask our teachers to have their students fill out a survey prior to and upon completion of the program. Below, you will find a series of graphs used to illustrate the perfect change in responses between the pre and post surveys, as well as some breakout pie charts for further clarification on important topics. This year, 673 students completed the pre-survey, while 669 completed the post-survey. We continue to refine the survey and our programming year after year based on teacher feedback and metrics gathered from these surveys. To view this year's survey questions, use the following hyperlink: RX 21-22 Survey.

This year, we reframed the survey questions using a likert scale (with varying responses) with the hopes of demonstrating more range in growth across knowledge, attitudes and behaviors. In viewing other similar watershed program surveys, like the Watershed Project from the Bay Area in California, we hoped to look beyond our learning objectives and explore what kind of beliefs students had around water conservation behaviors. For example, in the question that asks how important/impactful are the following actions in protecting and conserving water, we were hoping to see increases from some or mild importance to high importance. Since the questions students had to respond to were all individual actions they could take, this movement to high importance, in theory, would demonstrate that they would feel more conviction to take those actions since they find them important and impactful.

As discussed with the MRGSQT general public survey, beyond collecting general knowledge about stormwater issues or watershed health, surveys can be educational tools as well. For example, asking students to select the positive water conservation behaviors they do “often” suggests that both these behaviors are important and desired. So even if students are answering how they think they should behave versus their action behaviors, this is still an effective tool to increase knowledge about behaviors that are positive for water conservation and watershed health.

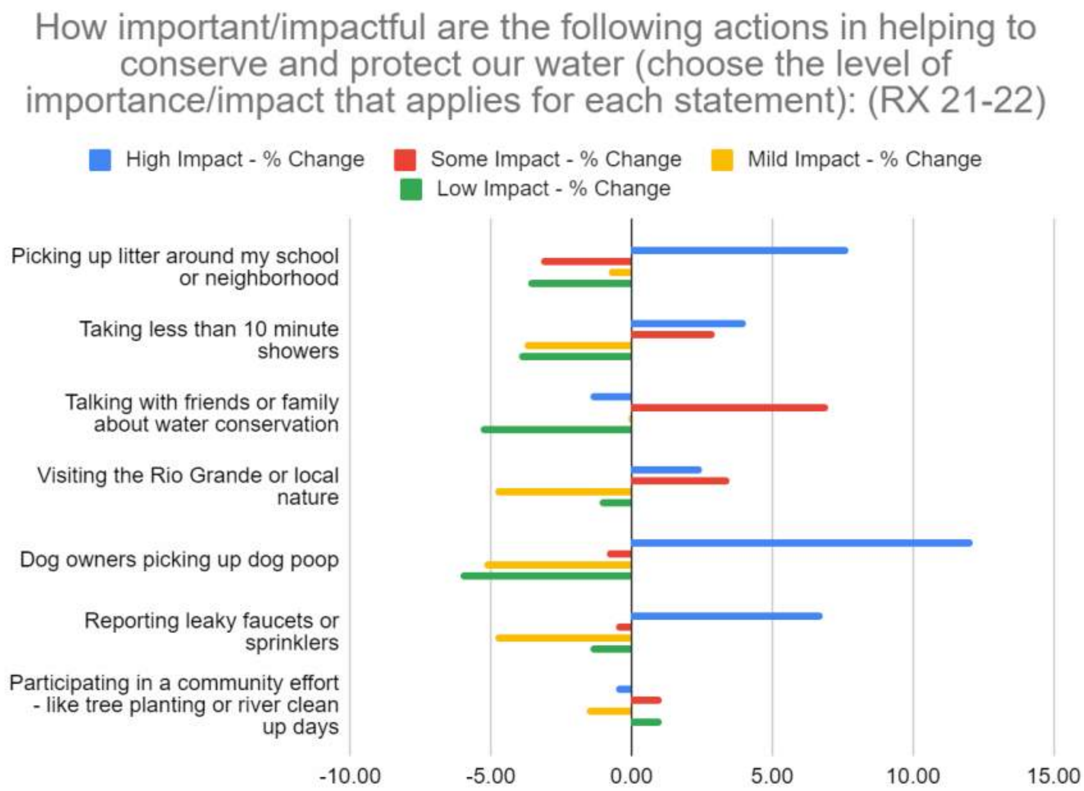
RiverXchange Percent Change Graphs for Pre-Post Surveys for 2021-2022

<u>Watershed Definition</u>

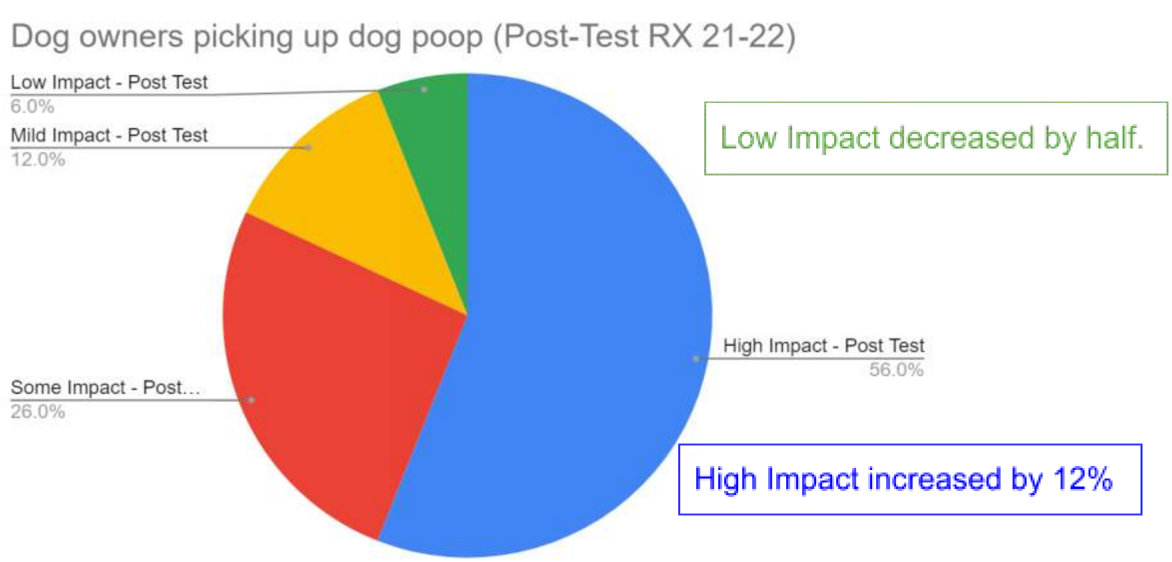


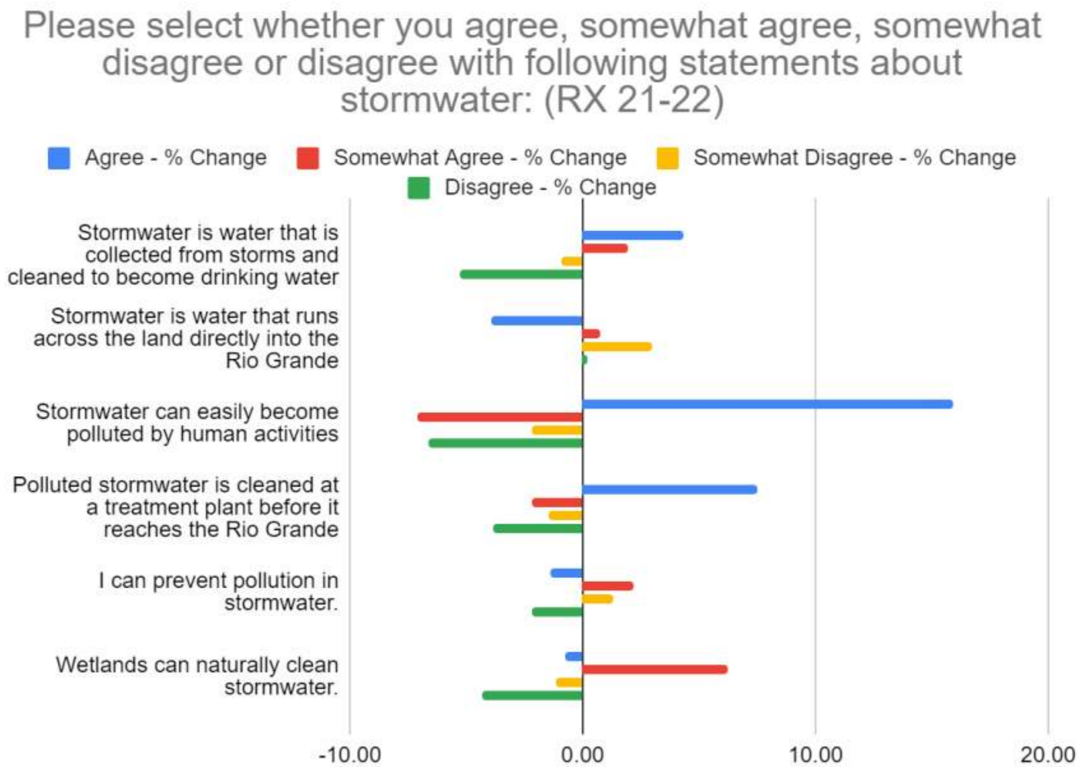
Results: We see over a 20% increase of correct answers for a watershed.

RX Stormwater & Pollution

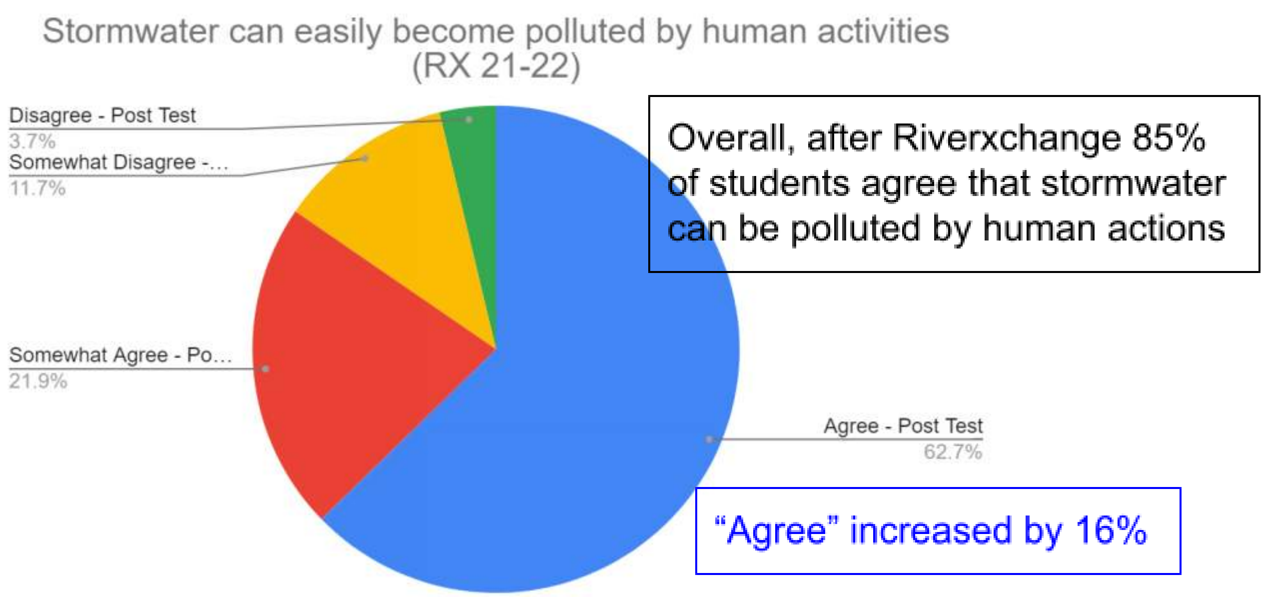


Results: Positive attitudes about picking up litter, taking shorter showers, picking up dog waste and reporting leaky faucets all increased after the program. There was also an increase in the belief that talking with friends and family can have some impact in water conservation. Breakout pie chart: In total over 90% of students believe picking up dog poop is impactful in helping protect water.

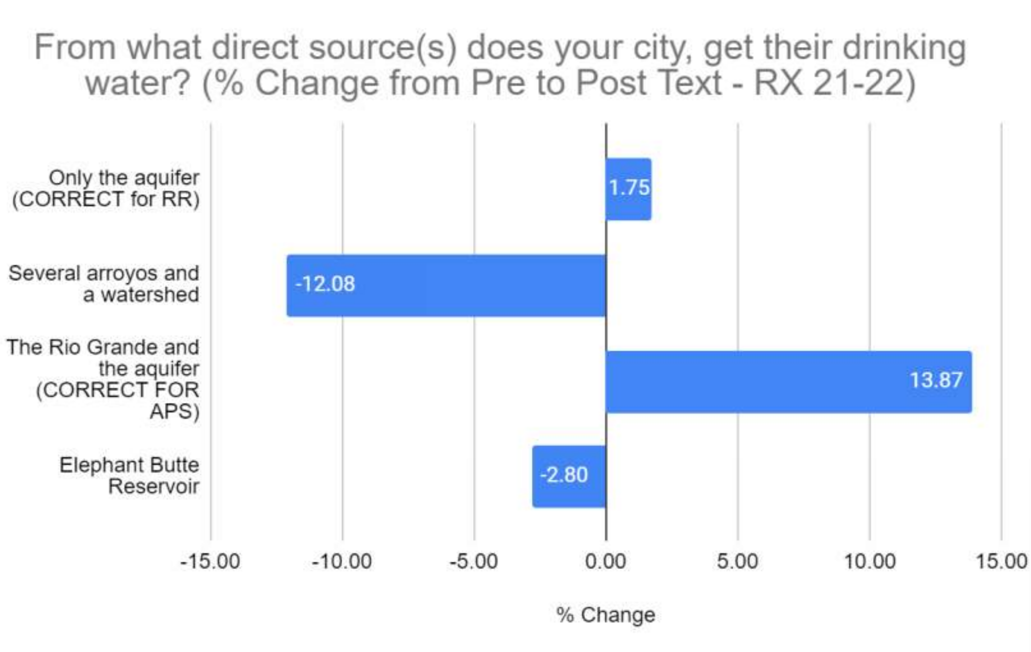




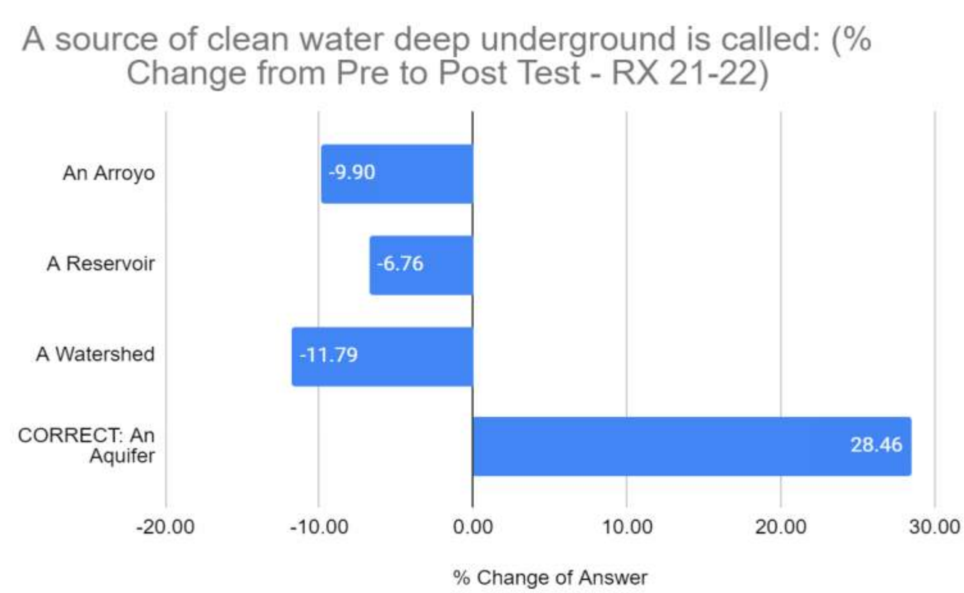
Results: Over the past few years, students seem to struggle with understanding the definition of Stormwater. However, more students agreed that stormwater can be polluted by human activities after the program and over 85% of students agree in total.



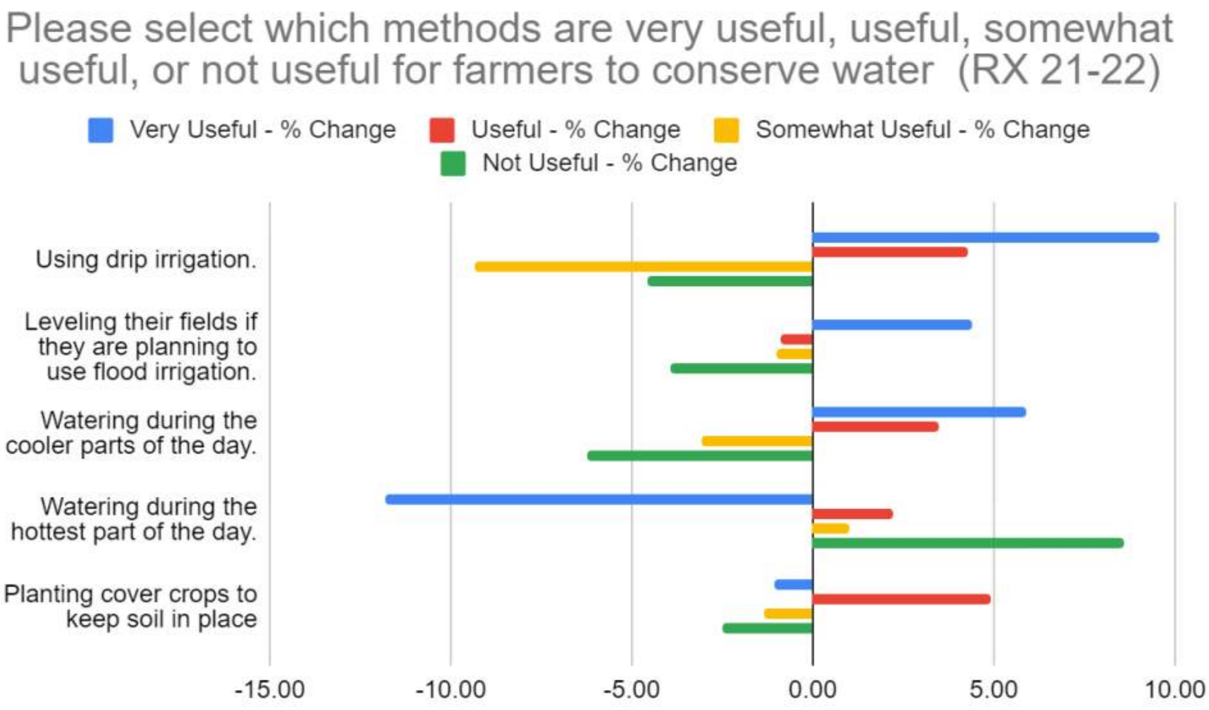
RX Watersource



Results: In looking at the totals separate by school district, APS overwhelmingly answered the drinking water question correctly. RRPS did not do as well selecting only the aquifer, this could possibly be because this isn't reinforced as much as it is in APS with other programs like The Water Utility Authority Rio Field Trip, and could also be because this lesson was in a pre-recorded video format. However, over 75% of students correctly answered the definition of an aquifer, with a 28% increase post-program.

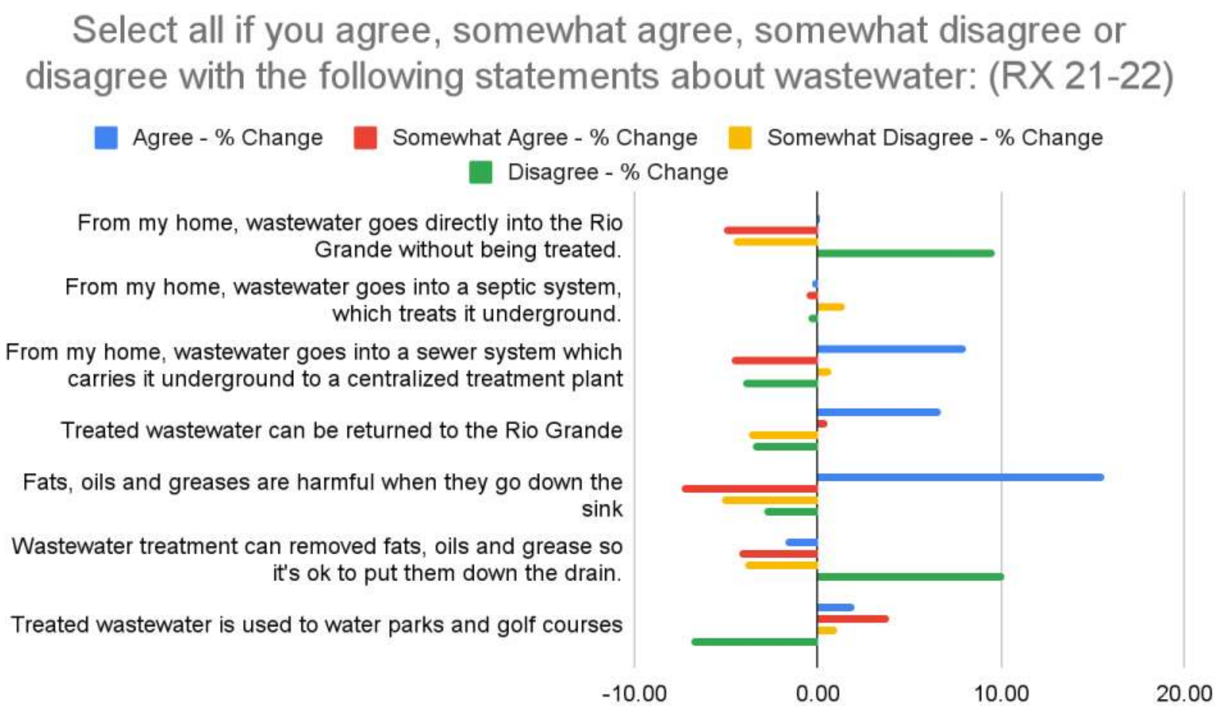


RX Farmers



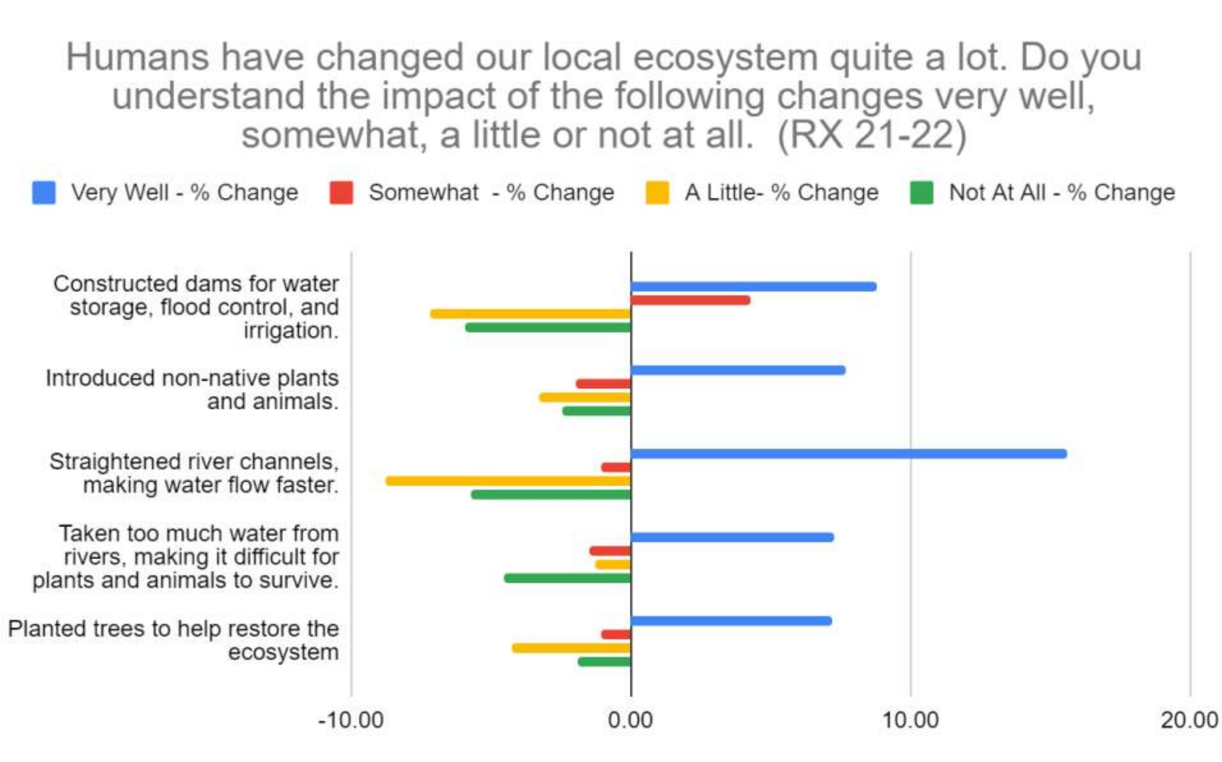
Results: Generally speaking students demonstrate an increase in selecting water conservation strategies in agriculture as "very useful" or "useful" post-program. They also increased the choices of not useful and decreased their choice of highly useful for watering during the hottest part of the day. The agriculture presentations may have touched briefly on the use of cover crops for soil health as a water conservation topic, so while selections of "very useful" decreased, "useful" increased more students may have been considering the topic in the moment, relying on previous knowledge to answer that question.

RX Wastewater

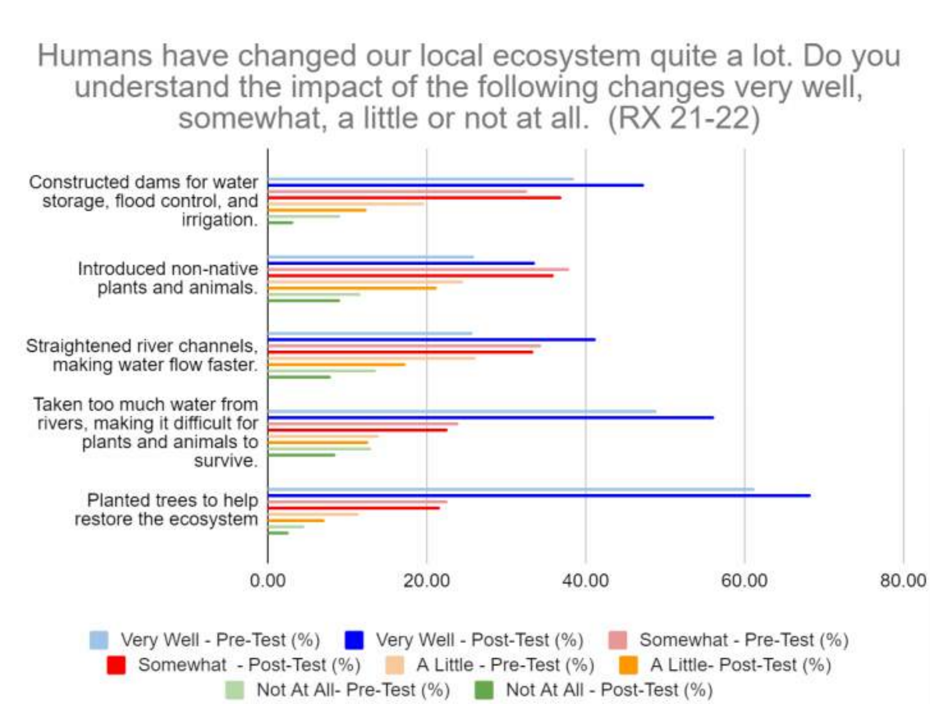


Results: Positive growth is demonstrated across all questions except the septic question which may just be confusing because it doesn't apply to every student.

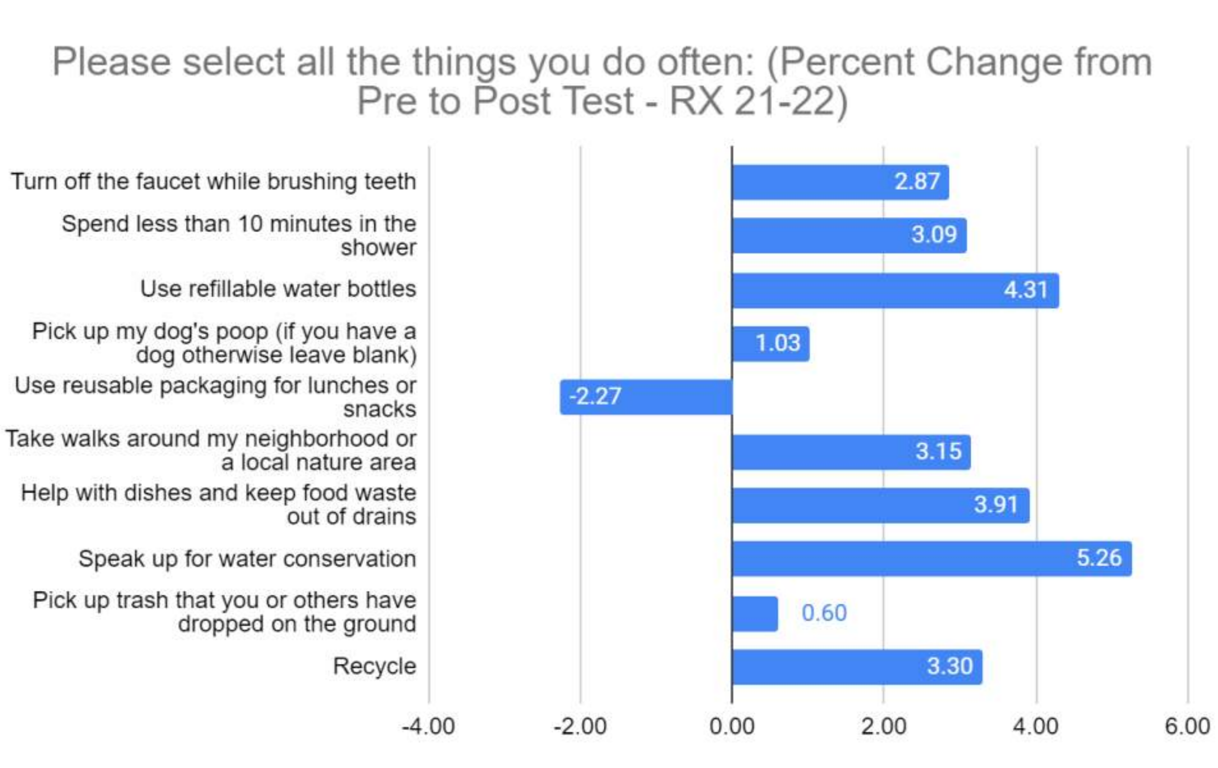
RX Confidence



Results: The goal of this question was to determine student confidence in RiverXchange learning outcomes. When you look at the percentage of total responses below a lot of students seemed pretty confident that they understood these concepts before the program - which is great! It is also great that after the program in general students increased their confidence and decreased their lack of confidence across all topics. This demonstrates they found the program helpful in supporting their understanding of human impacts on our ecosystem.



RX Behaviors



Results: Seeing around 5% change in behaviors from pre to post surveys has been consistent with past years findings. As a fifth grader you might not be changing your behaviors significantly due to family and community behaviors and culture. However, it is exciting to see that the largest percent change was in students speaking up more for water conservation. At this age, this has the potential to shift family and community behaviors more than other behaviors due to the rippling effects of more people taking other actions to conserve and protect water.
The decrease in using reusable packaging could be due to students' increased awareness of food packaging in the cafeteria or home packed lunches or an increased use of single use plastics due to covid concerns.

Appendix A

RiverXchange Virtual Field Trip 2021-2022

1. What are we trying to teach students in this activity?

Essential questions:

· What is a floodplain and why is it important? (Rio Bravo)
· How has the Rio Grande floodplain been changed by humans? (Rio Manso)
· What efforts are being made to conserve the Rio Grande Floodplain? (Rio Nuevo)

2. How can we tie this activity to our teaching goals:

Learning Objectives	**Methods**
The riparian ecosystem of the Rio Grande is shaped by natural flooding.	Observation and finding evidence of: ● riparian habitat - plants and animals that depend on the ecosystem. ● the role of the Cottonwood tree as a keystone species and its dependence on flooding for its life cycle.
Human impacts have reduced or eliminated flooding.	Observation and finding evidence of: ● Human impacts ● Reduced flooding
Conservation efforts are now being made to rehabilitate and strengthen the riparian ecosystem	● What monitoring methods can be used to determine the health of the ecosystem? ● What is being done to restore this ecosystem?

3. How can we tie this activity to standards?

Using the NGSS framework to explore **Phenomena** and support **Claims** based on **Evidence** and **Reasoning.**

Performance Expectations	**DCIs**
5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers and the environment	LS2.A Interdependent Relationships in Ecosystems
5-ESS2-1 Develop a model using an example to describe ways in which the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	ESS2.A Earth Materials and Systems ESS2.C The Roles of Water in Earth's Surface Processes
5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment	ESS3.C Human Impacts on Earth Systems

4. How should this lesson be organized?

I. Introduction
   a. First, the presenters should introduce themselves by name, position, and organization.
   b. A presenter will take the students through the agenda.
      i. Ask students what they have already done in class—this should be the Rio Bravo and Rio Manso activities. Today, we will be taking them through the timeline again, reviewing and demonstrating aspects of both models that are still present in the Bosque still today. Then, we will be introducing a new concept—Rio Nuevo and doing the model with the river as it is today!
   c. Pan the camera around, can students identify where we are? It is the Bosque!
      i. Give the students a brief history of the Open Space Division and its connection to the Bosque and other public lands.
      ii. Describe the importance of understanding and connection to the land. The land needs us just as much as we need it. Part of understanding the land is making observations and questioning the world around us. This will lead directly into the next activity "I notice, I wonder, it reminds me of"

II. "I notice, I wonder, It reminds me of"
   a. This activity is meant to engage students' observational and thinking skills - to turn on their "nature" brains!
      i. Let students know you will describe the activity first and then bring the camera to focus on a smaller, up-close frame of our object to be observed.
      ii. Walk students through each prompt. Describe how these prompts relate to the scientific method (observation, questioning, hypothesis)
      iii. I notice (the foundation of an observation): shape, size, texture, color, location, etc. These are simply what we see, without labeling their function or what we assume is the function.) Ex: "I notice a long, thin shaped object that is bumpy, brown colored with small lines on it."
      iv. I wonder (the foundation of questioning): Take any statement that we think applies to our object and turn it into a question. "I wonder if something was eating this object that caused the lines? I wonder if this is a plant? I wonder if it is alive? I wonder if it is dormant?
      v. It reminds me of: (the foundation of a hypothesis): Making connections to what we already know or can remember helps us make an educated guess to answer our questions. For the purpose of this exercise, we are simply practicing making connections. "It reminds me of a spiral. It reminds me of the colors of sunsets in Albuquerque."
      vi. Complete the activity, prompting and modeling as you go.

III. Rio Bravo
   a. Discussion: Students will have been taken through the Rio Bravo exercise. RX presenter will ask:

i. Do you remember what Rio Bravo means?
ii. How was the river shaped?
iii. What did you place down in and around the river?
1. Yes! You placed down animals and plants in and around the river. We can still find evidence of the wild river today even though it has changed. Can you name some of the plants or animals that you placed in the Rio Bravo?

b. Activity: What evidence can we find of the Rio Bravo and ecosystem in the floodplain? (A floodplain is a riparian ecosystem so what we are looking for is evidence of a variety of plants and animals that depend on the river).

i. Plant #1 - Coyote Willow (walk around and "see" your first plant)
1. "Look at this plant! Wow, it's everywhere here in the Bosque. It's here… over here… and even over there! (point camera.) Let's get a closer look. It has long skinny leaves and smooth bark on the branches.
2. What do you think it is? Vote with your card or write the name on a paper and hold it up.
3. You're right! It's a coyote willow! The way you can tell is that it's a shrub that always grows next to water, it's short, and it has long skinny leaves. It's one of the most common shrubs around water (riparian ecosystems) in New Mexico. Beavers LOVE to eat its branches, but it's also eaten by porcupines, deer, and rabbits.

ii. Animal #1- Beaver (walk to an old beaver chew)
1. "What do you think has been here?" It looks like something has used long incisors to chew horizontally through the bark. It is a beaver!
2. Introduce the beaver skull and discuss other adaptations that beavers have that allow them to live in this riparian ecosystem.
a. Castor oil that they use to waterproof their fur
b. Ear flaps that close so they don't get water in their ears
c. Extra eyelid to see underwater
3. Could you live in a riparian ecosystem? What adaptations do you have?
4. Coyote Willow is not the only plant that beavers will rely on!

iii. Plant #2- Cottonwood
1. "If the porcupine is living and eating this tree, we should probably know what it is. Let's look at the leaves and see if we can figure it out. The leaves aren't on the tree right now because it's winter, so let's find one on the ground. (get leaf). Okay, here it is - it has a heart-shaped (or triangular shaped) leaf with a flat stem that's also called a petiole. And if I look around, I see them everywhere in the Bosque. I can even see them on the other side of the river! (Span the Bosque then point camera to other side of river.)"
2. "What do you think it is? Vote with your card or write the name on a paper and hold it up."
3. "You're right! It's a cottonwood. And not just any cottonwood, but a Rio Grande cottonwood. These trees are a very important species in the Bosque. They provide food for many animals, like the porcupine, beaver, deer, rabbits, and insects. Birds eat the insects that feed on the cottonwood. PLUS, many animals use them for their homes! Porcupines sleep in them, and so do great horned owls. Birds make their nest in them. Squirrels live in them. They are a

very important part of a healthy Bosque ecosystem. And the way you identify them is by looking for their heart shaped leaves."

iv. Animal #2- Porcupine
   1. Look up in the cottonwood tree: do you see anything there?
      a. Option 1: I see a porcupine! It is just a small bundle of quills that is resting in the nook between two branches!
      b. Option 2: I see a bunch of branches without bark on them. Who did that? It was a porcupine!
   2. Porcupines live in the canopies of cottonwood trees because that is where their food is! Porcupines eat the same thing as beavers, which is the cambium, or inner layer, of the tree behind the bark. Beavers are chunky and unable to climb, so they cut down trees to get to their food, whereas porcupines are able to climb trees.
   3. Can we find any evidence of porcupines on the ground?
      a. Option 1: I found a track! This track has a bunch of texture on its paw pad. Do you have socks that have texture on the bottom? That helps you stick to the floor and not slide. I bet the texture on its paw pad will help it climb!
      b. Option 2: I found some scat! How do I know that it came from the porcupine? It's located in the middle of the trail, which is right under a big branch of the cottonwood tree. We can also distinguish scat by its shape, size, and color!

c. Conclusion
   i. Even though the river might not be as wild as it used to be in Rio Bravo, we still have an interconnected system of animals and plants that still live here today! Let's investigate how humans have altered this system in our next section, Rio Manso.

IV. Rio Manso

a. Discussion: Students will have been taken through the Rio Bravo exercise. RX presenter will ask:
   i. Do you remember what Rio Manso means?
   ii. How did humans alter this ecosystem?
      1. Yes! They used jetty jacks, added homes, dams, acequias, and invasive species.
   iii. What happened to the river?
      1. Yes! The river was channelized and no longer was the braided, meandering river that we once knew.

b. Activity: What evidence can we find of the Rio Manso in the Bosque today?
   i. Plant #3- Ravennae grass. Ravennae grass is an invasive species that was brought to New Mexico from Africa as an ornamental and also for soil stabilization. Ravennae is drought tolerant, deer tolerant, and frost tolerant so it thrives in New Mexico. Although it doesn't allow other plants to thrive alongside it. It does such a good job, it outcompetes our native grasses.
      1. Can you name some ways in which invasive species can travel?

a. Underneath boats/aircraft, hikers' shoes, bringing them on purpose (ornamental, biological control, soil stabilization)
b. So many more invasive species have made their way to the Middle Rio Grande, but most came on purpose. We just didn't know at the time how problematic they would be.

ii. What happened in the Rio Manso activity that allowed for the invasive species to move in? Yes, they took away vegetation like the cottonwood trees and native shrubs to make room for the expanded population and their homes! Let's take a closer look at the cottonwood trees here.
   1. Cottonwood trees are a keystone species, which means this ecosystem largely depends on their existence and their removal would be catastrophic.
   2. To understand better how our cottonwood trees are doing I want to measure their height. Height in a cottonwood tree doesn't necessarily determine its age, but rather how many resources are available to it.
      a. Explain to students how we use a tangent gauge in order to measure a tree's height. All staff to measure distance to a tree, have students guess the presenter's heights, and then have the students add the measurements to get a calculation.
      b. Trees that are between 60-70 feet are full grown cottonwoods, but with limited resources. Those old cottonwoods that were close to the water will reach up to 90 feet tall! We can't determine if the whole forest has insufficient resources by just one tree. Let's measure the height of another!
         i. Proceed with the same process with another nearby tree.
      c. See how those two trees have a very similar height? Look around at the canopy, what do you notice about the height of all of these trees? Yes, they are mostly the same! We have a very uniform canopy in the Rio Grande Bosque. What resource do you think the trees are not getting enough of? Yes, water! Let's take a look at why these cottonwoods are not getting enough water.

iii. Do you remember what the impact of jetty jacks, levees, and dams did to the Rio Grande in the Rio Manso activity? Yes! They channelized the river or made it straight.
   1. One reason that these cottonwood trees are not getting enough water anymore is because the river does not flood as it would have naturally done before construction.
   2. I need your help to run a little science experiment! I want to see whether a meandering river or a channelized river goes faster.
      a. I want you to form a hypothesis, can you share what you predict will be the answer?
      b. Now, I am going to run two different tests. One in which I will walk in a curved line and one in which I walk in a straight line, both the same length. When I say go, begin counting with [presenter #2]

c. Was your hypothesis correct? The meandering river does run slower! When our river is allowed to meander in cycles slowly and then quickly throughout any given year, the outside to those curves it allows for sand to be deposited and then for cottonwood seedlings to grow. But without those sandbars and moist soil in the floodplain, what happens to our cottonwoods? The seeds cannot grow!

c. Conclusion
   i. Humans have fundamentally altered the Middle Rio Grande, but all it not lost! Humans have also begun to take measures to support a new relationship between our lives and the river. This next section, we have not discussed yet and it is called Rio Nuevo or new river.

V. Rio Nuevo
   a. In the last two models, we were describing what had happened in the past. Rio Nuevo is happening right now and you will ultimately be the ones that get to decide what our river looks like in the future. I want you to be the engineer for me. What would you do to restore the river and make it look more like Rio Bravo?
      i. As the students submit their answers, we will go one by one and explain how that would alter the model. The model will have been already set up as Rio Manso prior to the field trip starting.
      ii. Overbank flooding: during years with high winter snowpack there will be lots of water melting and flowing down into the watershed. Engineers could decide to allow for overbank flooding, which would give the Rio Grande cottonwood seedlings a chance to grow! It would also allow for a better cycling of nutrients so that native species have a better chance of competing with the invasive ones.
      iii. Pole plantings: one way to counteract the decreasing number of cottonwoods is by cutting a long, young branch of an existing cottonwood tree and planting it directly into the ground so that it touches the water table. This branch will then grow roots and form its own, independent tree without the need to grow the trees from seeds.
      iv. Wetland construction: land managers can create new ponds and wetlands that support the variety of wildlife that used to have a home in the Bosque. Some of these are created by allotting space, constructing the ditch with big machines, and providing water as has been done at the Open Space Visitor Center.
      v. Fuel-wood reduction: in earlier years, the overbank flooding that would occur would saturate the branches and leaves that had fallen on the ground and allow them to decompose. It would also act as fire suppression. We now need to manually need to stop these fires because the Bosque is dry and has a lot of fuel. One way to stop these fires is by cleaning the area of downed trees and branches, reducing the fuel.
      vi. Creation of secondary channel: the river used to have many channels as it flowed down the valley. In areas in which a bank may be too high, land managers can remove the excess bank and create a side channel that has enough flow to allow cottonwoods

to germinate and establish themselves. Sediment from these banks can be replaced in the river to provide for sandbars, which is habitat for certain species (silvery minnow).

vii. Removal of exotic species: Many different groups have taken to removing a number of invasive species such as saltcedar, Russian olive, Siberian elm, and others. The Open Space Division hosts spring cleanups every Saturday from April through mid-may in which families are welcomed to come out and help remove invasive species. This is something you can learn how to do!

viii. Water conservation: the amount of water that people use along the river has a large impact on the health of the Bosque and river life. Pumping more water than is being replenished each year has caused the water table to drop and has made it more difficult for native species to survive. Planting low-water use landscaping, installing rain barrels, low-flow toilets, turning off the water while brushing teeth, and taking shorter showers are things that we can do personally. We can also ask businesses and other entities to self-impose water-use limits so that we are all working together.

ix. Jetty Jack Removal: Today, the riverbanks and levees are quite stable. The jetty jacks are seen as a danger to emergency vehicles moving through fires, eye sores, and ultimately the channelization of the river does not benefit the Bosque. Land managers can try to remove the jetty jacks, although it is difficult to do given their size, weight, and difficult access.

x. Monitoring: an important part of managing the Bosque is to understand what is happening to the plants, animals, water table, and other ecological functions. Monitoring is the process of collecting, compiling, and analyzing that information. There are many organizations that will do monitoring throughout Albuquerque in order to ensure that what we do going forward will only benefit the Bosque. So many of our previous actions had unintended consequences and monitoring is one way of making sure that we do not repeat mistakes.

VI. Conclusion

RiverXchange Virtual Field Trip Synopsis 2021-2022

I. Introduction (Ellie: 10 minutes)

II. "I notice, I wonder, It reminds me of" (Erin: 10 minutes)

III. Rio Bravo
   a. Discussion: (Ellie)
   b. Activity
      i. Plant #1 - Coyote Willow (Ellie: 5-7 minutes)
      ii. Animal #1- Beaver (Ellie: 5-7 minutes)
      iii. Plant #2- Cottonwood (Erin: 5-7 minutes)
      iv. Animal #2- Porcupine (Erin: 5-7 minutes)
   c. Conclusion (Erin)

IV. Rio Manso
   a. Discussion (Ellie)
   b. Activity:
      i. Plant #3- Ravennae grass. (Ellie: 5-7 minutes)
      ii. Plant #4- Cottonwood tree / Tangent gauge (Erin: 7-10 minutes)
      iii. Model of river shape- (Erin: 5-7 minutes)
   c. Conclusion (Ellie)

V. Rio Nuevo (Ellie- 30 minutes)

VI. Conclusion (Erin)

Watershed Stewards

2021-2022 Final Report

Submitted by
Erin Blaz, Ciudad SWCD
June 2022

SUMMARY

The overall intent of this program is to educate the public on the all-encompassing importance of watershed health, SSCAFCA's role in local watershed management, and to encourage personal commitment to watershed stewardship. This year's program focused on delivering watershed stewards in partnership with activity coordinators at the Meadowlark Senior Center in Rio Rancho and Del Webb Alegria Community in Bernalillo. The program consisted of lecture-style presentations and field trips to local open spaces and other sites of interest, and also included an outreach activity for Pollinator Day at Meadowlark Senior Center in the spring.

The program required funding in the amount of $10,249.05 generated $599.00 in-kind match, and reached 135 senior citizens, significantly more than our original target of 25 seniors. A few of the participants returned for multiple events. There were 17 presentations/field trips that lasted from 1-2 hours for participants, reaching beyond our target of offering 25 hours of program this year.

2021-2022 Themes and Locations

The theme of this year's fall program centered on Green Stormwater Infrastructure (GSI) and included educational presentations and field trips that were specific and relevant to the concepts of GSI and the role of GSI in watershed health. The theme of spring's program was "Walks and Talks" which focused on local wildlife, native and medicinal plants, and brought participants to Arroyo and Riparian areas located within Rio Rancho Open Spaces. All presentations were able to integrate and connect watershed stewards learning objectives to the content, such as stormwater pollution prevention and local habitat protection.

We also offered two events at the Rio Rancho WaterWise Garden, which is an excellent demonstration space for a range of topics. In the fall, the Master Gardeners gave a tour of the garden with a focus on water conservation, plant selection for drought tolerance with a preference on native species and green stormwater infrastructure. In addition to the tour, Sandoval County presented the Rolling River, and discussed the importance of residential and municipal GSI in watershed health. In the spring, Dara Saville of the Yerba Mansa Project completed a very well received talk and tour at the Waterwise garden about native and medicinal plants.

In addition to our normal programming, we also celebrated pollinators at the Meadowlark with a talk about honey bees and a presentation by ABQ Backyard Refuge. During this time we also made bee hotels with participants and passerby's out front of Meadowlark.

Building Partnerships
This year we increased partner support from Sandoval County Master Gardeners and Cooperative Extension office, Dyane Sonier of City of Rio Rancho Parks, Recreation and Community Services and Dave Gatternman of SSCAFCA, which generated some in-kind match to support the program. Discussions with Dyane Sonier focused on taking a reciprocal approach to engaging the local community in areas where our different programs align. There was hope to invite watershed stewards to help plant the new pollinator garden at the WaterWise Garden, but timing did not allow for this event to include Watershed Steward participants this fiscal year.

Stewardship Opportunities
One of the goals of the Watershed Stewards Program is to encourage personal commitment to watershed stewardship, and while the presentations and field trips offered build knowledge around stewardship strategies, program staff continue to seek out ways to engage our participants in hands-on projects that support watershed health.

This year one participant was interested in applying some GSI techniques to an erosion problem behind his house. Dave Gatterman and Erin Blaz met with this participant and Mr. Gatterman was even able to get City of Rio Rancho approval to apply some mitigation and restoration strategies. This was an exciting opportunity to engage participants in a project, however during the process of planning the city applied an erosion treatment to the hillside and it was determined best to wait and see the results of that effort.

During the pollinator day, we also hosted ABQ Backyard Refuge at Del Webb Alegria. This was a very interesting and fruitful conversation. 11 community members participated from Alegria and discussed the need for support in some of their open spaces within the Del Webb development. There was high interest in creating wildlife refuges in these spaces, but they cited challenges within their own HOA and community perceptions - like a desire for lawns and manicured spaces.

Evaluation
Considering we were able to bring in-person programming back safely to this community after a year of virtual programming due to the pandemic, this year's program reached a larger than expected audience and offered more hours of program than anticipated. However, there are certainly ways to improve. Watershed Stewards will benefit from continued support or partnership with other local entities in Rio Rancho and Town of Bernalillo so that we can collectively reach more people with a wider range of content. Watershed Stewards would also benefit from tracking participant contacts across all programs by Ciudad to be able to maintain correspondence, build community around action and stewardship, and survey folks to increase our understanding of our audience and impacts. In response to this FY22 funding was used to purchase a tablet that can be used in the field to track participant signs-in and survey participants. Additionally, finding ways that are of interest and well-suited to the senior community to engage with hands-on projects will need to continue through relationship and rapport building within the community and local partners.

Program Pictures





Prior page: WWG program with tour and rolling river. Top this page: Mikal Deese with a local bird. 2rd row: Justin shows bats & scat comparisons.
3rd row: Justin does Bosque and Arroyo Habitat walks. Bottom row: Dara Saville at WWG and Bee Hive for Pollinator Day.




Outcome Report

for Fiscal Year 2021–2022

(July 1, 2021 to June 30, 2022)

MID RIO GRANDE STORMWATER QUALITY TEAM

Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) • City of Albuquerque • Bernalillo County • Town of Bernalillo • Village of Corrales • Ciudad Soil and Water Conservation District • Eastern Sandoval County Arroyo Flood Control Authority (ESCAFCA) • Village of Los Ranchos de Albuquerque • Department of Transportation (NMDOT) • City of Rio Rancho • Sandoval County • Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)

PRESENTED BY

SUNNY505

Introduction

The outcomes report is designed to illustrate the collective successes of the Middle Rio Grande Stormwater Quality team. In fiscal year 2022, the Storm Team reached over 100,000 individuals in the Albuquerque Metro area through special events, educational efforts, as well as digital promotions via various social media and the website.

The Storm Team is a collaborative organization made of of the following: The Albuquerque Metropolitan Arroyo Flood Control Authority, the City of Albuquerque, Bernalillo County, the City of Rio Rancho, Ciudad Soil and Water Conservation District, the New Mexico Department of Transportation, the Southern Sandoval County Arroyo Flood Control Authority, the Town of Bernalillo, the Village of Corrales and the Village of Los Ranchos.

MID RIO GRANDE STORMWATER QUALITY TEAM

Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) • City of Albuquerque • Bernalillo County • Town of Bernalillo • Village of Corrales • Ciudad Soil and Water Conservation District • Eastern Sandoval County Arroyo Flood Control Authority (ESCAFCA) • Village of Los Ranchos de Albuquerque • Department of Transportation (NMDOT) • City of Rio Rancho • Sandoval County • Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)

Table of Contents

Bernalillo County

Public Outreach and Education Tracking

FY2022: July 1, 2021 – June 30, 2022

Date	Location	Event Topic	Description of Education/Outreach Event Program/Materials	Participants	Source for Participant Count
8/11/2021	Bosque	Illegal dumping cleanup	BernCo and Amazon Illegal Dumping Partnership Clean Up in the Bosque. Illegal Dumping Partnership 1,250 tons of junk and rubbish cleaned up on annual basis.	80	BernCo News Release
9/9/2021	505Outside monthly landscaping newsletter	Learn How to Harvest Rainwater in Your Yard article	Provided article promoting video training series on how to design, construct, and maintain residential rainwater harvesting features. See https://www.505outside.com/2021/09/01/learn-how-to-harvest-rainwater-in-your-yard/	1098 visits to article	cbustos@abcwua.org jillbrown@browngreenandmore.com
9/26/2021	Los Vecinos Community Center (478 NM-333, Tijeras, NM 87059)	East Mountain Celebration	Natural Resources Services table in Bernalillo County tent. Provided information to educate County residents on stormwater quality, water conservation methods and incentive programs, and groundwater monitoring program. In addition, the County worked working in collaboration with Knowaste Services to provide a litter free event. East Mt. Celebration resulted in Compost 168.0 lbs., Recycle 29.0 lbs., Landfill 155.5 lbs., Cardboard 33.5 lb., Glass 4.5 lbs., Film 1.0 lbs., total weight managed 391.5 lbs., total weight diverted 236.0 lbs. with a diversion rate of 60.3%	2500	Bernco Office of Community Engagement and Outreach email - Cathy Lopez
9/27/2021 and 10/1/2021	Virtual and Gutierrez Hubbell House (6029 Isleta Blvd SW, Albuquerque, NM 87105)	Waterwise Landscaping training for ABC Tree Stewards Program	This workshop for the ABC Tree Stewards Program addressed principles of Waterwise Landscapes including native and arid-adapted plants, mulch, efficient irrigation, and rainwater harvesting. Day Two of the training was a tour of the Rainwater Harvesting Learning Landscape at the Gutierrez-Hubbell House.	11	2021 Tree Stewards cohort

2/11/2022	All Nations Wellness & Healing Center (6416 Zuni Rd SE, Albuquerque, NM 87108)	EJ in Action: Water-Wise Workshop	This class addressed waterwise landscaping principles including efficient irrigation, native and arid-adapted plants, and rainwater harvesting.	16	Head count at event
3/2/2022–3/4/2022	Virtual and in-person conference at Indian Pueblo Cultural Center (2401 12th St NW, Albuquerque, NM 87104)	New Mexico Land and Water Summit conference	Conference theme was "From Concept to Completion: Lessons Learned" and addressed GSI/LID projects through all stages of development including planning and design, implementation, public acceptance, and maintenance. Conference also included full-day tour of GSI/LID projects in Santa Fe. Attendees included engineers, architects, landscape architects, planners, and water resources professionals. Served on Planning Committee, provided $5,000 sponsorship, and presented "Bernalillo County GSI/LID Standards".	272	Land and Water Summit Whova virtual conference platform report
3/19/2022	Loma Linda Community Center (1700 Yale Ave SE, Albuquerque, NM 87106)	Work day at Loma Linda Community Center Community Garden	Provided demonstration on how to convert an IBC Tote to a rain barrel	22	Head count at event
4/7/2022	Our Land: New Mexico's Environmental News/ NM In Focus	LIVE NOW: Plastic Bags & Stormwater Risks	Interview on how the repeal of Albuquerque's plastic bag ban could affect water quality in Rio Grande. https://www.newmexicopbs.org/productions/newmexicoinfocus/assessing-the-impact-of-tax-rebate-checks-recreational-cannabis-legalization-spring-runoff-forecast/	65,000-70,000 viewers in Central & Northern NM	KNME Communications Director Michael Privet
4/19/2022	Gutierrez Hubbell House (6029 Isleta Blvd SW, Albuquerque, NM 87105)	Waterwise Landscaping training for ABC Tree Stewards Program	This workshop for the ABC Tree Stewards Program addressed principles of Waterwise Landscapes including native and arid-adapted plants, mulch, efficient irrigation, and rainwater harvesting, and included a tour of the Rainwater Harvesting Learning Landscape at the Gutierrez-Hubbell House.	18	2022 Tree Stewards cohort
4/24/2022	Westside Community Center (1250 Isleta Blvd SW, Albuquerque, NM 87105)	South Valley Pride Day	Natural Resources Services table in Bernalillo County tent. Provided information to educate County residents on stormwater quality, water conservation methods and incentive programs, and groundwater monitoring program.	4000	Bernco Office of Community Engagement and Outreach email - Cathy Lopez
4/29/2022	ABQ BioPark (2601 Central Ave NW, Albuquerque, NM 87104)	Maintenance of Green Stormwater Infrastructure features	This class provided an introduction to GSI, descriptions of GSI features (permeable pavement, stormwater harvesting basins, infiltration conveyances, plants, and mulch), and maintenance requirements for GSI features.	20	Registration list from ABCWUA Water Conservation Program
5/14/2022	Le Jardin Verde (540 Utah St NE, Albuquerque, NM, 87108)	Spanish Waterwise Workshop	This Spanish-language workshop addressed waterwise landscaping principles including native and arid-adapted plants and rainwater harvesting.	18	Head count at event
5/19–20 2022	Virtual Conference	Next Generation Water Summit	Conference theme was "Growth in a Time of Drought." Attendees included the building and development community, water reuse professionals, water policymakers, and the general public. Provided sponsorship of $1,500. Sponsorship included free registration for Bernalillo County staff and customers of the Bernalillo County Water Conservation Program (i.e. private well owners and customers of small water systems in Bernalillo County).	364	Next Generation Water Summit Planning Committee email (Doug Pushard at doug@kuelwater.org)

6/9/2022	Virtual workshop	Rainwater or Graywater: Which is Right for You? Workshop	This workshop provided an overview of residential rainwater harvesting and graywater systems that can supply water for use indoors and outdoors.	53	Bernco Cervis Event Registration System report
6/11/2022	Virtual workshop	Rainwater or Graywater: Which is Right for You? Workshop	This workshop provided an overview of residential rainwater harvesting and graywater systems that can supply water for use indoors and outdoors.	26	Bernco Cervis Event Registration System report
6/23/2022	Gutierrez Hubbell House (6029 Isleta Blvd SW, Albuquerque, NM 87105)	Residential Rainwater Harvesting: Q&A with Local Experts Workshop	In this workshop, local rainwater harvesting experts discussed passive water harvesting best practices and took questions from the audience.	73	Bernco Cervis Event Registration System report
6/25/2022	Gutierrez Hubbell House (6029 Isleta Blvd SW, Albuquerque, NM 87105)	Selecting Plants for Rainwater Harvesting Basins Workshop	This workshop addressed how to select plants for rainwater harvesting basins in the Middle Rio Grande.	22	Headcount at event. 35 registered per Bernco Cervis Event Registration System report.
8/24/21, 9/28/21, 3/16/22, 5/6/22	Water Conservation Program News Bulletin	Water Conservation Program News Bulletin	Water conservation articles, news, and events for Bernalillo County residents	1300	GovDelivery subscriptions
7/20/21, 10/26/21	Stormwater Quality and Watershed Protection News Bulletin	Stormwater Quality and Watershed Protection News Bulletin	Stormwater quality and watershed health-related articles, news, and events for Bernalillo County residents	800	GovDelivery subscriptions
9 events (7/10/21-6/25/22)	Multiple	HHW collection events	HHW weekend collection events	333	HHW Annual Report
FY2022	Homes and businesses in unincorporat-ed Bernalillo County	Water efficiency consultations	Conducted water efficiency consultations at homes and businesses to educate Bernalillo County residents on water conservation best practices. Consultations address water-efficient plumbing fixtures and appliances, landscaping, irrigation systems and scheduling, rainwater harvesting, graywater, and leaks.	94	WaterWays database

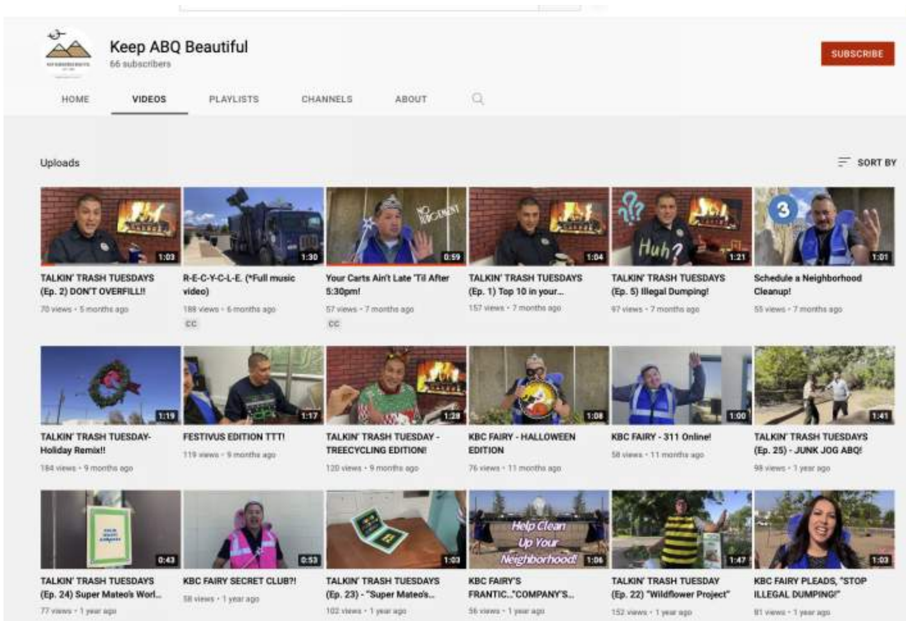
FY2022	Homes and businesses in Bernalillo County	Rain barrels	Provided rain barrels to Bernalillo County residents encourage rainwater harvesting through Bernalillo County Rainwater Harvesting incentive program	147	WaterWays database
FY2022	BernCo Website	Website Views	Public interaction with the "How Can Public Works Help You?" Webpages	4656	BernCo analytics
FY2022	Multiple	BEMP	BEMP direct student interactions	8549	BEMP Education Report
FY2022	Multiple	BEMP	BEMP Social Media interactions	88973	BEMP Education Report
FY2022	Multiple		River Xchange	866	River Xchange mid year report
FY2022	Multiple	Trail restoration and planting/ invasive special removal	Youth Corps, including Talking Talons, Rocky Mountain, Ancestral Lands Conservation Corps, and Valle de Oro National Wildlife Refuge. 43 volunteers worked 3428 hours.	43	BernCo tracking Youth Corps Engagement
FY2022			WW Permits Processed	1183	
FY2022		Septic permitting and outreach	Bernalillo County contacted system owners through the "unpermitted and aging wastewater system campaigns" in FY 2022 and an estimated 293 properties were resolved.	293	
FY2022	BernCo Open Space		Master Naturalist – 750 hours	17	
FY2022		IDDE	Employee Training	21	Training spreadsheet
FY2022		Stormwater Quality	Employee Training	14	Training spreadsheet
FY2022		Illegal Dumping Awareness Campaign	Online resources, digital advertising and billboard public outreach for the illegal dumping awareness campaign. Number includes repeats.	6,239,578	


ONE ALBUQUERQUE
city of albuquerque

City of Albuquerque
Public Participation Numbers

In 2021 the City of Albuquerque's Solid Waste's Keep ABQ Beautiful Program garnered 867 views of their YouTube channel, encouraging the public to pick up and recycle trash.
https://www.youtube.com/channel/UCEjJIl8yYk-IEv3Lpi6Bw3w/videos

WATCH OUR YOUTUBE CHANNEL



Additionally, the City of Albuquerque hosted clean up events from July 1, 2021 through June 30, 2022, with the following successes:

Company's Comin' Cleanup

- 9/25/21 – 9am to 12pm
- 699 Volunteers/Participants
- 3 hours
- 7.54 tons/15,080 lbs of trash collected

Junk Jog on the Bosque – Plogging

- 10/23/21 – 9a to 12p
- 20 Volunteers
- 98 Participants
- 3 hours
- .97 tons/1,940 lbs of trash collected

Household Hazardous Waste Collection Event

- 11/13/21 – 10am to 3pm
- 585 Participants
- 5 hours
- 24.19 tons/48,373 lbs of HHW collected

One ABQ Cleanup Month

- 4/9/22, 4/16/22, 4/23/22 & 4/30/22 – 9am to 12pm
- 895 Volunteers/Participants
- 3 hours each day x 4
- 38.32 tons/76,640 lbs of trash collected

Planting Numbers for 2021–2022

River Exchange

Date	School	Adults	Kids	Cotton	Willows
2.11.22	Valle Vista	4	34	27	
2.16.22	7 Bar	4	50	35	
2.17.22	7 Bar	3	22	37	
2.18.22	Manzano Mesa	2	40	27	
2.25.22	Manzano Mesa	2	18	18	
3.2.22	La Mesa	5	36	36	
3.9.22	La Mesa	5	46	40	10
3.10.22	Monte Vista	9	48	11	57
3.11.22	John Baker	6	18	11	15
3.16.22	John Baker	7	43	14	47
3.30.22	Cochiti	6	27	20	40
4.1.22	Valle Vista	3	35	21	29
TOTALS		**56**	**417**	**297**	**198**

Other

Date	Group	Adults	Youth	Cotton	Willows
2.10.22	Holy Ghost	2	27	50	
2.19.22	Peace Corps	31	11	65	25
2.23.22	Holy Ghost	2	36	53	
2.26.22	Multi Agency Community Day	42	8	50	100
3.4.22	Cottonwood Classical	4	15	48	
3.19.22	Peace Corps	39	7	75	25
TOTALS		**120**	**104**	**341**	**150**

Total Waste Diverted

Calendar Year	Month	Reuse Center	RC0014 Waste Oil	RC5056 Motor Fluids	RC0016 Lead Acid Batteries	RC6006 Mercury	ACT15687 Household Paint, xylene, toluene etc	RC0011 Aerosols	RC7485 Alkaline Batteries	RC7486 Lithium Batteries	RC6254 NiCad Batteries	ACT46232 Compact Bulbs, CFL	ACT46233 HID Lamps	ACT46235 4 Foot Lamps	RC7658 8 Foot Lamps	ACT50491 Non PCB Ballast	ACT58121 Fire Extinguisher	ACT58246 Fertilizer
		FY22 Total HHW (lbs) Diverted from Landfill																
		Recycled Waste																
2021	Jul	1,902		28,874	1,034			3,265	1,382	371	603	385		87	34	347		
	Aug	1,806		19,817	133	5		2,930	956	84	256	310		88	81			
	Sep	2,334		22,986	1,145			921	796	190	227	317		18		137		
	Oct	2,730		13,854		766		6,418	883			114		40	32	300		
	Nov	2,850		22,039	1,241			1,319	444		1,576	222		62	51			
	Dec	3,066		12,811				1,000	479			378						
MID YEAR		14,688	0	120,381	3,553	771	0	15,853	4,940	645	2,662	1,726	0	295	198	784	0	0
2022	Jan	2,130		9,286				884	923			582		62	59			
	Feb	1,668		7,716										61	32		247	
	Mar	1,530		9,176				1,472	443			242		14				
	Apr	1,806		10,544	1,234			1,575	1,247			214		38	20			
	May	1,662		19,007				1,716	863			432		80	61			
	Jun	2,532		17,152	1,131			2,330	1,242	209		229		102	2,029			
TOTAL (lbs)		26,016	0	193,262	5,918	771	0	23,830	9,658	854	2,662	3,425	0	652	2,399	784	247	0

* Misc = Compact Bulbs, 4 ft lamps, Ballast, PCB Capacitors, Carbides, Phosphides, Fertilizers, CO2 Cylinders, etc...

TOTAL	345,872
TOTAL Recycled Waste	225,967
% Recycled	65.3%

PO Amount:	$1,000,500.00
Paid Amount:	$954,466.81
Amount left on PO:	$46,033.19

~~PO# DSW0016901~~
PO# DSW0022306

* Information on this report is gathered from the Reuse forms sent by mail from ACT and the breakdown of items processed list sent by email monthly by Nicole Gwash

RC0012 Acids	RC0013 Bases	RC0015 Flamables Toxics Incenerated	RC6002 Toxic-Solid (Poisons)	RC7129 Compressed Gas	RC7182 Oxidizers	ACT145226 Pesticides Liquid Toxic	Misc*	TOTAL
Sent for Destruction								
1,684	1,354	2,689	2,886	749	299			47,945
895	1,290	861	1,510	169			917	32,108
1,006	981		930	135	78		1,601	33,802
610	518			458			1,330	28,053
805	540	120	1,248			2,352		34,869
588	3,483		682			1,594		24,081
5,588	8,166	3,670	7,256		377		3,848	200,858
472	569		580	100	177	1,823		17,647
848	5,003		175			442		16,192
1,987	4,366		858		837	1,008		21,933
802	822		767			971		20,040
1,383	2,632		1,155			2,357		31,348
2,599	5,264		1,396			1,639		37,854
13,679	26,822	3,670	12,187		1,391		3,848	345,872

	Total Pounds Recycled	Tons Recycled	Total Destroyed	Amount Paid
July	38,284	19.14	4.83	$105,924.00
August	26,466	13.23	2.82	$91,903.31
September	29,071	14.54	2.37	$86,831.00
October	25,137	12.57	1.46	$85,161.75
November	29,804	14.90	2.53	$72,841.00
December	17,734	8.87	3.17	$59,653.00
January	13,926	6.96	1.86	$66,513.25
February	9,724	4.86	3.23	$47,311.00
March	12,877	6.44	4.53	$64,536.25
April	16,678	8.34	1.68	$83,559.75
May	23,821	11.91	3.76	$86,074.75
June	26,956	13.48	5.45	$104,157.75
	270,478	135.24	30.80	$954,466.81

City of Albuquerque and Bernalillo County: Public Participation Numbers

Household Hazardous Waste Collection Participation

July 2019- June 2020

Month	Participants w/Unknown Location or Not Enough Info to Geocode	Total	Orphaned waste at facility	City Participants (City + No Match or Not Enough Info)	County Participants	Out of County	Out of County Breakdown	County Percentage	Monthly Cost	Light Bulbs (included in monthly cost)	Total Cummulative Cost
Jul-19		1550		1329	206	15	Sandoval- 13, SF-1, Valencia-1	13.3%	$102,037.50	$1,287.50	$102,037.50
Aug-19		1500		1273	216	11	Sandoval- 7, SF-2, Valencia-2	14.4%	$97,977.00	$477.00	$97,977.00
Sep-19	44	1227		1042	175	10	Sandoval - 8, SF-1, Taos-1	14.3%	$80,771.25	$1,016.25	$80,771.25
Oct-19	50	1190		962	222	6	Sandoval - 4, Valencia - 2	18.7%	$78,985.00	$1,635.00	$78,985.00
Nov-19	44	939		758	168	13	Sandoval- 9, Socorro-1, Valencia-3	17.9%	$62,614.25	$1,579.25	$62,614.25
Dec-19	32	715		602	110	3	Sandoval - 2, SF-1	15.4%	$47,934.50	$1,459.50	$47,934.50
Jul-Dec 2019	**170**	7121	**0**	**5,966**	**1,097**	**58**		15.4%	**$ 470,319.50**	**$7,454.50**	$470,319.50
Jan-20	53	990		831	154	5	Sandoval County-4, Valencia County-1	15.6%	$66,612.00	$2,262	$66,612.00
Feb-20	65	834		713	111	10	Sandoval County-8, Valencia County-2	13.3%	$56,121.00	$1,911	$56,121.00
Mar-20	51	928		754	165	9	Sandoval County-8, Torrance County-1	17.8%	$61,742.75	$1,423	$61,742.75
Apr-20	67	1031		864	152	15	Sandoval County-10, SF-2, Valencia-3	14.7%	$67,646.25	$631	$67,646.25
May-20	47	1535		1270	233	32	Cibola-1, Sandoval-24, Santa Fe-3, Torrance-1, Valencia-3	15.2%	$101,687.75	$1,913	$101,687.75
Jun-20	113	1829		1,523	284	22	Sandoval -14, SF-6, Valencia-2	15.5%	$120,614.00	$685	$120,614.00
Jan-Jun 2020	**396**	**7,147**	**0**	**5,955**	**1,099**	**93**		15.4%	**$474,423.75**	**$8,825**	**$474,423.75**
FY20 Total	**566**	**14,268**	**0**	**11,921**	**2,196**	**151**		**15.4%**	**$944,743.25**	**$16,279**	**$944,743.25**
				Participant Total (other than orphaned)			**14,268**			**$16,279**	

Monthly Average	**1189**
Participant Fee	$ 65.00
FY20 Budget	**$ 540,000.00**
Remaining Balance	**$ (404,743.25)**

	Participants	Percentage	Cost
BERNCO Participation to date	2,196	15.4%	$142,740
Unknown or Not Enough Info to Geocode (costs absorbed by COA)	566	3.97%	$36,790

Email Daniele Berardelli, Jake Daugherty, Debra Kelley and Steve Falk if we need to adjust POR amount before the end of the fiscal year.

* All information in this report comes from ACT - Nichole Gwash (NGwash@ACTEnviro.com) by email. She will send an invoice, a list of residents (which must then be sent to Ben Sanborn for geocoding), a list of items processed, and any logs for drums and light bulbs & tubes.

Use the invoice from ACT emailed by Nicole Gwash to fill in the Monthly Costs and Lught Bulbs section. Use the geocoded (by Ben Sanborn) resident list to fill in the participant information. Ben will add a sheet with totals, but go back and search for the :abandoned" items to add to the report. add the number of resients that did not have enough information to the COA total but also list them separate so we can track them.

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City of Albuquerque and Bernalillo County: Public Participation Numbers

Household Hazardous Waste Collection Participation

July 2020- June 2021

Month	Participants w/Unknown Location or Not Enough Info to Geocode	Total	Orphaned waste at facility	City Participants (City + No Match or Not Enough Info)	County Participants	Out of County	Out of County Breakdown	County Percentage	Monthly Cost	Light Bulbs (included in monthly cost)	Total Cummulative Cost
Jul-20	78	1624		1329	280	15	Sandoval-10, SF-5	17.2%	$106,809.00	$490.00	$106,809.00
Aug-20	142	1799		1526	246	27	Sandoval-18, SF-8, Valencia-1	13.7%	$119,039.25	$789.00	$119,039.25
Sep-20	119	1419		1190	224	5	Sandoval-5	15.8%	$94,591.00	$931.00	$94,591.00
Oct-20	78	1374		1162	202	10	Sandoval-5, SF-4, Valencia-1	14.7%	$90,951.25	$622.00	$90,951.25
Nov-20	39	892		755	133	4	Sandoval-1, SF-3	14.9%	$59,205.00	$463.00	$59,205.00
Dec-20	42	830		716	113	1	Sandoval-1	13.6%	$55,716.00	$665.00	$55,716.00
Jul-Dec 2020	**498**	7938	**0**	**6,678**	**1,198**	**62**		15.1%	**$ 526,311.50**	**$3,960.00**	$526,311.50
Jan-21	44	992		842	150	0	0	15.1%	$66,322.75	$715	$66,322.75
Feb-21	60	885		745	140	0	0	15.8%	$59,791.25	$859	$59,791.25
Mar-21	41	1248		1078	169	1	Valencia-1	13.5%	$83,046.50	$758	$83,046.50
Apr-21	60	1396		1187	209	0	0	15.0%	$91,927.25	$529	$91,927.25
May-21	70	1426		1237	188	1	Sandoval-1	13.2%	$95,211.75	$998	$95,211.75
Jun-21	59	1636		1,399	237	0	0	14.5%	$108,494.75	$874	$108,494.75
Jan-Jun 2021	**334**	**7,583**	**0**	**6,488**	**1,093**	**2**		14.4%	**$504,794.25**	**$4,733**	**$504,794.25**
FY20 Total	**832**	**15,521**	**0**	**13,166**	**2,291**	**64**		**14.8%**	**$1,031,105.75**	**$8,693**	**$1,031,105.75**
				Participant Total (other than orphaned)			**15,521**			**$8,693**	

Monthly Average	**1293.416667**

Participant Fee	$	65.00
FY21 Budget	**$**	**540,000.00**
Remaining Balance	**$**	**(491,105.75)**

	Participants	Percentage	Cost
BERNCO Participation to date	2,291	14.8%	$148,915
Unknown or Not Enough Info to Geocode (costs absorbed by COA)	832	5.36%	$54,080

Email Daniele Berardelli, Jake Daugherty, Debra Kelley and Steve Falk if we need to adjust POR amount before the end of the fiscal year.

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ACT Environmental Services
208 Murray Road SE
Albuquerque, NM 87105
(505) 445-9400 ext. 410 Office
E-mail: mthornton@ACTEnviro.com

HHW Chemical Waste Inventory:

Project Name:	Albuquerque/Bernalillo County Household Hazardous Waste Collection Event 5000 Balloon Fiesta Parkway Albuquerque, NM 87113
Job Date:	November 13, 2021
Client:	City of Albuquerque/Bernalillo County
Report Date:	January 25, 2022
Author:	Melanie Thornton / Martin Aranda
Site Contact(s):	Jake Daugherty

On November 13, 2021, ACT Environmental Services, and the City of Albuquerque/Bernalillo County, in a joint effort collected, segregated, packaged, labeled, transported, and disposed of 48,373 pounds of Household Hazardous Waste, and 10,380 pounds of Non-Regulated Solid Waste from 585 residents from residents within the Albuquerque/Bernalillo County at an average of 100.43 pounds of waste per customer.

This work was performed per the Scope of Work given to ACT by the City of Albuquerque/Bernalillo County. A copy of each HHW Chemical Waste Manifest/Bill of Ladings was provided to the City Representative at the time of collection.

DOT Hazard Class	Subsidiary Risk	Types of Chemicals	Total Gross Weight	Number of Drums X Size of Drums	Treatment Technology
Non-Haz		Used motor oil & Antifreeze	8,262 lbs.	4 X 275 Portable Totes	Recycle
Non-RCRA/Non-DOT Regulated Material Solid		Solid waste, empty containers, trash	10,380 lbs.	4 X 40 Yard Bins	Landfill
Non-RCRA/Non-DOT Regulated Material Liquid		Latex Paint	27,280 lbs.	1 X 20 Yard Bin 1 x 30 Yard Bin	Landfill
2.1 – Flammable Gas		Aerosol Spray Cans	1,686 lbs.	3 X 275 Cubic Yard Box	Energy Recovery / Fuel Blending
3 – Flammable Liquid		Paint Related Material	3,511 lbs.	10 X 55 Gallon Metal Drum	Energy Recovery / Fuel Blending
3 – Flammable/Toxic Liquid	6.1 - Toxic	Captan, Diazinon	2,887 lbs.	16 X 55 Gallon Poly Drum	Energy Recovery / Fuel Blending
5.1 – Oxidizing Solids		Potassium Nitrate/Sodium Hypochlorite	12 lbs.	1 X 05 Gallon Poly Drum	Incineration
6.1 – Toxic Solid		Captan, Diazinon	944 lbs.	6 X 55 Gallon Poly Drum	Energy Recovery/Fuel Blending
8 – Corrosive (Acids)		Hydrochloric Acid, Sulfuric Acid	342 lbs.	2 X 55 Gallon Poly Drum	Stabilization / Landfill
8 – Corrosive (Basic)		Sodium Hydroxide, Potassium Hydroxide	1,491 lbs.	8 X 55 Gallon Poly Drum	Stabilization / Landfill
8 – Corrosive (Batteries)		Automotive Lead Batteries, NiCad, Lithium Ion, Alkaline	1,340 lbs.	1 x Wooden Pallet, 2 x 30 Gallon Poly Drum, 5 x 5 Gallon Poly Drums	Recycle
8 – Mercury		Mercury	5 lbs.	1 X 5 Gallon Poly Drum	Recycle
9 – Environmentally Hazardous		Fluorescent Light Bulbs	613 lbs.	9 x Cylinder Box & 1 x 55 Gallon Poly Drum	Recycle

Albuquerque/Bernalillo County Household Hazardous Waste Collection Event at Balloon Fiesta Park

Treatment Technology	Weight
Recycle	10,220 lbs.
Energy Recovery / Fuel Blending	9,028 lbs.
Incineration	12 lbs.
Landfill	39,493 lbs.

Waste Total	Cost	Cost/lbs.
58,753 lbs.	$40,663.75	**$1.44/lbs.**

585 – Albuquerque/Bernalillo County Participants

We are committed to working with you in fulfilling the environmental needs of our communities.

Melanie Thornton
ACTEnviro Office Manager - ABQ

2022 Foothills Spring Cleanup Results (1 of 2)

2022 Foothills Spring Cleanup Results

Location	Volunteers	Dog Poop (in Lbs.)	Trash (bags)	Trash * (cubic yards)	Mixed Recycling (bags)	Glass (5 gal buckets)	Aluminum (bags)	New Trail Built (miles)	Trail maintained (miles)	Notes:
Rt 66	29			14.5	6	4	2	0.1		Large items included numerous tires and a matress, 2 trail crews completed the a reroute
Copper	51	40	5	0.9	1	1	0.33		0.5	4 trail crews did maintenance on .5 miles of trail. One cactus crew closed off several social trails
Indian School	43	25	1	0.2	1	0.5	0		0.45	4 trail crews did maintenance on about .45 miles of trail. Two cactus crews planted hundreds of cactus cuttings to block social trails.
Menaul	55	35	3	0.5	1	2.5	1		0.4	four trail crews did maintenance on about .4 miles of trail. Three cactus planting crews planted hundreds of cuttings to block off social trails
Piedra Lisa	39	25	0.5	0.1	0.5	2	0.5		0.25	1 trail crew built 27 drain dips on .25 miles of trail. 2 rock crews built steps on the Canyon Trail, 1 cactus planting crew planted hundreds of cactus cuttings on a variety of short cuts, and 1 graffiti crew scrubbed graffiti off a rock outcrop.
Embudito	31	20	1	0.2	1	0.33	0.25		0.2	1 trail crew built 20 drain dips and did general maintenance on .2 miles of trail, 1 rock crew reinforced several rock ramps on Trail 365, and 2 Cactus planting crews planted hundreds of cactus cuttings on several social trails adding up to .15 miles of trail closure.
	*trash bags converted to cubic yards and added to cubic yard total									
2022 River Cleanup										
	102			15	10	6	2			Filled a dump trailer, plus 4 pickup trucks. Large items: 12 tires, 5 shopping carts, and a vinyl kiddie pool
2022 National Trails Day										
	100							0.04	1.4	4 crews planted cactus on short cuts and social trails
										6 crews did maintenance on approximately 1.4 miles of trail
										2 crews built rock retaining walls
										1 crew built a trail reroute (about 190 feet) to replace several social trails
										several volunteers cleaning up dog poop and trash

ONE ALBUQUERQUE city of albuquerque

Mid Rio Grande Stormwater Quality Team

2022 Foothills Spring Cleanup Results (2 of 2)

		Volunteers	Dog Poop (in Lbs.)	Trash (bags)	Trash (cubic yards)	Mixed Recycling (bags)	Glass (5 gal buckets)	Aluminum (bags)	New Trail Built (miles)	Trail maintained (miles)
Totals		450	145	10.5	31.4	20.5	16.33	6.08	0.14	3.2
Dia del Rio										
Make a Diff Day										
Grand Total		652	145	10.5		30.5	22.33	8.08		

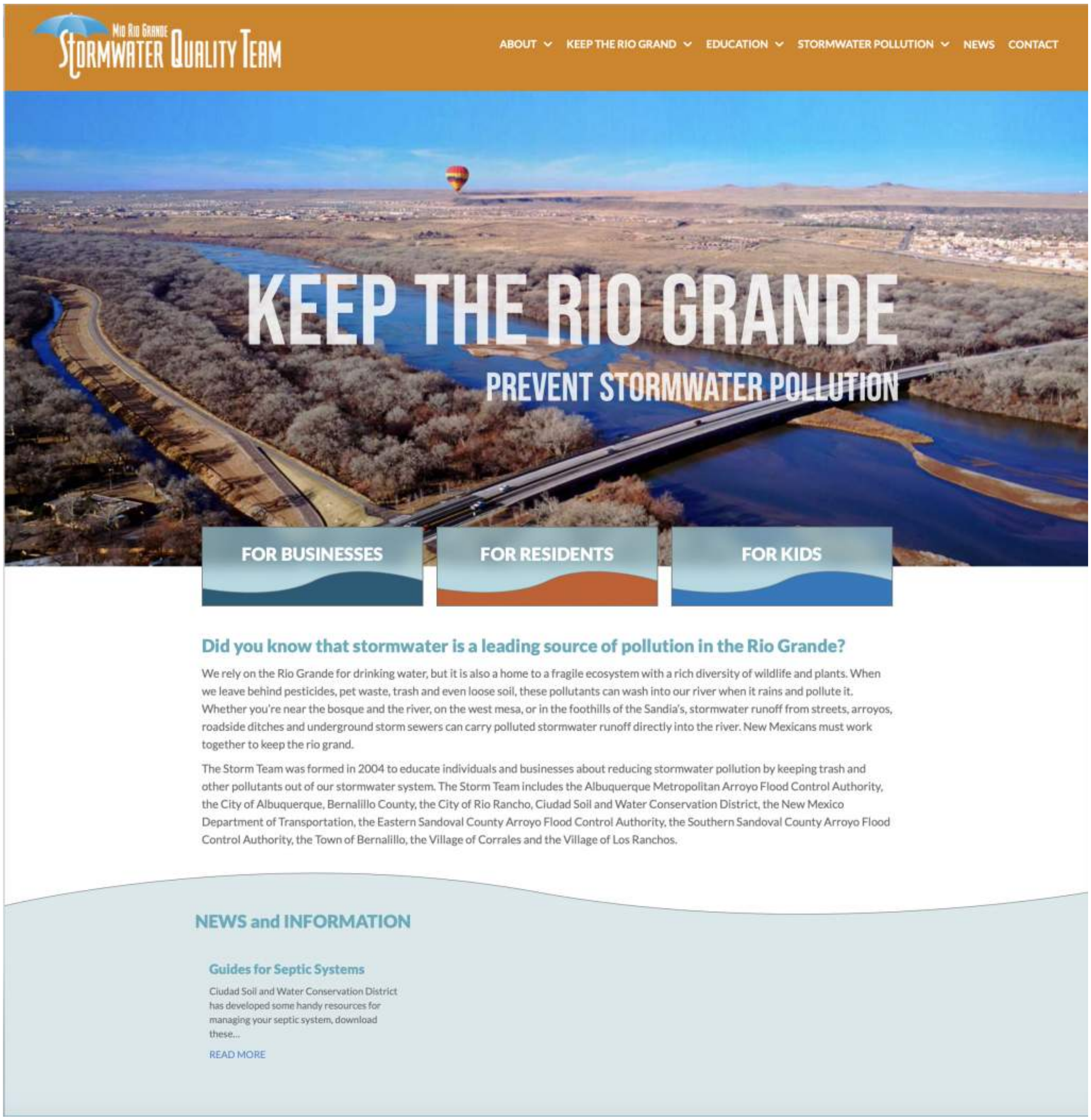
ONE ALBUQUERQUE city of albuquerque

Poop Fairy Signs

During FY22 we distributed 276 Poop Fairy signs to local residents.
We also gave 250 to Parks and Open Space for posting.

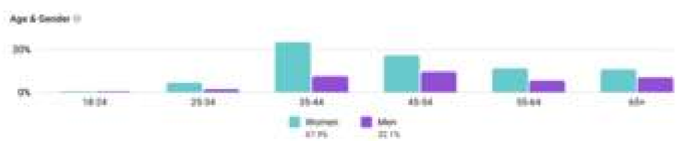
Mid Rio Grande
Stormwater Quality Team

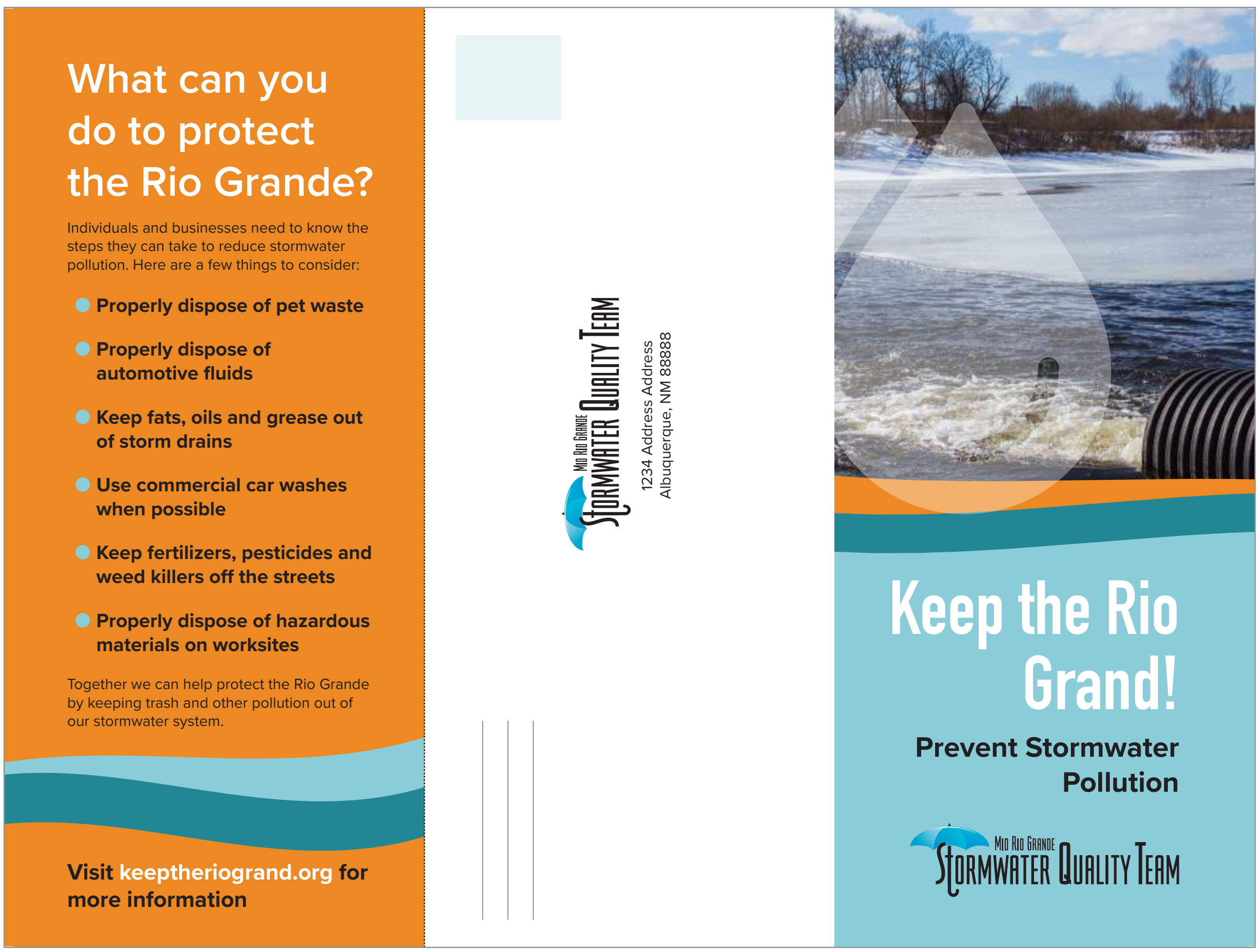
In FY2022 the MRGSQT developed a brand new website.
https://keeptheriogrand.org



FACEBOOK

The MRGSQT Facebook page garnered 1,322 page reach, and an overall 73.1% increase in new page likes.





Additionally, the MRGSQT team developed a new survey card that is now in the rotation for distribution.

Village of Corrales

The Village of Corrales does not have a municipal storm sewer system. To handle stormwater flows from development, engineered grading and drainage (G & D) plans are required of all new residential construction (anything roofed or paved areas on sloped areas) that disturb more than 1,000 square feet. Engineers may use retention ponding, berms and other aspects that keep the impervious surface stormwater flows on the subject property and not running into streets or adjacent properties. In the Commercial zone, retention areas must be built into Site Development Plans.

During the past year, 18 residential G&D's were processed through the Planning and Zoning Department.

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Village of Los Ranchos

Similar to the Village of Corrales, Los Ranchos does not have a municipal storm sewer system. Grading and drainage plans are required for most residential and commercial construction within the Village, and Site Development Plans are additionally required for major subdivisions and new commercial construction. Permeable pavement elements have been incorporated throughout the Fourth Street redevelopment area in Los Ranchos (as shown on page 13), which provide multiple benefits such as reducing flooding and erosion and enhancing groundwater recharge. The next phase of the Fourth Street Project, from Pueblo Solano Rd NW to Ortega Rd NW, will include elements that address stormwater and drainage concerns within that phase. This year, staff participated in educational outreach activities as part of the Stormwater Quality Team, including distributing materials at the Los Ranchos Farmer's Market and posting and distributing poop fairy signs throughout the irrigation system in Los Ranchos.

CIUDAD SOIL & WATER CONSERVATION DISTRICT

Ciudad Soil & Water Conservation District

Ciudad Soil & Water Conservation District

Stormwater Presentations 2022

Date	Times	RR or ES	Event	Presenter(s)	Visitors
4.23.2022	9:00am–12:00pm	RR	RiverXchange Community Day	Erin, Steve, Salema	10
6.4.2022	9:00am–12:00pm	RR	BernCo Master Naturalist Presentation	Steve, Erin	25
6.11.2022	9:00am–12:00pm	RR	GHH	BernCo OSD	12
6.13.2022	9:00am–12:00pm	RR	Shady Lakes	Erin, Steve, Jaren (Nature Ninos)	45
6.18.2022	9:00am–12:00pm	RR	Phil Chacon Park	COA OSD – Nature in Your Neighborhood	did not attend
6.13.2022	10:00am–1:00pm	RR	Shady Lakes: Nature Ninos Summer Camp	Steve, Jaren, Saleema (Nature Ninos)	40
6.23&25.2022	6:00–7:30pm 9:00–11:00am		Residential Rainwater Harvesting 2.0 (Online & In-person at GHH)	Erin, Judith, Hunter, Tess, Jim	45
6.30.2022	10:00am–1:00pm	RR	Shady Lakes: Nature Ninos Summer Camp	Steve, Jaren, Saleema	75

arid LID

Low Impact Development in Arid Environments

MIDDLE RIO GRANDE
Green Stormwater Infrastructure
MAINTENANCE MANUAL

Prepared by Arid Low Impact Development Coalition

June 2022

CIUDAD SOIL & WATER CONSERVATION DISTRICT

The Arid Low Impact Development (LID) Coalition

is a multi-disciplinary group representing an array of perspectives, skills, and organizations who share a common vision to foster public awareness of stormwater as an asset instead of a liability and to increase literacy around effective, arid-adapted **green stormwater infrastructure (GSI) and low impact development (LID)** strategies. The many benefits of these strategies include improving water quality, watershed stewardship, and well-being for all inhabitants in the Rio Grande Watershed.

The Coalition works to provide technical resources and education needed to design GSI and LID interventions in our high desert environment, facilitate communication and collaboration, and support high-quality demonstration and research projects. For more information please visit www.aridlidcoalition.org.

This document was developed by the Arid LID Coalition in conjunction with partners Ciudad Soil and Water Conservation District, The Nature Conservancy, Bernalillo County, Sites Southwest, New Mexico Department of Transportation, MRWM Landscape Architects, Water Authority, and the Urban Waters Federal Partnership.

Special thanks to Sunny 505 and MRWM for providing graphics.

Document Overview

This manual provides an introduction to GSI (Module 1), followed by descriptions of GSI techniques (permeable pavement, stormwater harvesting basins, infiltration conveyances, plants, and mulch) and maintenance requirements for these GSI features (Modules 2 through 6).

Click on the green box to go to the page.

MODULE 1

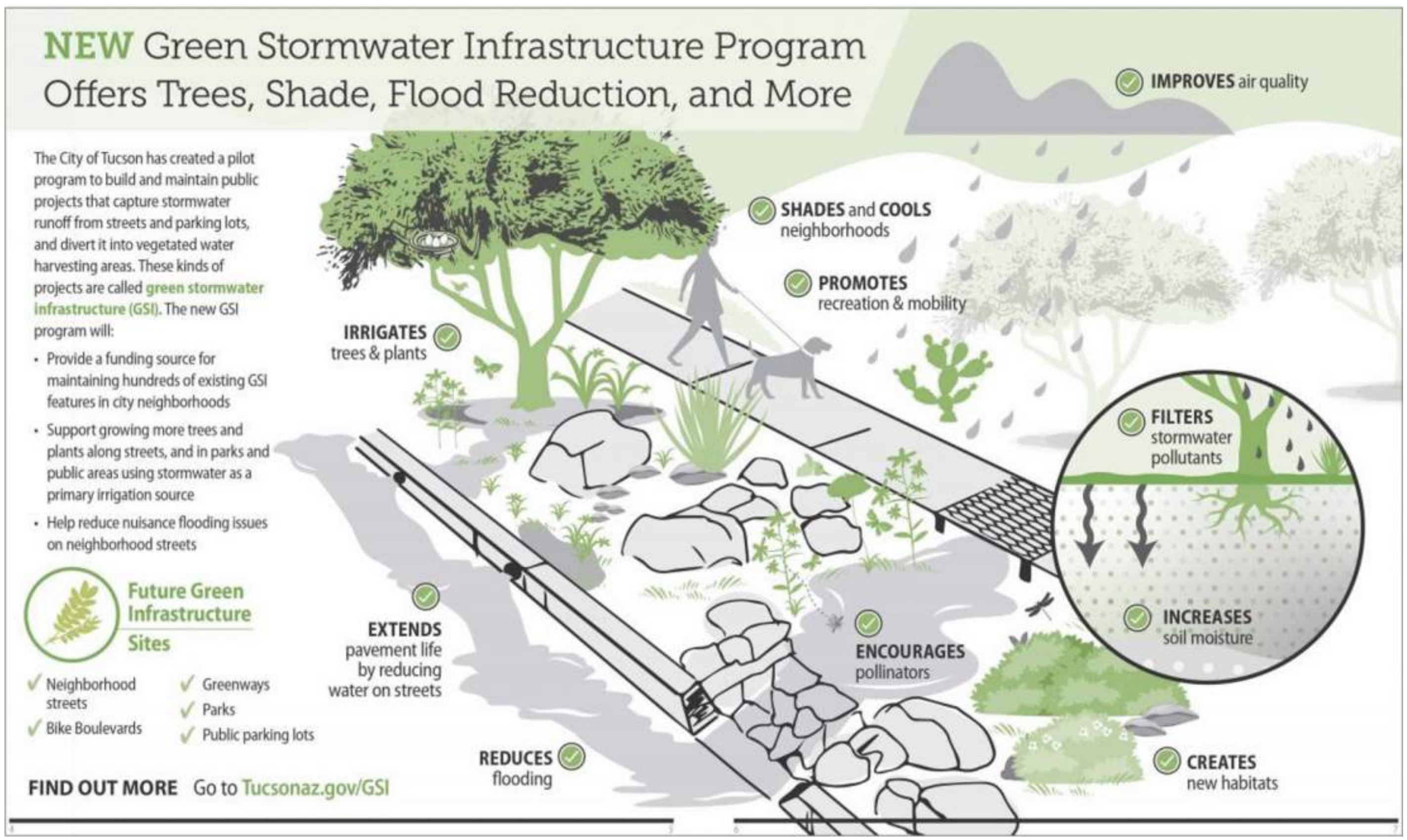
Introduction to Green Stormwater Infrastructure & Maintenance

Green Stormwater Infrastructure & Maintenance

When rain falls in natural, undeveloped areas, the water soaks into the ground and is filtered by soil and plants. But in an urban environment, when rain falls on impervious surfaces (roofs, streets, and parking lots), the water can no longer soak into the ground. Stormwater that runs off these impervious surfaces in urban areas results in higher flows in drains, gutters, storm sewers, and other gray stormwater systems, eventually discharging into arroyos, streams, and rivers. Stormwater runoff carries trash, bacteria, heavy metals, and other pollutants that pose a threat to human health and the environment. Higher flows resulting from heavy rains also can cause flooding and property damage as well as erosion and flooding in streams, damaging habitat, property, and infrastructure.

Green stormwater infrastructure (GSI) is an approach to stormwater management that mimics natural processes to provide nature's benefits, such as:

- Reducing flooding
- Conserving water
- Improving water quality
- Improving air quality
- Carbon sequestration (capturing and storing carbon dioxide)
- Reducing heat island effects
- Providing shade
- Creating wildlife habitat
- Calming traffic
- Improving livability
- Promoting walkability in neighborhoods



From: Tucsonaz.gov/gsi

Why GSI?

Traditional gray stormwater infrastructure includes gutters, pipes, culverts, and detention ponds and is designed to move stormwater runoff from the built environment to water bodies like streams and rivers as quickly as possible.

GSI helps keep rainwater where it falls, provides natural benefits, is less expensive to build than traditional gray infrastructure, requires less maintenance over time, and is less resource intensive.

What is GSI?

GSI includes a variety of measures—stormwater harvesting basins, infiltration conveyances like swales and trenches, permeable pavement—to store, treat, infiltrate, evaporate, or transpire (water use in plants) stormwater and reduce flows to stormwater sewer systems and surface waters. GSI is intended to be used alongside gray infrastructure, not replace it, and in some cases actually reduces the need for costly expansions of gray infrastructure improvements as networks of pipes are undersized in many cities with increased development or density of buildings.

Gray Stormwater Infrastructure

Concrete, metal, pipes and drains

Storm Drain Inlet, Albuquerque, NM (photo by Tess Houle)

Culvert under Interstate 25, Albuquerque, NM (photo by Tess Houle)

North Diversion Channel, Albuquerque, NM (photo by Tess Houle)

What GSI is NOT

GSI is not “zero-scaping”—it does not mean rockscapes with little or no plants. It is not a dirt hole in the ground that solely captures water without treatment or other benefits. GSI installations should include native and arid-adapted plants in order to function properly.

TOP: GSI with limited function: This stormwater harvesting basin does not support vegetation or properly treat pollutants; it instead uses heat-trapping rock mulch and cobble, and does not take advantage of the stormwater to irrigate the plants in this landscape.

BOTTOM: GSI with stacked functions: This stormwater harvesting basin captures street runoff that supports native trail-side shrubs and grasses; treats pollutants; balances organic and inorganic mulches; and overflows into subsequent basins further downstream to reduce in-street flooding during heavy storm events.
(Location: Alameda Drain Trial)

GSI is not meant to solve major flooding issues, but it does reduce localized flooding. Also, like any landscape feature, GSI does not take care of itself—it requires regular inspection, care and maintenance!

Benefits of GSI

Implementing GSI practices in the middle Rio Grande region has many benefits for our watershed. The fundamental goal is to reduce the amount of stormwater runoff and pollution reaching surface waters and adversely impacting our watershed. Benefits of GSI include:

- Reducing air and water pollution by including trees and vegetation, which act as a natural filter.
- Providing traffic-calming benefits with trees and plants adjacent to roadways.
- Reducing heat-related impacts to people and natural landscapes.
- Replicating native environments and providing wildlife habitat in the urban environment.
- Providing opportunities for physical activity for residents, while also improving mental health outcomes by reducing stress and promoting cognition.
- Addressing social equity and environmental justice when used in communities that don't have access to quality outdoor spaces. Environmental justice means all people, regardless of race, color, national origin, or income, are entitled to equal protection from environmental risks.

Maintenance

For green stormwater infrastructure to function properly and allow water to soak into the ground over time, maintenance is needed. Healthy plant root systems help water soak in, and removing sediment and debris prevents clogging and overflowing of the systems.

Modules 2 through 6 in this GSI Maintenance Manual will cover maintenance needs for the most common types of GSI features, including permeable pavement, stormwater harvesting basins, and infiltration conveyances, as well as routine and seasonal plant maintenance and mulch maintenance. Some routine maintenance tasks that generally apply to most GSI installations include:

- Visiting stormwater infrastructure during rainstorms to see stormwater flows in action. Green stormwater systems are designed to harvest rainwater and stormwater, so managing water flow is essential.
- Inspecting and maintaining irrigation systems.
- Managing vegetation that supports natural filtering, but doesn't block the flow of water.
- Removing sediment and trash and clearing inlets and outlets of debris and vegetation.
- Maintaining and refreshing mulch.
- Repairing erosion and human-caused damage.
- Adjusting schedules over time as issues arise and landscapes mature.. Frequencies of inspection and maintenance depend on drainage area, land use, activities in the watershed, and rainfall magnitude and intensity.

Some common problems to look for when doing maintenance inspections are:

- Is water backing up or not making it to the basins and tanks? Look for leaking gutters, clogged curb cuts, or clogged pipes.
- Has the capacity been reduced due to sediment and debris build-up?
- Is there enough capacity to capture sufficient rain?
- Are overflows and outlets working like they should? Look for water overflowing away from outlet or signs of erosion like rivers of dirt on sidewalks.
- Is there standing water for more than a few hours after a storm? If standing water is still present 24 hours after the storm, maintenance is likely needed.

Tools and Specialized Equipment

Routine maintenance and best management practices on vegetated green infrastructure are similar to general landscape maintenance: removing trash and debris; keeping plants healthy; and cleaning out accumulated sediment and pollutants. These tasks can be completed using the following tools:

- Trash, debris, and sediment can be removed with rakes, shovels, and trash grabbers. Leaf and plant trimmings can be added to the basin bottoms to replenish mulch and provide a nutrient source for plants and healthy soils except for noxious and invasive weeds. They should be bagged and removed from site.
- Flat-blade shovels are especially useful for scraping accumulated sediment from inlets and along curbs and gutters or upstream of inlets.
- Vegetation can be pruned for safety, visibility, and plant health using pruning shears and weed pullers. Power shearing equipment should be used sparingly or not at all.
- Properly clean shears before and after use to eliminate the spread of diseases.
- Watering during the plant establishment period and in extended droughts can be done with a hose, bucket or irrigation system.
- Permeable pavement is best maintained using a vacuum-powered street sweeper, and replacement pavers are sometimes needed for repairs (See Module 2).
- Heavy equipment, such as backhoes and front-end loaders, may be needed infrequently if the facilities need to be replaced or if large amounts of sediment have accumulated. If using heavy equipment, care should be taken to avoid compacting soil at the bottom of GSI installations.

Equipment Needed

Site map/site plan/as-built

Trash grabbers

Trash bags

Gloves

Bucket/other sediment/
trash removal container

Broom and dust pan

Tarps (for stockpiling
plant materials removed)

Wheelbarrow

Push broom

Digging shovel

Square-nosed (or flat-bladed) shovel

Spade/trowel

Rake—leaf, shrub, row, and/or hand

Wire or stiff plastic brush

Pruning shears/clippers

Maintenance Objectives:
Health and Safety

Health and safety plans and precautions should be provided by employer/site owner; below are a few considerations for health and safety during maintenance of GSI facilities:

- Appropriate Level D personal protective equipment (PPE), including a minimum of a safety vest, steel-toed boots, and safety glasses, should be worn during maintenance activities; hard hats and hearing protection should be used around heavy equipment.
- Equipment operations and procedures must meet Occupational Safety and Health Administration (OSHA) guidelines and standards.
- To protect the health, safety and welfare of the community, put into practice integrated pest management strategies that provide the least toxic methods to control pests, including noxious and invasive weeds.
- Cones, barricades, and/or other protective and warning devices for vehicles and pedestrians to ensure safety of workers and pedestrians.
- Sun protection including clothing, hats and minimum SFP30 sunscreen.
- Stay cool.
- Know the signs of heat stress and heat stroke and proper actions to take.
- Have a first aid kit and ensure that it is well stocked.
- Know where the nearest emergency room and/or urgent care facility is located.

MODULE 2

Permeable Pavement

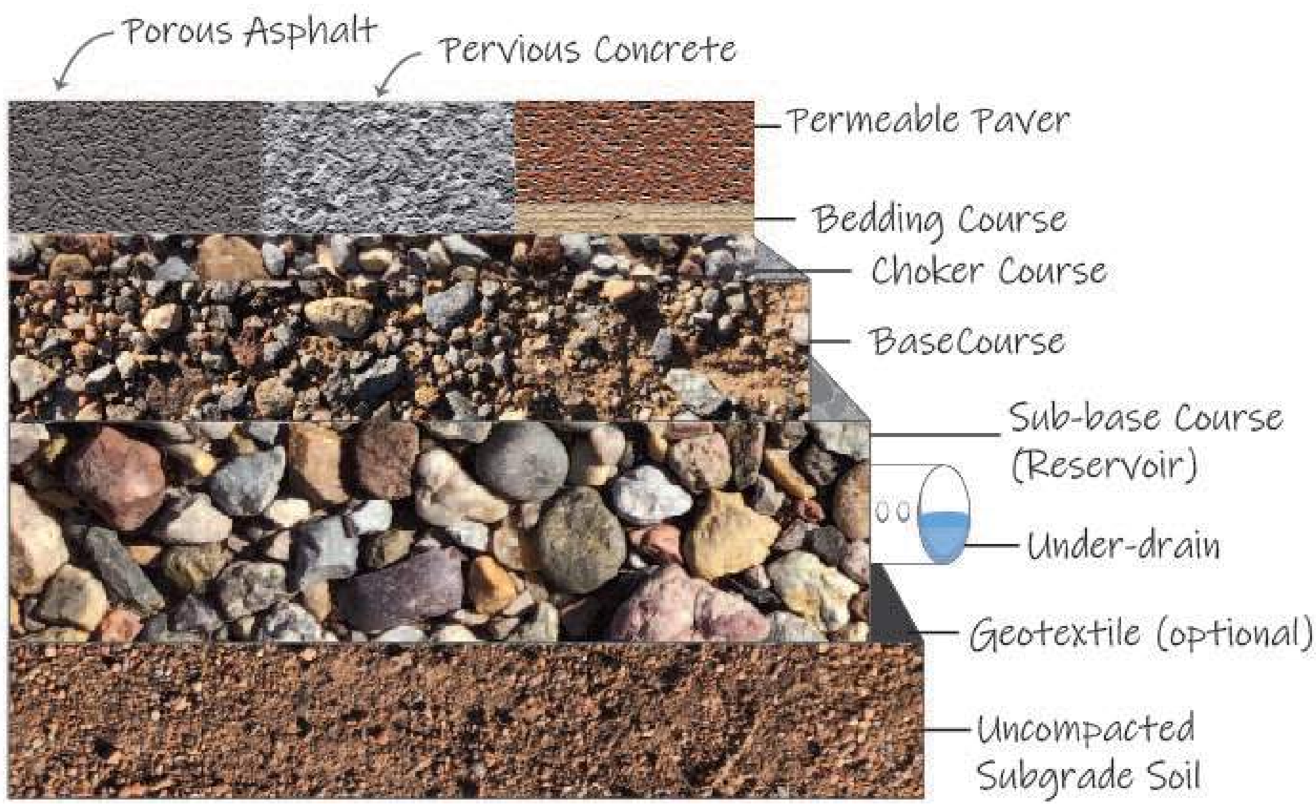
Permeable Pavement

Permeable pavement is a constructed system that allows water to pass through the pavement to the underlying native soil or a constructed infiltration bed below the pavement. Permeable pavement systems can vary, but are generally made up of five layers:

- **Pavement:** A surface pavement layer that is permeable (for example: pervious asphalt, pervious concrete, permeable interlocking pavers).
- **Bedding course:** A thin bedding layer, approximately 2 inches thick, made of 3/8-inch to 1/2-inch diameter stone to stabilize the pavement.
- **Choker course:** An underlying crushed stone reservoir layer, a minimum of 6 inches thick, made of 1-inch- to 2.5-inch diameter stone.
- **Base course or subbase layer:** A combined layer of aggregate stones, ranging in size from 2 to 3 inches, for storing water and distributing the pavement load. A geotextile filter fabric is sometimes added below the subbase level.
- **Under-drain:** An under-drain is sometimes used to move water to additional storage capacity to prevent prolonged saturation.
- **Uncompacted soil subgrade:** (i.e., local soils).

Regular maintenance of permeable pavements ensures they remain functional, allowing water to soak into the ground quickly, reducing flooding during storm events and allowing water stored underground to be used by nearby trees and plants.

Types of permeable pavement may include porous concrete, pervious asphalt, or various types of interlocking pavers. In addition, plastic grid systems (also called reinforced turf pavement) can be used in areas with limited vehicular traffic (such as infrequent parking areas or emergency vehicle or fire access lanes). Permeable pavements can also be paired with other engineered structures like silva cells that create a supported, but suspended surface. This allows for uncompacted soils underneath that make space for tree and plant roots or additional stormwater storage.



Benefits of Permeable Pavement

- Permeable pavement reduces flooding, prevents erosion and property damage, reduces pollutants carried into streams and rivers, and can enhance groundwater recharge by allowing stormwater to soak into the ground quickly instead of being carried away in roadways, sidewalks, or gutters.
- Permeable pavement can melt snow and ice faster during winter storms, dries faster than traditional impervious pavement, minimizing slips and falls, and reduces the need for deicing chemicals and costly snow removal services.
- Permeable pavement allows tree roots to access air and water easily, unlike traditional concrete. Trees along streets have been shown to substantially reduce nitrogen and other pollution loads in stormwater by acting as a natural filter and provide traffic-calming benefits.

Wheelchair accessible permeable pavement

Regular inspection of permeable pavers is needed to make sure they remain level with a smooth, ensuring compliance with the Americans with Disabilities Act (ADA) specifications.

System with multiple permeable pavement types

Maintenance

Key maintenance issues for permeable pavement include:

- **Clogging.** To work effectively, permeable pavement needs to drain without clogging. Permeable pavement should NOT be located adjacent to areas with exposed soil that can clog these features.
- **Exposed soils.** Any nearby exposed soil should be separated from permeable pavement by barriers such as vegetated areas, and those barriers should be maintained to capture sediment before runoff reaches the permeable pavement.
- **Organic debris.** Organic debris, such as leaf litter and grass clippings, should NOT be deposited on or allowed to sit on permeable pavement, as debris can cause clogging and lifting. Leaves and plant material should be regularly collected from permeable pavements for composting.
- **Maintenance.** Ask landscape maintenance personnel to help maintain permeability by not dumping materials or sediment onto permeable pavement.
- **Drainage.** The permeable pavement system must be allowed to dry (de-water) between rainfall events. Too much water retention in the base course layers can prevent the absorption of additional rainfall and result in runoff. There should be an observation well that allows inspectors to determine if excessive water is being held within the system.
- **Site maps.** Show areas of permeable pavement and inspection wells on maintenance site maps.

4th Street permeable pavers curb detail, Photo by Sites SW

4th Street permeable pavers, Photo by Sites SW

4th Street Permeable Pavers, Photo by Sites SW

Maintenance Tasks and Schedules

NOTE: Areas with a lot of vehicle traffic may require maintenance more frequently than those with less traffic or only pedestrian traffic.

- Keep sediment or areas with bare soil from draining onto permeable pavement and maintain vegetated areas that provide a buffer between pavement and bare soil.
- Inspect at least twice a year (at the end of winter and in the fall, when leaves drop) and remove any clogging material from permeable pavements to prevent safety issues (separation and lifting).
- Inspect after rain events of 0.25-inches or greater and remove any material that may clog permeable pavers/pavement.
- Vacuum porous asphalt or permeable concrete at least twice a year with standard street-cleaning equipment with a vacuum device. After vacuuming permeable pavers, stone between pavers may need to be replaced. Some types of permeable pavers do not require vacuuming (The third picture on the right is one example.).
- Inspect bricks for shifting, cracking, lifting, and/or clogging after freeze thaw cycles and after major storm events. Adjust bricks to maintain a smooth and level surface. This is important for trip hazards as well as ADA compliance.
- Observe performance during rainstorms. When water begins to pond during typical rainfall events, you may need to vacuum the pavement.
- DO NOT apply sand and/or fine aggregate to enhance snowmelt or winter condition traction, as these materials will quickly clog permeable pavement causing water to pool on the surface instead of draining quickly.
- Sweep and remove any snowmelt products like salt as soon as it is no longer needed. Salts will effect water quality and plant health.
- DO NOT resurface or seal the permeable pavement, as you normally would with a traditional pavement. This will block the permeability of the pavement.
- Clean areas that are stained by grease or oils with a biodegradable grease and oil cleaner such as liquid dish soap or OxiClean.
- Repair or clean all damaged areas or areas that are not draining as soon as the issue is observed to prevent further damage.

Tools and Specialized Equipment

See general tool list in Module 1.

Specialized equipment includes: street sweeper with vacuum attachment, brooms, trash-grabbers

Photos by: Mario Nuño-Whelan

MAINTENANCE INSPECTION CHECKLIST & SCHEDULE

Permeable Pavement

Location:

Weather: Rainfall over last 2–3 days?

Inspector:

Site conditions:

Pavement Type: ☐ asphalt ☐ concrete ☐ interlocking pavers ☐ grid pavers

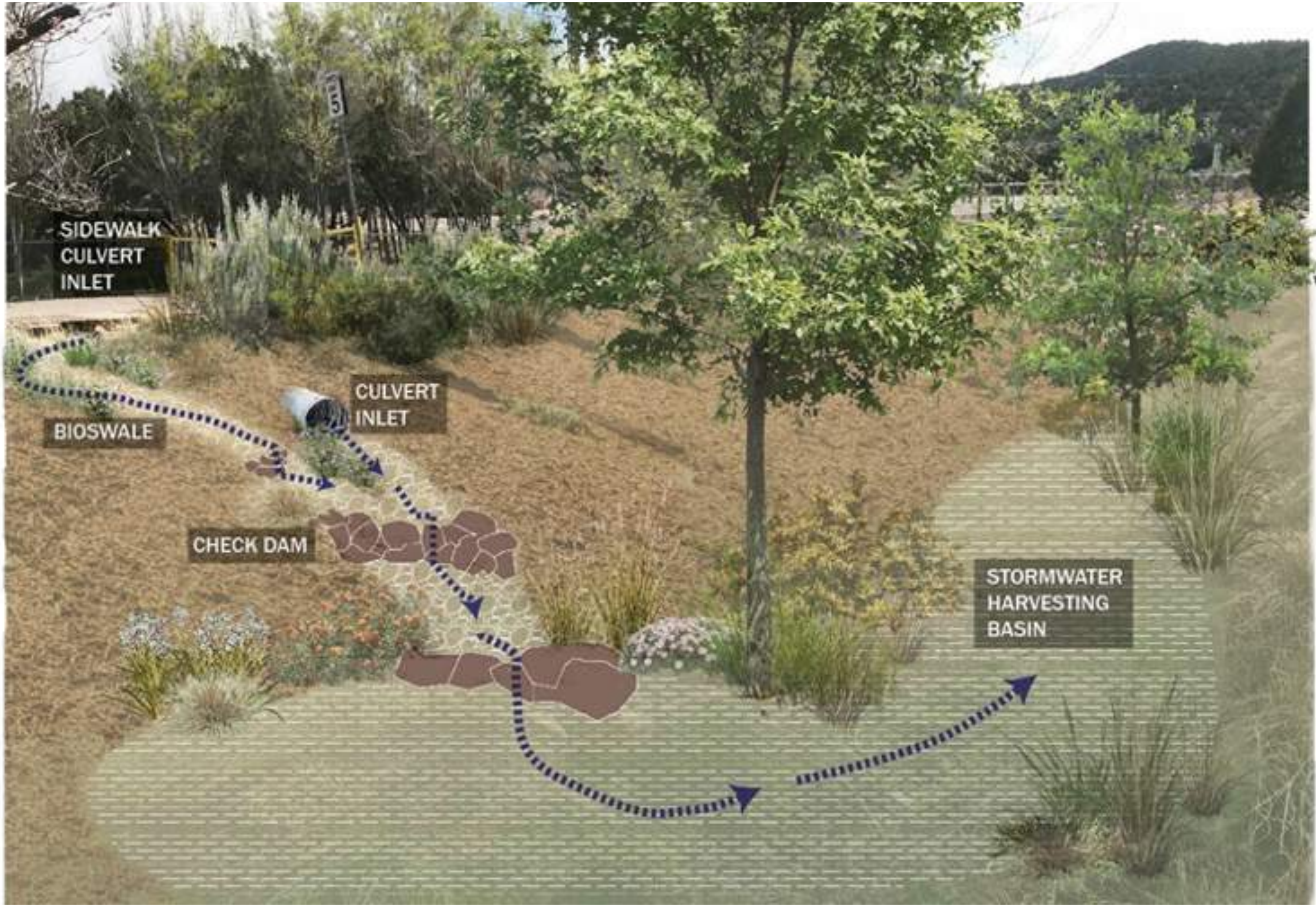
Date: Time:

MAINTENANCE NEEDED	ACTION	COMMENTS
Pavement Surface	*Frequency—Monthly*	
1. Are there signs of clogging? ☐ YES ☐ NO 2. Is there build-up of debris (sediment, trash)? ☐ YES ☐ NO 3. Is there standing water on the permeable pavement? ☐ YES ☐ NO	1. Schedule cleaning with street sweeper/vacuum. 2. Remove debris from surface of pavement. 3. Check inspection wells (if present) to see if there is water that has not infiltrated. If not, schedule a cleaning with street sweeper/vacuum.	
Adjacent Areas	*Frequency: Biannually or 2x per year*	
1. Is there erosion from or around underdrain, if present? ☐ YES ☐ NO 2. Are areas where soil is exposed discharging soil/sediment onto the permeable pavement? ☐ YES ☐ NO 3. Is the permeable pavement negatively impacted by an adjacent site feature? ☐ YES ☐ NO	1. Determine cause of erosion and mitigate by adjusting flow, using rip-rap, or other appropriate method. 2. Install a barrier, such as vegetation, rip-rap, curb, wall or fence with windscreen to stop the bare soil area from discharging sediment onto the permeable pavement. 3. Look for a way to reduce the impact. Discuss impacts and options with supervisor.	
Outlets and Overflow	*Frequency: Annually, after major storms (storms with 0.25" of rain or more)*	
1. If there is an outlet or overflow to a storm sewer system, is it free from debris and functioning? ☐ YES ☐ NO	1. If there is blockage, remove debris/sediment/trash.	
Other	*Frequency: Annually*	
1. Have there been complaints from residents? ☐ YES ☐ NO 2. Do you notice any hazards to the public? ☐ YES ☐ NO 3. Are there any other issue or problems? ☐ YES ☐ NO	1. Address complaints and/or discuss with supervisor. 2. If a hazard is observed, look for a way to fix the issue and discuss with supervisor. 3. If yes, describe in comments and discuss with supervisor.	

Inspector's signature: ______________________________

MODULE 3

Stormwater Harvesting Basins



Stormwater harvesting basin components

Maintenance for Stormwater Harvesting Basins

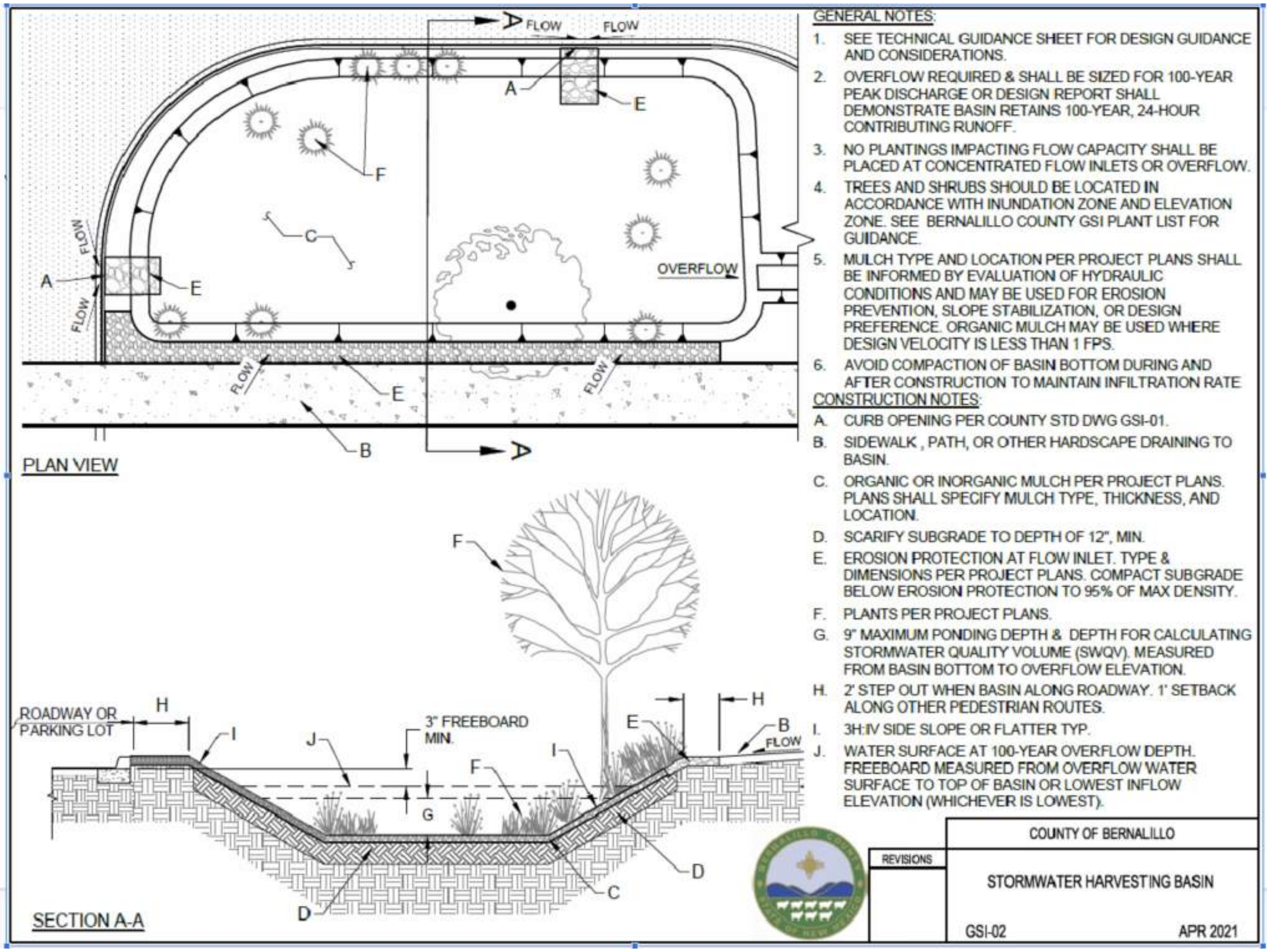
Stormwater harvesting basins are purposely vegetated depressions in the ground that collect stormwater runoff and allow that runoff to infiltrate the soil. The bottom of the basin should not be compacted because it will slow or even stop infiltration.

Stormwater harvesting basins help to control flooding and prevent pollutants from entering arroyos and rivers. The collected water supports trees and other vegetation, cooling our city and making it more livable.

Components of stormwater harvesting basins that need inspection and maintenance include:

- Inflow and outflow structures
- Sediment traps
- Infiltration rates (the rate water soaks into the ground)
- Erosion control/repair
- Plants/weeds management or removal
- Inundation zones within the basin (areas soaked with water after a storm)
- Irrigation system (if present)
- Mulch
- Access ramps/features

Careful maintenance is important to (1) ensure that stormwater harvesting basins capture runoff and allow it to infiltrate into the ground below and (2) prevent pollutants from running into surface waterways like arroyos, streams, and rivers. This protects our drinking water supply and makes our rivers swimmable and fishable.

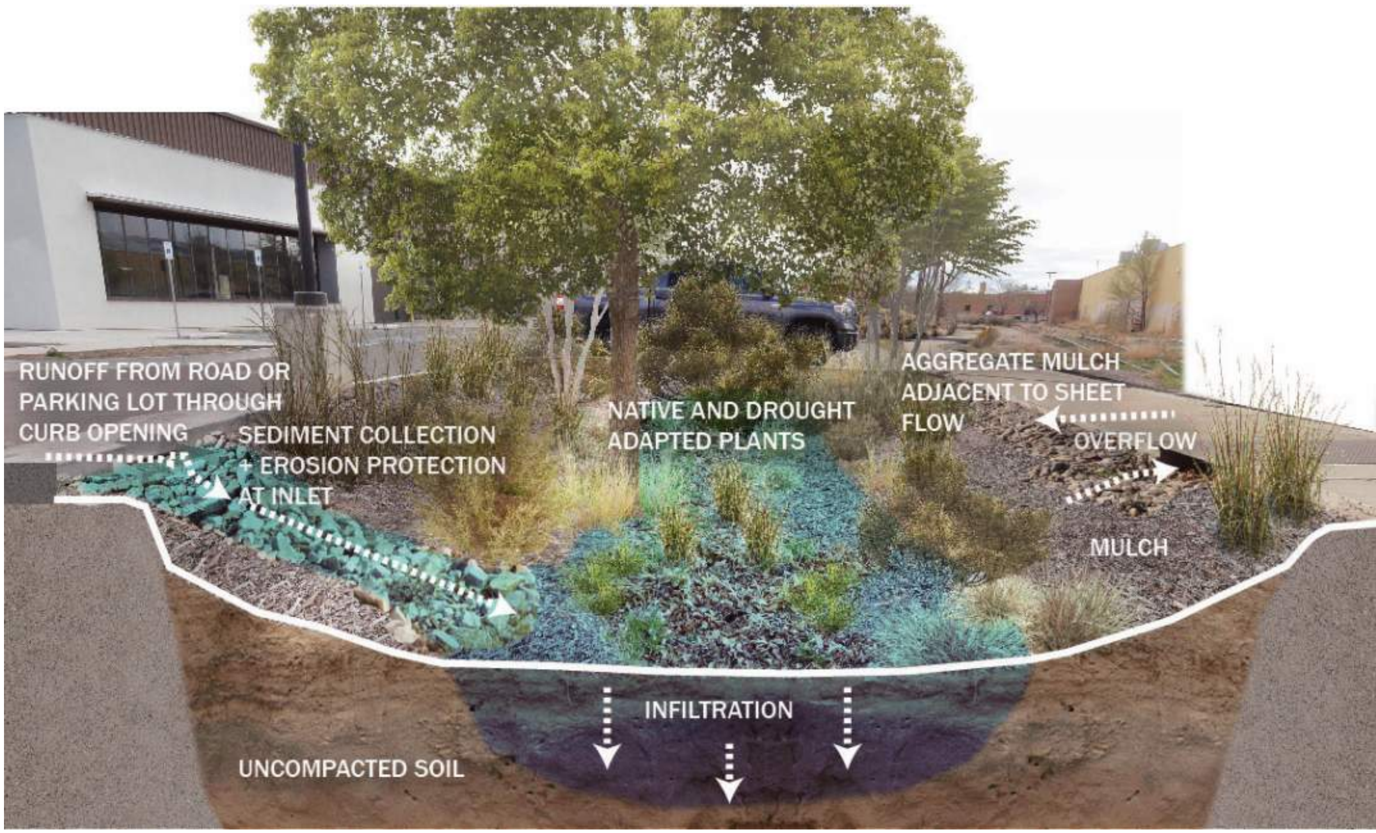


Bernalillo County standard design for a stormwater harvesting basin

Maintenance for Infiltration

To control flooding and pollutants, stormwater harvesting basins must allow water to infiltrate into the soil. If water is standing in the basin for more than 24 hours you may need to drain small to medium sized basins using a pump in to prevent mosquitoes or make repairs. The following maintenance tasks are needed to improve infiltration:

- Remove built-up sediment within the basin by scraping/shoveling to prevent clogging from fine particles.
- Look for any movement of mulch to find pooling zones (areas where water collects). If stormwater runoff isn't spreading throughout the basin evenly, re-grade to direct runoff to the entire basin.
- Make sure you have at least 3 inches of organic mulch in basins. See Module 6, Mulch, for more information on mulch maintenance.
- The roots of grasses and shrubs that can survive in areas inundated with water will improve the soil and help infiltrate water. See Module 5 Plant Maintenance for more information.
- Install soil sponges (mulched vertical infiltration drains) to move water more quickly down into the soil. (See diagram on page 22)
- If there is caliche (a hard clay layer common in the desert) or other confining layer (a layer of soil that allows little if any infiltration) in or under the basin, you may need to use a digging bar or pick to punch through the confining layer in some areas. This is also a good application for a soil sponge or french drain.
- Make the basin wider if there is space available. Spreading the water over a larger area will help it soak in.



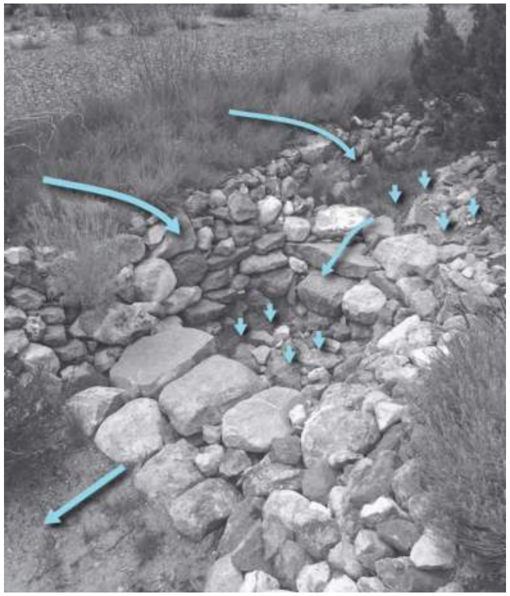
Stormwater harvesting basin schematic

Maintenance for Erosion

It is important to check for and repair erosion (washed out or displaced soil or rock mulch) because it can impact the function of the basin by causing clogging from increased sediment. When inspecting a basin, look for places where water is flowing around the inlet/outlet feature and causing erosion. Additional modifications to inlet height may be needed to redirect flow to inlet.

- Fill eroded areas with soil material similar to the existing material in place.
- Grade filled material with a rake, hoe, or other hand tool so that it matches the grade of the surfaces around it.
- If planting seeds, use an appropriate native seed mix.
- If erosion is happening due to a lot of water entering the basin too fast, consider installing a check dam, Zuni bowl, erosion blanket, or rip/rap. This will help slow the water down and minimize the amount of sediment washed into the bottom of the basin, which can cause clogging and additional maintenance.

Signs of soil erosion



Left: Stormwater harvesting basin at CNM

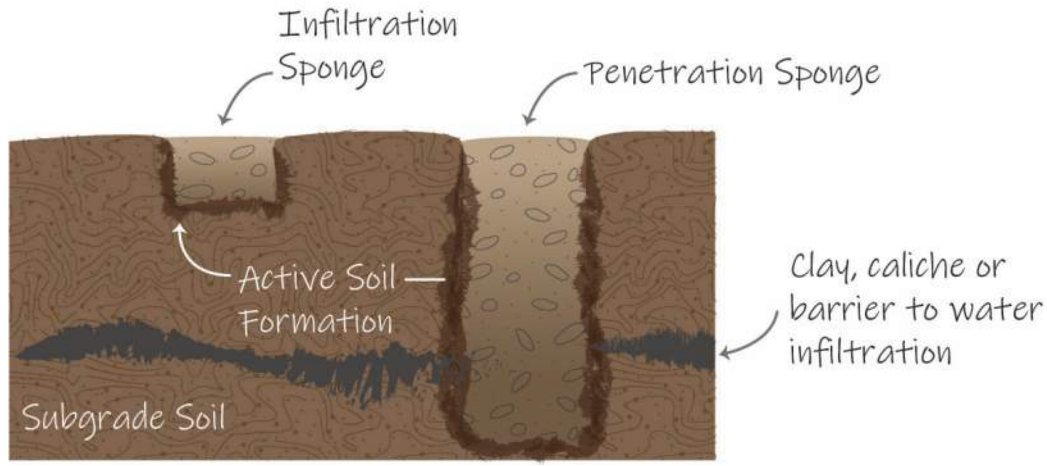
Zuni Bowl

A Zuni bowl is an erosion control feature. It generally consists of rock-lined steps and basins used to prevent headcuts or rills from forming. They work by slowing down and removing energy from the flowing water.

Maintenance to Prevent Clogging:

Use hand tools, such as shovels, rakes and push brooms, to remove sediment, trash, and plant material from:

- Sidewalk/paved areas adjacent to curb cuts/grates
- In and around inlets and outlets
- Sediment traps (plant material can be left in the bottom of basins)
- Basin
- Structure grates
- Pipe/structure openings
- Screens



Maintenance for Plants, Inundation Zones, and Mulch:

- Regular maintenance of plants is needed to keep stormwater harvesting basins functional. Please see the Plants Maintenance Guidelines in Module 5 for more detail.
- Mulch maintenance is also needed to keep stormwater harvesting basins functional. Please see the Mulch Maintenance Guidelines in Module 6 for more detail.

Maintenance for Access Ramps/ Features:

- Inspect the hard infrastructure (storm drain inlets, curb inlets, etc.) to ensure that they are not damaged or cracked and are not being undermined by higher-velocity water flows.
- Keep access ramps open and free of vegetation to allow access for maintenance activities.

Tools and Specialized Equipment

Removal of sediment/organic debris/trash by mechanized equipment may be necessary. However, use of heavy equipment may seriously damage the basin. To reduce impacts during maintenance activities:

- Include a provision in maintenance contract to quickly replace vegetation that is damaged or removed.
- Do not stage or drive heavy/mechanized equipment on or across infiltration areas to avoid compaction of soil/media.
- For soil sponge installation, an auger or post-hole digger will be needed.

See also the general tool list in Module 1.

Runoff captured in stormwater harvesting basin at CNM

MAINTENANCE INSPECTION CHECKLIST & SCHEDULE

Stormwater Harvesting Basins and and Bioswales (Conveyence)

Location:

Weather: Rainfall over last 2–3 days?

Inspector:

Precipitation amount:

Date: Time:

MAINTENANCE NEEDED	ACTION	COMMENTS
Frequency—Monthly		
1. Are there plants growing in inlets or outlets, blocking flow? ☐ YES ☐ NO	Remove plants that are blocking flow. If the plant is a good plant (i.e. not invasive), you may be able to move it to another part of the basin/swale. If it is an unwanted plant, remove and dispose.	
2. Are there unwanted plants, such as invasive plants or weeds? ☐ YES ☐ NO	Remove unwanted plants manually, which may include desirable plants growing in areas where they are not wanted (i.e. a tree seedling growing in an inlet).	
3. Are there diseased or dead plants? ☐ YES ☐ NO	Replace diseased or dead plants with similar native species.	
4. Have new plants been added? ☐ YES ☐ NO	Make sure young plants get the irrigation they need.	
5. Are weeds growing in mulch (if present)? ☐ YES ☐ NO	Manually remove mulch and add additional mulch to refresh.	
6. Is organic mulch (if present) at least 3 inches thick? ☐ YES ☐ NO	If mulch is less than 3 inches thick, add additional mulch.	
Frequency—Quarterly, after major storms (storms with 0.25" of rain or more)		
1. Is there standing water 24 hours after storm events? ☐ YES ☐ NO	If there is clogging or poor drainage, remove the accumulated sediment/discolored material/debris. Till or rake the remaining soil as needed.	
2. Is there sediment, plant material, trash/debris blocking inlets or outlets? ☐ YES ☐ NO	Remove sediment/plant material. These materials can be placed in another part of the basin/swale. Remove trash/debris and dispose.	
3. Are any plants diseased, impacted by pests, or have other issues affecting their health? ☐ YES ☐ NO	Replace diseased or dead plants with similar native species.	
4. Is irrigation system functioning correctly? ☐ YES ☐ NO	Fix any issues with irrigation system and adjust irrigation as needed based on season and plant needs.	

MAINTENANCE NEEDED	ACTION	COMMENTS
5. Do trees or shrubs have dead or damaged branches? ☐ YES ☐ NO	Remove any dead or damaged branches.	
6. Has mulch shifted or moved after storms? ☐ YES ☐ NO	Add additional mulch to refresh areas where much as been displaced.	
7. Is there erosion in any areas with organic mulch? ☐ YES ☐ NO	Inorganic (rock) mulch or riprap may be needed where erosion is occurring.	
Frequency—Quarterly in the beginning, then biannually (adjust frequency as needed after 3 inspections)		
1. Is there erosion? Impacts from animal burrows? ☐ YES ☐ NO	Repair soil erosion and repair the cause of erosion (i.e. is trash, debris, volunteer plant blocking the flow path?). Fill holes with lightly compacted soil.	
2. Is there more than 2 inches of accumulated material, like sediment, debris, and/or trash, in the bottom of the basin/swale (inundation zone) ? ☐ YES ☐ NO	If accumulated material is reducing infiltration, remove unwanted sediment/debris/trash. Add mulch or additional soil, if needed.	
3. Do plants look distressed? ☐ YES ☐ NO	During drought (longer periods without rain), adjust/increase irrigation as needed. Plants should be watered regularly until established (1–2 years for perennials, 3–5 years for shrubs, 7–10 years for trees) and as needed thereafter.	
4. Are inlets and outlets in good working condition? ☐ YES ☐ NO	Repair or replace any damaged structural parts of the inlets, outlets, sidewalls. Remove any sediment, debris, or volunteer plants blocking the inlet or outlet.	
Frequency—Annually		
1. Do plants need any pruning? ☐ YES ☐ NO	Prune plants ONLY AS NEEDED for clearance or health (dead, diseased, or damaged branches). Plants DO NOT need to be shaped or kept to size.	
2. Is there good plant coverage throughout the basin/swale? ☐ YES ☐ NO	Replace any dead or dying plants with similar native species.	
3. Are there complaints from residents? ☐ YES ☐ NO	Address complaints and/or discuss with supervisor	
4. Do you notice any hazards to the public? ☐ YES ☐ NO	If a hazard is observed, look for a way to fix the issue and discuss with supervisor.	
5. Are there any other issue or problems? ☐ YES ☐ NO	If yes, describe in comments and discuss with supervisor.	

Inspector's signature: ____

MODULE 4

Infiltration Conveyance

Infiltration Conveyance

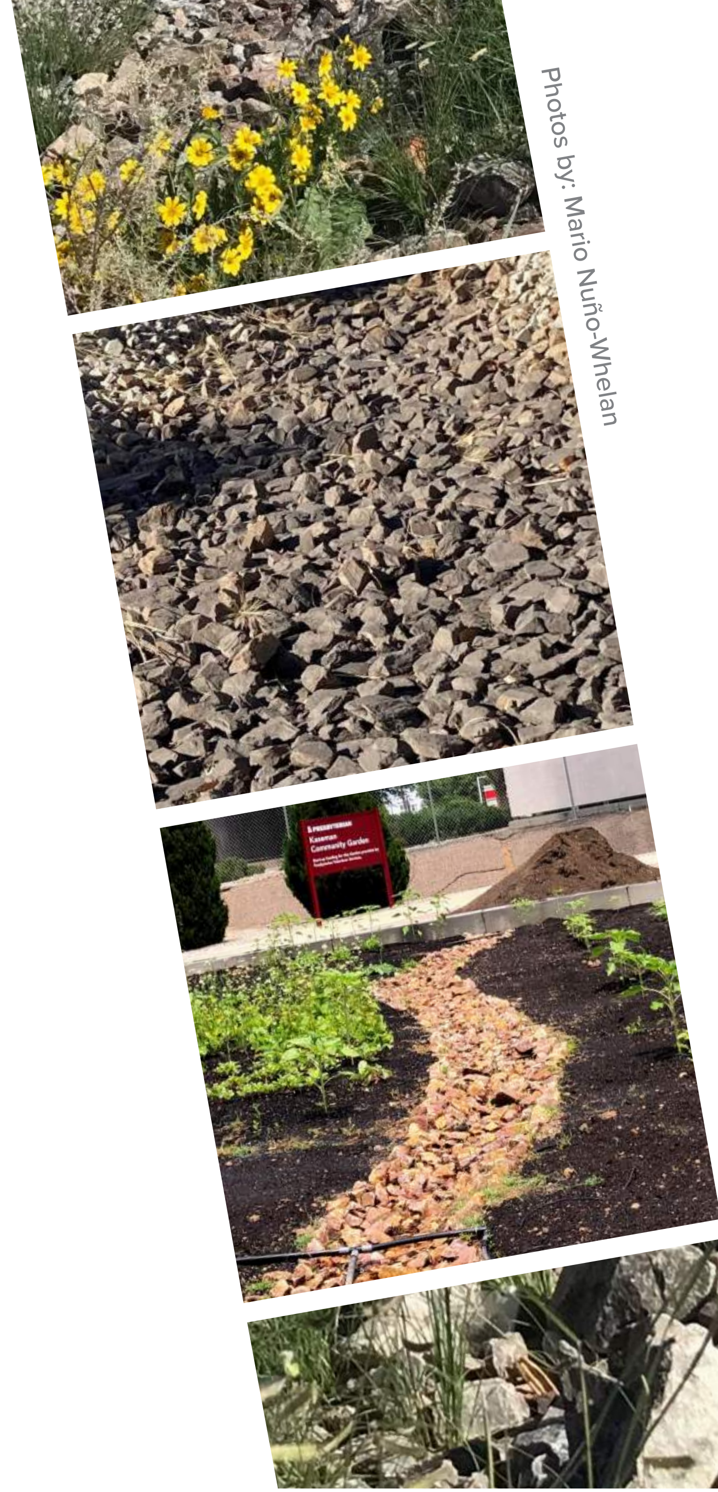
Infiltration conveyances are wide ditches that slow water velocity, direct stormwater flow, create temporary surface and subsurface storage of stormwater, and enhance the capacity of the ground to absorb stormwater, promoting groundwater recharge. Infiltration conveyances also aid in removing sediment and pollutants out of stormwater runoff.

Infiltration trenches are generally linear, stone-filled trenches that collect and infiltrate runoff and do not include plants.

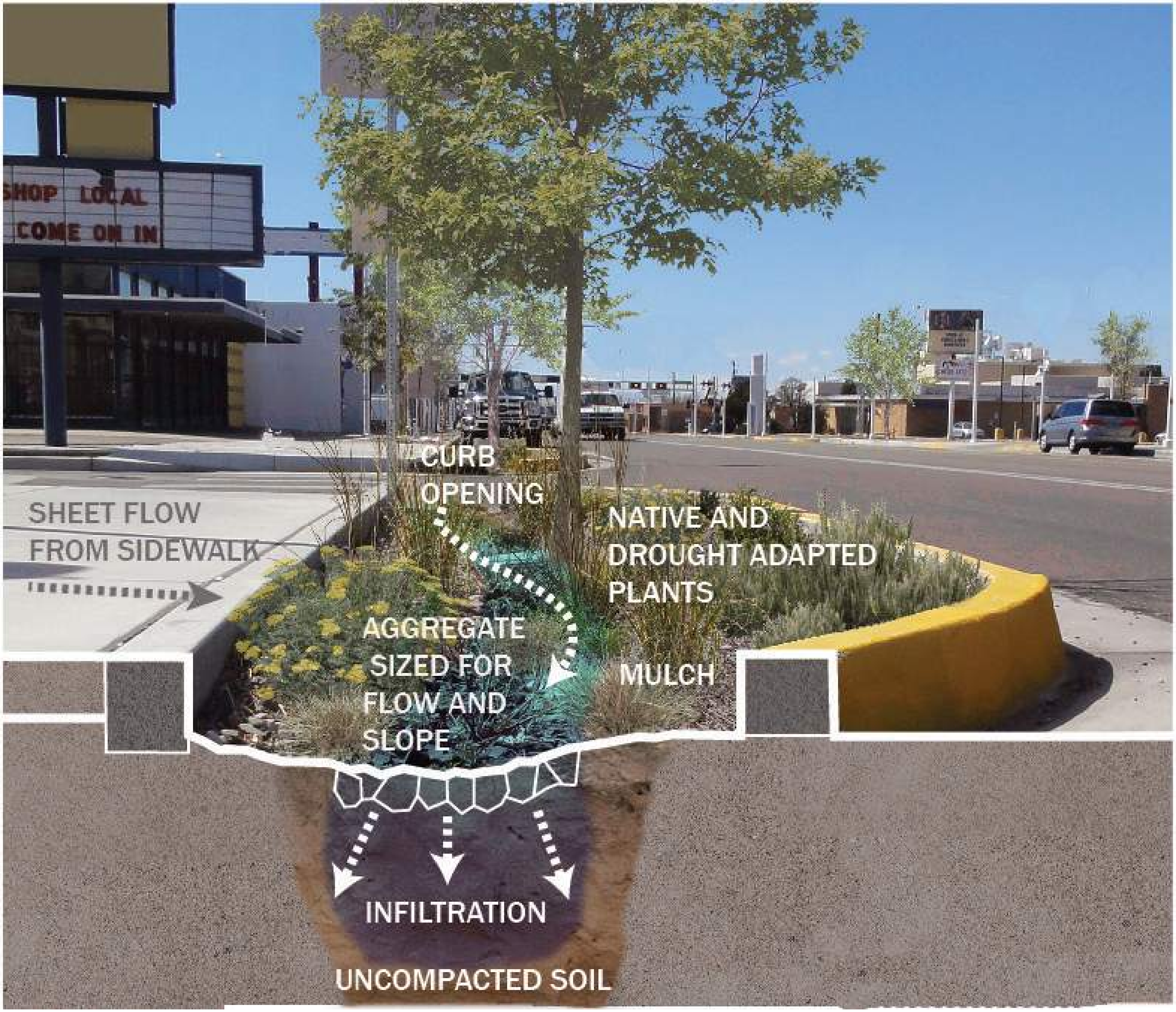
Bioswales, another type of conveyance, are shallow, linear, or curved linear features that include organic (wood/plant material) or inorganic (rock) mulch and plants (preferably native). They are designed to improve water quality by carrying (conveying), slowing, and treating stormwater runoff. Bioswales allow pollutants to settle out and promote infiltration.

Infiltration conveyances should slow the water enough to allow it to infiltrate and should have regular inspection and maintenance to keep them functioning properly. Components of infiltration conveyances that need inspection and maintenance include:

- Inflow and outflow structures
- Sediment traps
- Infiltration rates (see ASTM D3385)
- Erosion control and repair
- Plants/weeds
- Irrigation system (if present)
- Mulch



Photos by: Mario Nuño-Whelan



Stormwater Bumpout with Infiltration Conveyance

Infiltration Maintenance

To control flooding and reduce pollutants carried to our rivers, infiltration conveyances should slow down velocity (how fast the water flows), allow water to soak into the ground, and support vegetation when present (bioswales). Maintenance tasks include:

- Remove accumulated sediment, debris, and trash within the channel and at inlets and outlets. Organic debris, such as leaves and plant material, can be left in place if it is not causing blockage. Use manual tools instead of a power blower or trimmer to remove sediment, debris, noxious weeds, and trash.
- Inspect engineered elements for undercutting or clogging.
  - Stormwater moving around concrete or other hard surfaces may erode surrounding soils.
  - Look for and remove any material clogging vertical overflow pipes, honeycomb grates, or other outflow structures.
  - Look for significant changes in channel depth following storm events that might affect how stormwater moves through the feature.
- Where organic mulch (wood and plant material) is used, maintain and refresh as needed (see Module 6 for more information on mulch maintenance).
- If water is standing for more than 96 hours, remove clogging material or increase infiltration in bioswales by installing soil sponges (see Module 3 for more detail) to move water more quickly down into the soil.
- Replace rocks that were dislodged during storm events making sure no bare soil is exposed.

Infiltration trench in parking lot

Maintenance: Plant Care

- Inspect the bioswale for areas that are receiving more or less stormwater by observing soil moisture, dry areas with stressed or dying vegetation, and areas where vegetation is thriving. Determine if regrading is needed to evenly distribute water throughout the channel.
- Infiltration trenches DO NOT include vegetation; remove any vegetation within the trench. Plant roots present in these conveyances reduce infiltration.
- Remove vegetation that is blocking or inhibiting flow in the inlet, outlet, and graveled central channel. Dense vegetation in these locations may cause backup and overflow in undesired areas.
- See Module 5 for detailed plant maintenance information.

Visual inspection of the channel grade

- Check for any movement of sediment that changes the channel grade.
- If the channel grade is steep and water is flowing too fast, consider installing a check dam, Zuni bowl, erosion blanket, or other structure to help slow the flow of water. This may require renovation and is not part of regular maintenance.
- Remove and relocate sediment to maintain the channel grade and re-establish designed flow of water into appropriate areas. A flat shovel works well for this. A steel mesh screen placed over a wheelbarrow can help remove sediment from cobble or gravel.

Erosion control repair

- Fill eroded areas with soil material similar to the existing material in place.
- Use a flat shovel or similar tool to relocate eroded sediment or material (i.e., rocks) to areas where they are needed, or to areas where they were formerly located.
- If planting seeds to reduce erosion, use an appropriate native seed mix.

Bioswale along Second St, Mountain View Neighborhood, South Valley, Albuquerque

Maintenance:
Soil amendments and mulch

- Do not use salt, fertilizers or pesticides in the stormwater management area.
- Add mulch to a minimum depth of 3 inches. See Module 6 for more details on mulch maintenance.
- If there are high flow rates into the basin and the organic mulch (wood/plant material) is regularly washed away, consider adding a check dam or Zuni bowl or changing to inorganic (rock) mulch on just the water flow path, retaining organic mulch on more upland areas.
- See Module 5 for detailed plant maintenance information.

Urban agriculture infiltration conveyance including a conveyance trench and soil sponges.

Tools and Specialized Equipment

Sediment/organic debris/trash should be removed most often by hand equipment. Only use heavy equipment as a last resort or when regrading and refreshing the entire site (no more frequently than every 5 years). The use of mechanized equipment may damage the system. To minimize impacts during maintenance activities:

- Have new plants and a native seed mix available to quickly re-establish vegetation where it has been damaged or removed.
- Do not stage or drive heavy/mechanized equipment on or across infiltration areas to avoid compaction of soil/media. If mechanized equipment is required, use wheeled rather than tracked equipment where possible.
- See the general tool list in Module 1.

Stormwater Harvesting Basins and Conveyences

Location:

Weather: Rainfall over last 2–3 days?

Inspector:

Precipitation amount:

Date: Time:

MAINTENANCE NEEDED	ACTION	COMMENTS
Frequency—Monthly		
1. Are there plants growing in inlets or outlets, blocking flow? ☐ YES ☐ NO	Remove plants that are blocking flow. If the plant is a good plant (i.e. not invasive, non-native), you may be able to move it to another part of the basin/swale. If it is an unwanted plant, remove and dispose.	
2. Are there unwanted plants, such as invasive plants or weeds? ☐ YES ☐ NO	Remove unwanted plants manually, which may include desirable plants growing in areas where they are not wanted (i.e. a tree seedling growing in an inlet).	
3. Are there diseased or dead plants? ☐ YES ☐ NO	Replace diseased or dead plants with similar native species.	
4. Have new plants been added? ☐ YES ☐ NO	Make sure young plants get the irrigation they need.	
5. Are weeds growing in mulch (if present)? ☐ YES ☐ NO	Manually remove mulch and add additional mulch to refresh.	
6. Is organic mulch (if present) at least 3 inches thick? ☐ YES ☐ NO	If mulch is less than 3 inches thick, add additional mulch.	
Frequency—Quarterly, after major storms (storms with 0.25" of rain or more)		
1. Is there standing water 24 hours after storm events? ☐ YES ☐ NO	If there is clogging or poor drainage, remove the accumulated sediment/discolored material/debris. Till or rake the remaining soil as needed.	
2. Is there sediment, plant material, trash/debris blocking inlets or outlets? ☐ YES ☐ NO	Remove sediment/plant material. These materials can be placed in another part of the basin/swale. Remove trash/debris and dispose.	
3. Are any plants diseased, impacted by pests, or have other issues affecting their health? ☐ YES ☐ NO	Replace diseased or dead plants with similar native species.	
4. Is irrigation system functioning correctly? ☐ YES ☐ NO	Fix any issues with irrigation system and adjust irrigation as needed based on season and plant needs.	

MAINTENANCE NEEDED	ACTION	COMMENTS
5. Do trees or shrubs have dead or damaged branches? ☐ YES ☐ NO	Remove any dead or damaged branches.	
6. Has mulch shifted or moved after storms? ☐ YES ☐ NO	Add additional mulch to refresh areas where much as been displaced.	
7. Is there erosion in any areas with organic mulch? ☐ YES ☐ NO	Inorganic (rock) mulch or riprap may be needed where erosion is occurring.	
8. Are there noticeable differences in channel grade? ☐ YES ☐ NO	If channel grade is too steep in some areas, adjust the grade or add a check dam or riprap to slow the flow of water.	
Frequency—Quarterly in the beginning, then biannually (adjust frequency as needed after 3 inspections)		
1. Is there erosion? Impacts from animal burrows? ☐ YES ☐ NO	Repair soil erosion and repair the cause of erosion (i.e. is trash, debris, volunteer plant blocking the flow path?). Fill holes with lightly compacted soil.	
2. Is there more than 2 inches of accumulated material, like sediment, debris, and/or trash, in the bottom of the basin/swale (inundation zone) ? ☐ YES ☐ NO	If accumulated material is reducing infiltration, remove unwanted sediment/debris/trash. Add mulch or additional soil, if needed.	
3. Do plants look distressed? ☐ YES ☐ NO	During drought (longer periods without rain), adjust/increase irrigation as needed. Plants should be watered regularly until established (1–2 years for perennials, 3–5 years for shrubs, 7–10 years for trees) and as needed thereafter.	
4. Are inlets and outlets in good working condition? ☐ YES ☐ NO	Repair or replace any damaged structural parts of the inlets, outlets, sidewalls. Remove any sediment, debris, or volunteer plants blocking the inlet or outlet.	
Frequency—Annually		
1. Do plants need any pruning? ☐ YES ☐ NO	Prune plants ONLY AS NEEDED for clearance or health (dead, diseased, or damaged branches). Plants DO NOT need to be shaped.	
2. Is there good plant coverage throughout the basin/swale? ☐ YES ☐ NO	Replace any dead or dying plants with similar native species.	
3. Are there complaints from residents? ☐ YES ☐ NO	Address complaints and/or discuss with supervisor	
4. Do you notice any hazards to the public? ☐ YES ☐ NO	If a hazard is observed, look for a way to fix the issue and discuss with supervisor.	
5. Are there any other issue or problems? ☐ YES ☐ NO	If yes, describe in comments and discuss with supervisor.	

Inspector's signature: ____

MODULE 5

Plant Identification and Maintenance

Plant Maintenance

Plants are an important component of green stormwater infrastructure systems. When polluted stormwater passes through a biologically active filter (biofilter) or a plant community (referred to as a bioretention system), pollutants are reduced, and water quality improves. Plants and organic ground cover (e.g., mulch) are the most visible parts of a biofilter but much or most of the filtering happens below ground in healthy soils.

Healthy, native plant systems can:

- Reduce overall runoff volumes
- Reduce peak flows (preventing flooding)
- Increase and maintain infiltration rates
- Cool the soil surface (reducing heat islands)
- Reduce noxious weed establishment

Schematic of plants serving as a biofilter

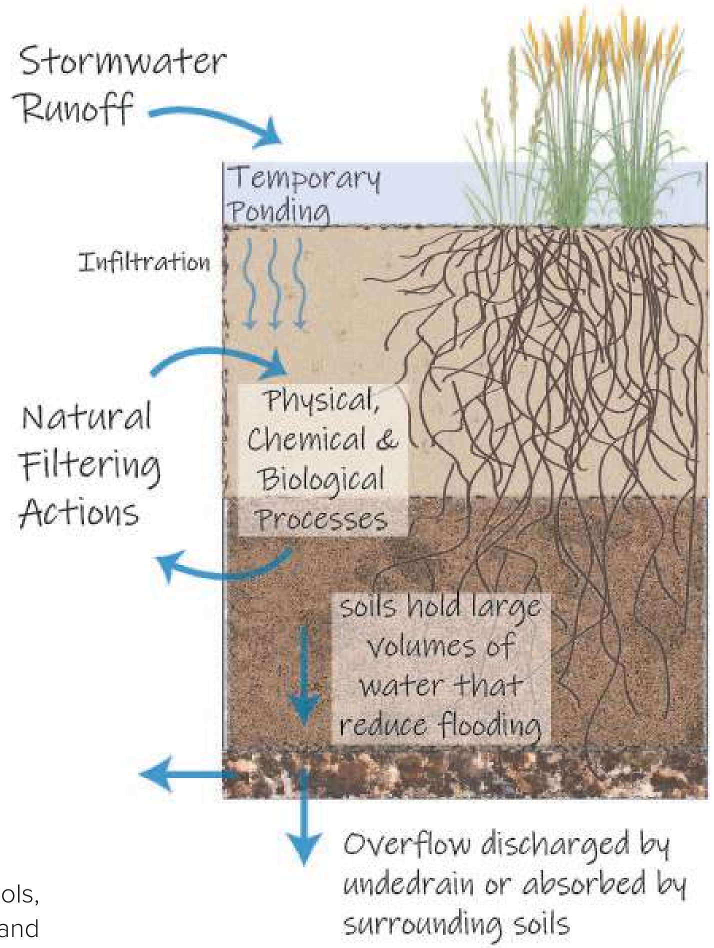


Image Credit: Sarah Hurteau, TNC; IAN Symbols, University of Maryland

Photos by: Mario Nuño-Whelan

Why are Plants Important?

Healthy plants are a vital component of green stormwater infrastructure to help:

- Control erosion
- Keep soils healthy — including soil fungi and microbes
- Promote natural filtering and breaking down of pollutants through biological and chemical processes
- Protect water quality by providing filtration and treatment for pollutants in stormwater runoff
- Provide habitat for wildlife
- Improve the urban environment for people
- Increase infiltration rates as water follows roots systems deeper into the soil

Plant maintenance can affect the optimal performance of green stormwater infrastructure in many ways:

- When vegetation dies and is not replaced, green stormwater systems lose the pollutant and water uptake benefits provided by the plants. Plant replacement is an important maintenance activity and will reduce/eliminate future renovation costs.
- Healthy soil microbes and bacteria that help break down pollutants die without healthy plants.
- Without vegetation, the soil holds less water, which in turn increases runoff.
- Clogged soil media prevents infiltration and can lead to a complete failure of a system, requiring replacement of the soil.

Bioretention systems are stressful environments for plant growth due to periods of flooding and pollutant loading, followed by long dry periods. Certain plant species are more capable of thriving in these extremes than others and can help to minimize the amount of maintenance needed due to plant die-off.

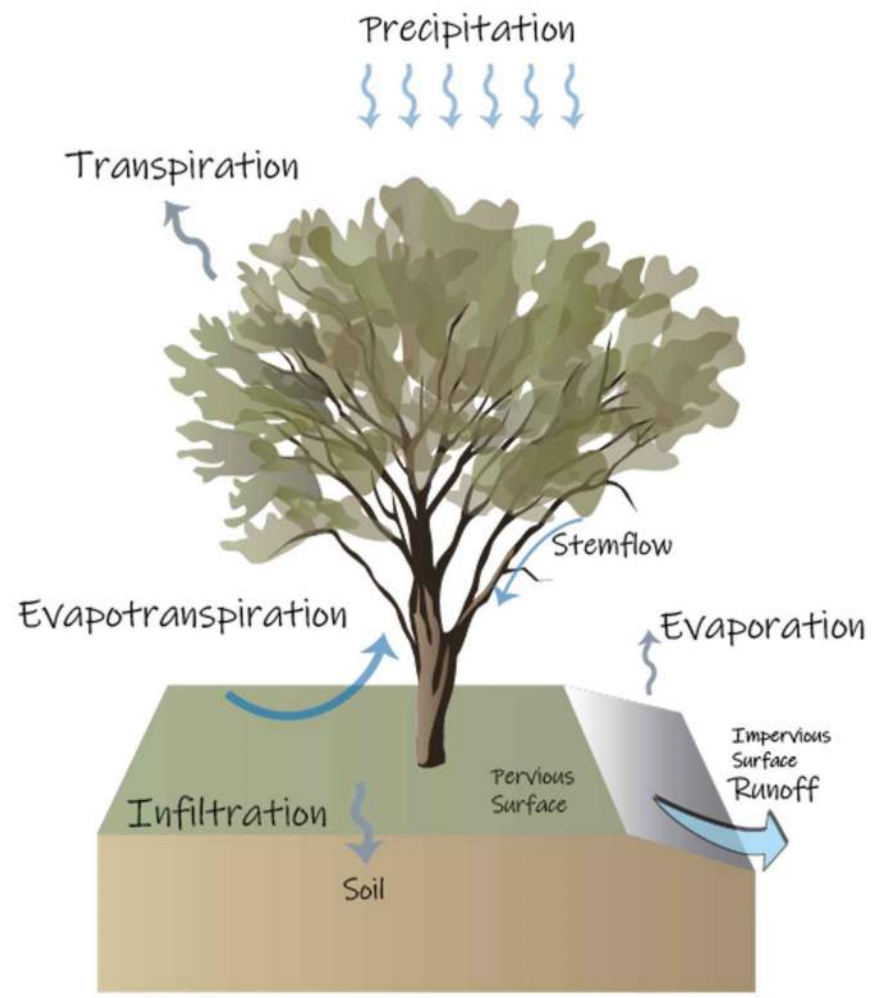


Image Credit: Sarah Hurteau, TNC; IAN Symbols, University of Maryland

Different Plants Live in Different Soil Water Zones

Each planting zone will have a different community of plants that will do best under these really different soil water conditions.

- Inundation zones (where water accumulates on the surface) will require plants that can be submerged in water for up to 48 hours.
- Transition zones (slopes on the edges of the trench or basin) will function best with plants that like extra water and may be occasionally submerged.
- High ground/uplands (areas bordering the trench or basin) require plants that are drought tolerant and require less water overall.

For more information of which plants do best in our native systems, please visit: www.bernco.gov/plantlist.

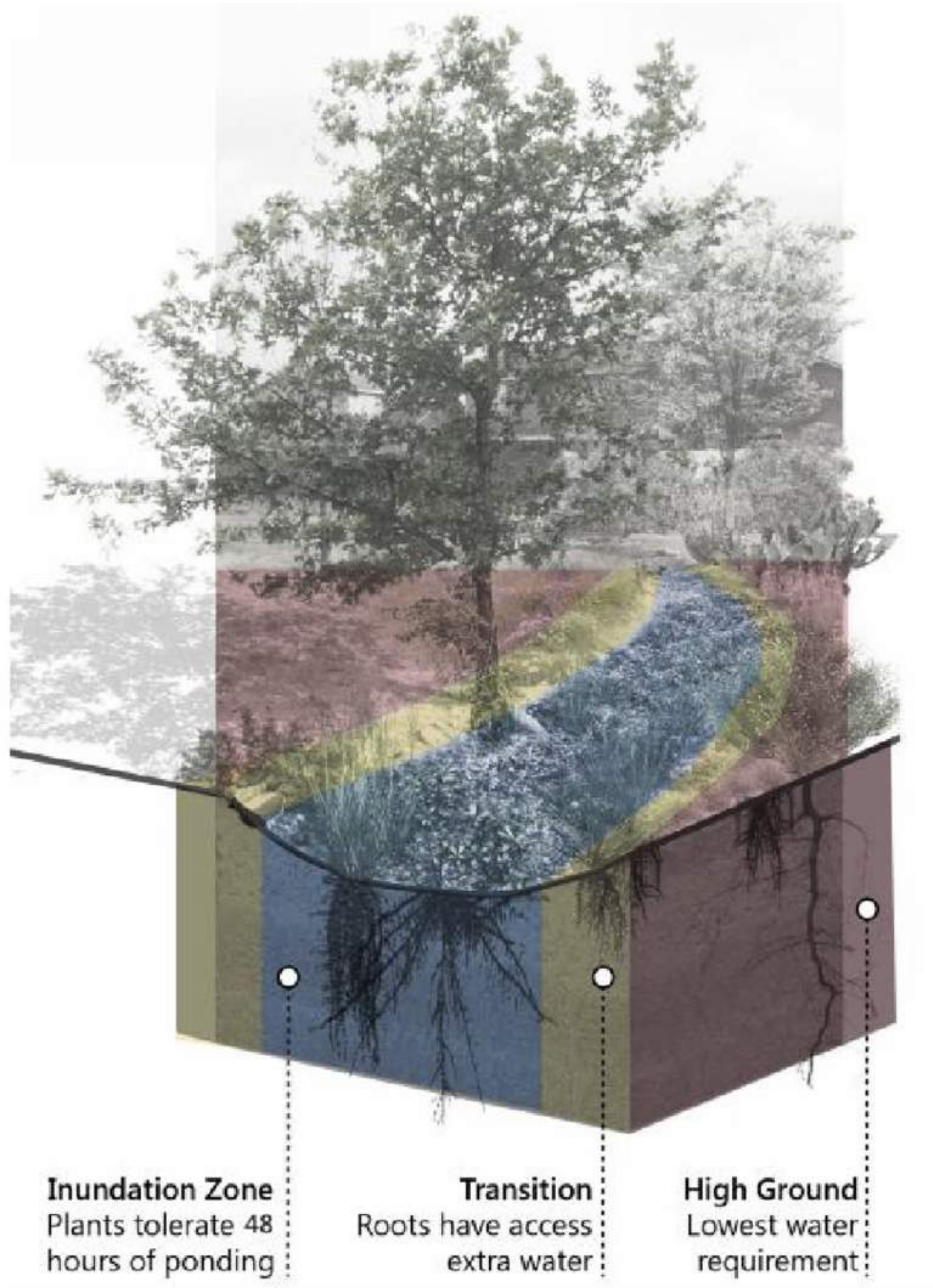


Image Credit: Tess Houle MRWM

Maintenance

- Check the design plan, if possible, so you know what plants should be there, and how the feature is supposed to function. If plants fail repeatedly, consult native plant list for appropriate substitute: bernco.gov/plantlist
- Inspect plants at the beginning of each season (quarterly) and after storm events, checking for healthy plants and pests/disease.
- Some plants may need to be removed so the feature can maintain function.
- Prune plants only as needed. Many plants, especially native plants, need little to no pruning. Many native plants, including grasses, need little or no pruning. Native grasses do not need mowing.
- Don't over-prune trees or shrubs; prune trees and shrubs only if they interfere with human pathways and to maintain sightlines for vehicles in features adjacent to roadways and intersections. Only trim for clearance, not to "shape" the plants!
- Prune trees for health. Pruning trees for health means:
  - Removing any broken limbs or branches.
  - Removing dead, diseased, and damaged branches.
  - Removing a branch if it is rubbing on another branch (crossing branches) or unwanted multiple leaders.
  - Trimming back one of the limbs when two limbs grow closely together, making a "V" in the branch union. This narrow angle makes for a weak branch attachment that could damage the tree later as the limbs grow larger.

For more information on pruning, please visit the Arid LID website for links to short video tutorials. https://aridlidcoalition.org

Native Plant Roots Strengthen and Stabilize the Soil

Some native plants have roots that extend as deep as 15 feet underground. These plants promote infiltration and reduce erosion.

Sod has a shallow root system and does not provide many ecological benefits.

Maintenance (cont.)

- Only remove major tree limbs in winter when the sap is NOT flowing. Deadwood can be removed anytime.
- DO NOT mound organic or inorganic (rock) mulch around tree trunks like a volcano. Make sure mulch is at least 4 inches away from the tree trunk. The root crown is beautiful and should be seen!
- Remove any unwanted plants, such as weeds and invasives, as needed and at least monthly and prior to seed set.
- Check for dead plants and replace them with similar plant types and prioritize the use of native species as they are better adapted to our desert climate.
- Increase irrigation for new plantings to help them get established. For native plants, establishment periods are 5 years for trees, 3 years for shrubs, and 1 to 2 years for perennials/herbs/forbs. For non-native plants, establishment periods will be longer.
- Adjust irrigation seasonally. Pay attention to monsoon and/or drought conditions and adjust irrigation frequency and duration as needed (more during hot/dry seasons and less during cool/wet seasons). Non-native plants usually require some winter irrigation.
- Gradually shift irrigation to less frequent and deeper watering, to maintain soil moisture.
- If replacing a tree, check the Climate Ready Tree List for an appropriate selection. Visit the Arid LID website for a link to this resource. https://aridlidcoalition.org
- Keep leaf litter and trimmings in place or in the basin bottom instead of removing if not causing blockages. This is free mulch and organic material that supports soil and plant health!
- Remove invasive weeds using species-specific guidelines (time of year, technique, etc.); for example, control silver nightshade where unwanted but leave in other areas for native pollinators.
- Weed less by using more organic (wood/plant material) mulch to reduce weed seed germination.
- Don't spray chemical herbicides; hand pull weeds when they pop up.
  - Pull weeds when they are small and after rain. Weeds are easiest to pull when roots haven't grown too deep yet and the soil is soft.
  - Remove weeds before they set seed to reduce future spreading.
  - Remove unwanted volunteer tree seedlings when they are young.
  - Pull or dig out the entire plant including the root system. If you just cut off the top, the plant will likely continue to re-sprout from the base. A trowel, hoe, or shovel should be sufficient to do the job.

Tools and Specialized Equipment

Have new plants available to quickly re-establish vegetation in case plants are damaged or removed.

See the general tool list in Module 1

MAINTENANCE INSPECTION CHECKLIST

Plant Maintenance

Location:

Weather: Rainfall over last 2–3 days?

Inspector:

Site conditions:

Date: Time:

MAINTENANCE NEEDED	
Frequency—Monthly	
1. Check for and remove unwanted plants, such as weeds and invasive plants. ☐ YES ☐ NO 2. Check for diseased or dead plants and replace them with similar native species. ☐ YES ☐ NO 3. Check for and manually remove weeds and invasives. ☐ YES ☐ NO 4. Irrigate young plants. ☐ YES ☐ NO	*Comments:*
Frequency—Quarterly; after major storms	
1. Inspect plants, checking for healthy plants, pests/disease, or other issues. ☐ YES ☐ NO 2. Inspect irrigation system and adjust as needed. ☐ YES ☐ NO 3. Remove any dead or damaged branches from trees and shrubs. ☐ YES ☐ NO	*Comments:*
Annually	
1. Prune plants only as needed for clearance or health (dead, diseased, or damaged branches). ☐ YES ☐ NO	*Comments:*

Inspector's signature: ____

MODULE 6

Mulch Maintenance

What is Mulch?

Mulch is a layer of porous material applied to the ground surface that helps to stabilize and reduce water loss from the soil by evaporation. It is an important part of green stormwater infrastructure. Mulch can be applied in stormwater harvesting basins, conveyance channels, or any area where retaining soil moisture, preventing erosion, and promoting healthy plant growth is desired.

Types of mulch include:

- **Organic mulch** is generally composed of chipped and/or shredded wood and plant materials. Organic mulch is appropriate for almost all applications.
- **Inorganic mulch** consists of gravel, crushed rock, lava rock, or pebbles and may be appropriate for areas where there are high stormwater flow rates, steep slopes, or where there is heavy foot traffic.

Organic mulch is preferable for most applications as it helps to suppress weed growth and contributes to pollutant treatment and healthy soils. Partially composted, shredded woody mulch is ideal because it locks together, making it more resistant to floating or blowing away. Mulch that is partially composted brings good bacteria and fungi that improve soil and plant health.

Different Types of Mulch

Organic mulch helps:

- retain soil moisture
- control weed growth
- limit big temperature swings in the soil
- prevent erosion
- support a healthy microbiome (a community of microbes, such as bacteria and fungi)
- treat pollutants through filtration

Organic mulch decomposes over time (which is good for the soil and microbiome) acting as a natural fertilizer for both soil and plants and consequently requires periodic refreshing. When using organic mulch within a GSI installation, use the following best practices (adapted from the DRAFT Bernalillo County Green Stormwater Infrastructure Low Impact Design Standards):

- Leaf litter does not need to be removed from the surface of areas with organic mulch.
- Avoid organic mulch products containing bark chips or products that are likely to blow or float away, such as pecan shells. Bark chips are naturally water repellant and resist decomposition.

Healthy fungi “gluing” mulch and soil together.
Source: https://edibleoasisidaho.blogspot.com/2014/10/mold-in-my-lungs-is-good-thing.html

- Keep all mulch at least 4 inches away from the base of trees and plants.
- Spread (or re-spread) mulch evenly across the site, especially when mulch has moved during storm events.
- Use wood chips, natural material erosion control blankets, or small rock mulch over drill seeded or hand broadcast seeded areas.

Inorganic Mulch

Inorganic mulch (gravel, rocks) is not preferred, although it may be useful in some circumstances. It does not contribute to the treatment of runoff or to the biological health of soil and plants. It also stores and releases heat. Inorganic mulch is best used on steep slopes where stormwater runoff velocities may be high or where there is a lot of foot traffic, as it provides added stability, and may be paired with landscape fabric to help prevent erosion. If inorganic mulch is necessary, use the following best practices (adapted from the DRAFT Bernalillo County Green Stormwater Infrastructure Low Impact Design Standards):

- In depressed basins or swales, install a 3-inch depth of chipped wood mulch below a single layer of inorganic mulchof aggregate size of 1” to 2” or large. Chipped (non-composted) wood mulch is recommended to be used under rocks and inorganic mulch materials as it will degrade more slowly than shredded, partially composted wood mulch. OR install landscape fabric in place of chipped wood mulch.
- Use rock and inorganic mulch where there are high flow velocities (greater than 1 foot/second) to slow down the water and prevent erosion.
- Rock and inorganic mulch containing fine grains can create additional sediment accumulation and clogging and therefore should not be used.
- If rock and/or other inorganic mulch is used, plan for maintenance to remove sediment and debris from the mulch; weeds will grow in sediment that accumulates in the rock and inorganic mulch.
- Dark-colored rock and inorganic mulch materials, such as basalt, are preferred for areas that will be stained by urban runoff. Light-colored rock and inorganic mulch materials are preferred for other areas because they retain less heat than dark colored materials.

Landscape fabrics for weed control are not recommended for use in GSI installations. These fabrics generally prevent stormwater runoff from reaching the soil and plant roots and are only permeable when they are fully saturated. Permeability declines as sediment accumulates on the top of the fabric layer, and can’t be corrected without digging up the overlying mulch. Weedblock fabric placed under organic or inorganic mulch collects sediment where weeds will grow, creating additional maintenance needs. Organic mulch, when applied appropriately, is much more effective at preventing weed growth.

TOP: Native mulch
BOTTOM: Forest floor mulch
Photos from Soilutions

Maintenance
for Organic Mulch

- Check for an even layer of mulch. If the mulch is piled up in some areas, move it around so that the depth is consistent.
- Organic mulch 3-inches in depth should last at least 3 years; mulch may be top-dressed annually to freshen the appearance. If the GSI facility receives frequent or high-volume flows, mulch may need to be refreshed more frequently.
- Leaf litter does not need to be removed from the surface of areas with organic mulch.
- If flow rates of runoff into the basin are high and the organic mulch is regularly washed away, consider installing inorganic mulch or riprap at the inlet to slow down the flow of water.

Tools and Specialized Equipment

Replacement mulch (see discussion above for appropriate mulch)

See the general tool list in Module 1.

Maintenance
for Inorganic Mulch

- Sediment and debris will accumulate in inorganic mulch over time; remove sediment and debris as necessary.
- Weeds will grow in the accumulated sediment; manually remove weeds when present.

Reference Materials

Climate Ready Trees List, now available statewide: https://www.nature.org/content/dam/tnc/nature/en/documents/Climate-Ready-Trees-Report-Nov2020.pdf

Noxious and Troublesome Weeds of New Mexico: https://aces.nmsu.edu/pubs/_circulars/CR698.pdf

Native Plant List: https://www. bernco.gov/plantlist

Irrigation Quick Reference: https://www.youtube.com/watch?v=WWnwg1DpEsU

Tree Care Quick Tips: https://www.youtube.com/watch?v=hRs3EmjVw9U&list=PL-o5jtJniuba3Pk9sWN94LgHYClPCaUro&index=2&t=4s

How to Plant a Tree: https://www.youtube.com/watch?v=sJmi99gxnFQ&list=PL-o5jtJniuba3Pk9sWN94LgHYClPCaUro&index=4

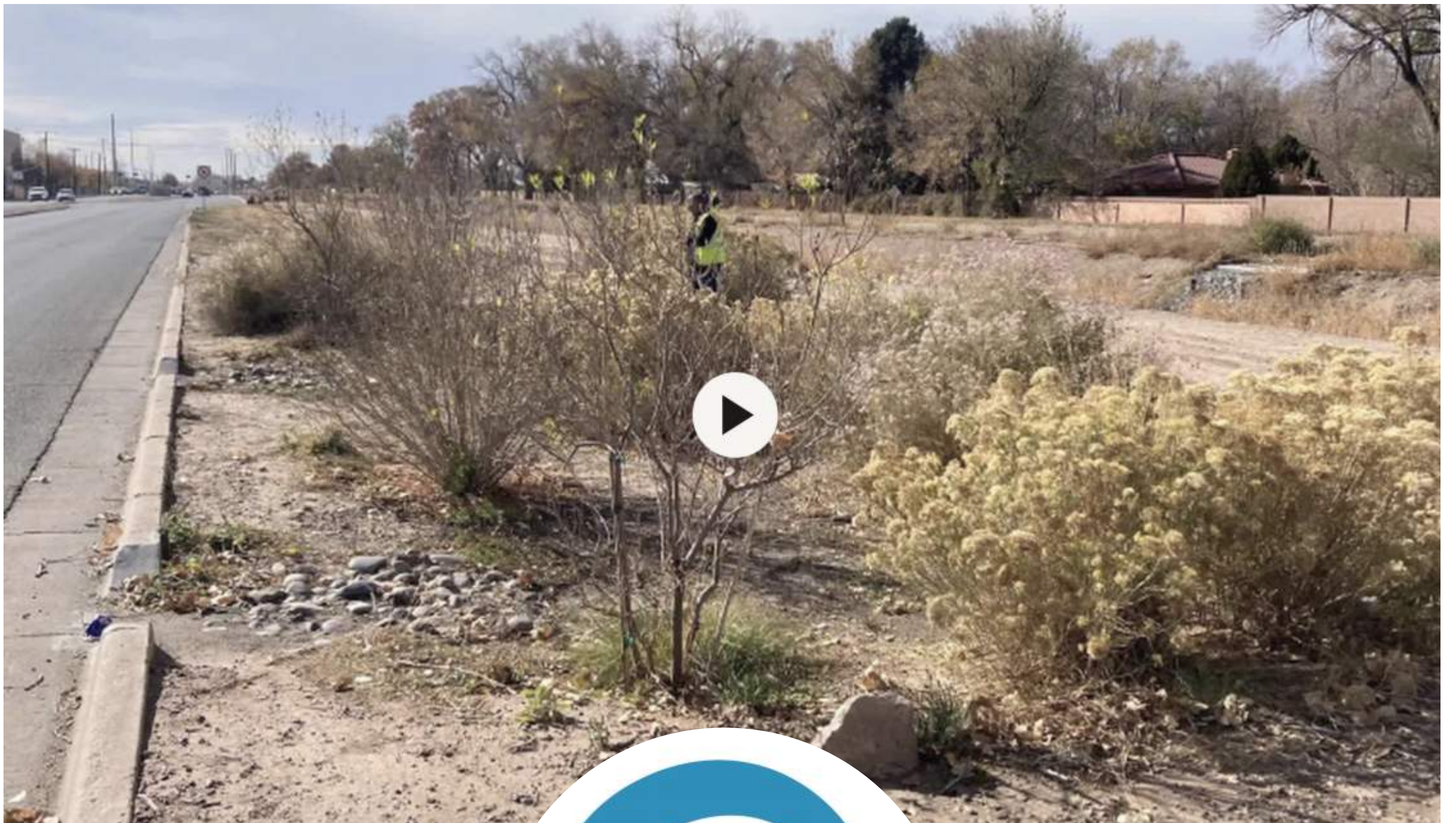
Tree Pruning Intro: https://www.youtube.com/watch?v=tR1EUMzuFP8&list=PL-o5jtJniuba3Pk9sWN94LgHYClPCaUro&index=5

Arid LID website for short video tutorials on pruning: https://aridlidcoalition.org

arid LID

Low Impact Development in Arid Environments

CIUDAD SOIL & WATER CONSERVATION DISTRICT



arid LID

Low Impact Development in Arid Environments

MIDDLE RIO GRANDE
Green Stormwater Infrastructure Maintenance Videos

WATCH TRAINING VIDEOS

Making Meaningful Connections by Integrating Water Resources Topics with Language Arts & Science

2022 Report

Presented by
Ciudad Soil & Water Conservation District
Erin Blaz, Education Manager
Saleema Robinson, Assistant Education Coordinator

June 2022

CONTENTS

SUMMARY

This year, funding enabled 39 NM classes (866 students and 41 teachers) to participate in a combination of *virtual and in-person programming* RiverXchange® program. 38 classes were funded for the program, but 39 were placed in the program considering the likelihood that not all bus and substitute funding was going to be used due to the uncertainty of field trip approval and substitute availability. Eight of the fourteen schools we served were Title 1. All program costs and coordination are provided free of charge to teachers. The program required $56,218.89 in cash and generated a total match valued at $67,351.11 in the form of in-kind contributions including teacher workshop attendance, presenter time and preparation for virtual presentations, as well as volunteer time from students and adults on the field trips to plant 495 trees in the bosque. Student Capstone Projects reached at total of 3,090 community members about stormwater and watershed health related topics.

RiverXchange® continued to have a successful year, even in light of the on-going global pandemic. One of the challenges this year was managing diverse policies for presentations and field trips across schools and presenter preferences and capacity. The result of these variations meant that students experienced varying levels of contact with the program. For example Rio Rancho schools primarily had video presentations and virtual field trips with live presenters, while one Rio Rancho school actually went on a field trip to Candelaria Nature Preserve. APS students primarily had virtual presentations with a live presenter and almost all APS schools did pole planting. However, in evaluating the program metrics both districts demonstrated knowledge gains and improvements in positive water conservation behaviors and attitudes.

Another significant change to the program this year was the evolution from blogging to the Capstone Project. With the inundation of technology and virtual learning in schools as a result of the global pandemic, it was time to rethink the goals of the blogging component and determine if they really support making meaningful connections for students in water resource education. The goal of the Capstone Project was to pilot a language arts component that would support making meaningful connections with students' immediate community- such as the larger school community or neighborhood. Results from the Capstone Project are shared further on in this report. In summary, much of the work we see is similar to the work that was posted on the blog, except many of the teachers that were able to integrate the Capstone Project challenged their classes to share their work with other classes at the school or even the school administration. This meant the work wasn't going into a digital void where only RiverXchange® staff would view it, but that it rippled out to more local students and adults!

In addition last year RiverXchange®, Bosque Ecological Monitoring Program and Valencia SWCD staff met monthly to discuss watershed and stormwater education collaboration opportunities, such as program continuity across grades and program assessment strategies. This effort continues to help support and improve core aspects of our programs and outreach.

RiverXchange® has demonstrated that its collaborative efforts with partner agencies to bring effective presentations to schools, funding structure to support teacher professional development and field

trips, and management by the Ciudad Soil and Water Conservation District, has allowed it to be not only resilient during times of uncertainty but a valuable resources for teacher and students alike. In fact, RiverXchange® has emerged as a strengthened program that will continue to evolve for years to come and improve how it engages our local community with watershed health and stewardship.

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 optional 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 K12 water resources outreach in NM since 2007, the RiverXchange program creators 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, they continued to find that upper elementary students had little or no understanding of major water resources topics unless the teacher specifically integrated a wide range of water topics into the curriculum. For this reason, as well as successful festival work with upper elementary students, this age level was selected as the focus for the RiverXchange program.

RiverXchange was created to provide a free program that is fun, interesting, and easy to integrate into the normal curriculum. The hope was to motivate participants to explore water resources topics in depth. The program was originally designed to be 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. Today RiverXchange runs over the course of 3-4 months, as a response to the challenges of implementing a year-long curriculum with the ongoing demands on teachers and students time and requirements for testing and other curriculum.

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 tele-conferencing to present what they had learned.

After the pilot project, RiverXchange transitioned to a web-based technology called a wiki. This enabled the program 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 classroom guest speakers were introduced to reduce teacher workload and bring up-to-date technical information into the classroom. In 2017, the program switched to a blogging platform called Kidblog and in 2021 Kidblog rebranded to Fanschool. Due to the inundation of technology from virtual learning in the global pandemic and the continued barriers to connecting classes on Kidblog/Fanschool, RiverXchange piloted integrating a Capstone Project into the

program instead of the blog in 2021-2022.

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. In 2020, ownership and the trademark registration of RiverXchange® was transferred fully to Ciudad Soil and Water Conservation.

Since 2007, we have served over 20,166 students!

This year, the program featured the following components:

- Optional standards-based curriculum including hands on science, math, and social studies lessons, as well as writing assignments
- Teacher training on curriculum and Capstone Project implementation
- Ongoing motivational support and Capstone Project monitoring
- End of year teacher survey
- Pre and post student surveys
- Coordination of at least four guest speakers into the classroom
- Coordination of a virtual field trip or in person field trip to the local river or important watershed feature
- Field trip leadership and activity planning

2021-2022 PROGRAM OVERVIEW

I. Program Management and Financial Support

The program timeframe was July 1, 2020 through June 30, 2021. All components including fundraising, design, planning, implementation, and analysis were carried out by employees and contractors of Ciudad Soil & Water Conservation District, including:

Erin Blaz
Jenny Lloyd-Strovas
Astrid Hueglin
Saleema Robinson

SPONSORS

- Southern Sandoval County Arroyo and Flood Control Authority (SSCAFCA)
- Middle Rio Grande Stormwater Quality Team (MRGSQT)

Sponsors provided a total of $56,218.89 in cash.
MRGSQT - $38,532.98 | SSCAFCA - $17,683.04

Program expenses included:

- Technology services
- Office and educational supplies
- Teacher workshop materials and food
- Coordination services (planning, implementing and assessing all program components)
- Bus funding
- Substitute funding

IN-KIND PARTNERS

- Albuquerque Water Utility Authority
- City of Albuquerque – Open Space Division
- City of Rio Rancho – Environmental Programs Office
- City of Rio Rancho — Parks, Recreation and Community Services Department
- Sandia Labs
- Sandoval County Cooperative Extension
- Bernalillo County Cooperative Extension
- Rio Grande Return

In-Kind contributions totaled $67,351.11

In-kind contributions included virtual guest speaker coordination, prep and presentation time. The City of Albuquerque significantly increased their match this year by including a pre-lesson kit and/presentation to classrooms. Additionally, in-kind match was able to return to a pre-2020 range due to the allowance of pole planting field trips, where student and adult time and trees are counted as match through volunteer time and materials.

PARTICIPANT SELECTION

All 39 participating NM classes were fifth grade classes, distributed as follows:

FUNDER	MRGSQT		SSCAFCA	
	SCHOOL - Number of classes	Number of Students	SCHOOL - Number of classes	Number of Students

*Title 1 school	La Mesa* - 4	92	Colinas del Norte* - 5	109
	Valle Vista* - 3	53	MLK* - 4	98
	Duranes* - 1	19	Sandia Vista - 4	92
	Seven Bar - 3	79		
	John Baker- 3	67		
	Zia- 2	40		
	Monte Vista - 2	52		
	Cochiti* - 2	27		
	North Valley Academy - 2	52		
	Manzano Mesa* - 3	61		
	Maggie Cordova* - 1	25		
TOTALS	**26 classes**	**567**	**13 classes**	**299**
RX Total Classes	**39 classes**	**RX Total Students**	**866 students**	

PRESENTATION TOTALS

Program presentations were completed as follows:

Agriculture: 39/39
Stormwater: 39/39
Wastewater: 39/39

Drinking Water: 39/39
Landfill Presentation: 14/14 (Rio Rancho only)

<u>Field Trips</u>

Virtual: 14/14

Pole Planting: 21/21

Candelaria Nature Preserve: 4/4

I. Program Components

The core curriculum of RiverXchange® is delivered through a series of in-class presentations provided by our partner agencies that are guided by the “Big Water Questions” that aim to build an understanding of watershed health. Additionally the field trip, in partnership with City of Albuquerque Open Space, has remained a core component of our program by offering students the opportunity to participate directly in a restoration project to understand the value of action and stewardship as a community effort. The field trip also offers an opportunity for participating students, who come from diverse backgrounds and have varied relationships with the outdoors, a chance to connect with an important, local watershed feature and build a connection to their local river. Furthermore, beyond the core components of RiverXchange®, the program also supports a more robust understanding of watershed health through teacher facilitation of the Capstone Projects and other additional lessons that are demonstrated at the teacher workshop. Extensive resources can be found on the RiverXchange® website but we have found teachers are at their capacity often don’t utilize those resources. Each year we continue working on developing a more streamlined program.

A review of this year’s program components follows.

<u>PARTNER AGENCY PRESENTATIONS</u>

APS

The Water Utility Authority has a new presenter, Rhea Trotman, who is replacing Theresa Dunn - the long time WUA educator for RiverXchange. Ms. Trotman provided the drinking water and wastewater presentations. Brittany Johnson at Bernalillo County Coop Ext. provided the virtual agriculture presentation. The stormwater presentation will continue to be offered via a video recording from Sandia Labs.

RRPS

The city of Rio Rancho offered pre-recorded videos of their drinking water, wastewater and landfill presentations as this year's presentations. Students will also receive the stormwater video from Sandia Labs. The agriculture presentation will be offered virtually by Steve Lucero and Nicole Lujan from the Sandoval County Coop Ext.

Field Trip Pre-lesson

City of Albuquerque Open Space Division Educator Ellie Althoff provided significant support to students understanding the "why" behind planting cottonwoods and willows in the Bosque by offering a River of Change Kit (a model and lesson derived from the Bosque Education Guide). This kit and lesson was provided to classes for their own use or as an in-person presentation with Ellie to explore the first two segments of the lesson - Rio Bravo and Rio Manso - which discuss the pre-settlement ecology of the Middle Rio Grande and flood control impacts due colonization and non-native settlement of the Middle Rio Grande Valley. The final segment of this lesson called Rio Nuevo, where students are prompted to consider the possible restoration and mitigation strategies for flood control impacts on the ecosystem, was completed either on site at the field trip or during the virtual field trip presentation.

FIELD TRIPS

POLE PLANTING

A total of 417 students and 56 adults attended pole planting field trips from APS schools. With the support of Albuquerque Open Space, 495 total trees were planted in an area of the Bosque just north of I-40 on the east side of the Rio Grande. Images of students pole planting are in Appendix XXXX.

VIRTUAL FIELD TRIPS

This year we continued to offer virtual field trips for schools that were not allowed to go on in-person field trips. City of Albuquerque Open Space generously contributed another educator, Ellie Althoff to join Erin Blaz in facilitating these field trips. The virtual field trip spanned 1.45 hours and explored evidence of the flora and fauna in the existing riparian ecosystem, identification of invasive species, strategies for managing forest health and the Rio Nuevo activity.

CANDELARIA NATURE PRESERVE (CNP)

In March, Martin Luther King Elementary School notified RiverXchange® staff that they were just approved for in-person field trips. Pole planting does not have demonstrated success rates into the warming spring months, so we had to come up with field trip location and activities that would work in April. As Ciudad SWCD is now the land manager of Candelaria Nature Preserve in partnership with COA OSD and Rio Grande Return, we collaborated to deliver two field trip dates to serve four classes at this site. Students were able to contribute some hands-on work by mulching berms alongside basins created for nucleated habitats, as well as nature journaling to envision the future of CNP as an agricultural land converted to wildlife habitat, and the Rio Nuevo activity. Wildlife Biologist Kyle Faig also gave a wildlife talk to students. The event was a great success!










Top row: Ellie Althoff and Kyle Bality from Open Space teaching students to pole plant properly. Middle rows - students from various schools planting in varying weather. Bottom 3 pictures: Field trips to Candelaria Nature Preserve


CAPSTONE PROJECT

This year RiverXchange piloted a new approach to maintain the language arts component that has been meaningful to teachers across the years and to strive to achieve a new kind of meaningful connection between RiverXchange students and their community. The coordination budget that has been used in the past for blog support and evaluation went to supporting teachers in the process of completing this capstone project and acquiring documentation of their class projects. The criteria for the capstone project are:

- (1) Students create something new that teaches other about what they learned in RiverXchange
- (2) Students communicate what they learned beyond their classroom in their community (i.e. other classes at school, your neighborhood or city)
- (3) Students design a stewardship project of their own that includes aspects of conservation and sustainability in their community.

Teachers were asked to update staff on their projects in December and March and to share the context of the project as well as who the project would reach and impact. In April teachers submitted their projects via email to staff and 6 classes were awarded with pizza parties to celebrate their project completion. In total, student capstone projects reached 3,090 community members about stormwater and watershed health topics.

RIVERXCHANGE COMMUNITY DAY

As a strategy to both motivate and celebrate the Capstone Projects, staff offered a Community Day at the end of the year where the class projects were highlighted. The event was held on April 23 in conjunction with the Earth Day Celebration at Agri-nature Center in Los Ranchos. The event was publicized to all RiverXchange® classes and families were encouraged to attend.

TEACHER WORKSHOP

Teacher workshops were held Sept 24, 2021 and October 1st, 2021 at the Open Space Visitor Center with RiverXchange facilitators Jenny Lloyd-Strovas and Erin Blaz. The teacher workshops were highly successful, with 19 participants on the 9/24 and 15 participants on 10/1. We found that there were a lot of new teachers this year, not only new to RiverXchange but also new to the field of teaching. The RiverXchange program was introduced and reviewed, with many returning teachers expressing their appreciation for and confidence in the program. The capstone project was introduced, was well-received, and teachers spent time working in groups to plan their projects. We ran through a few teaching strategies for lessons about the watershed using a 3-D model of the Middle Rio Grande Watershed for integrating geographical mapping and layering of life zones, historical development, biological features, etc, with the final layer demonstrating pollution on our watershed model. City of Albuquerque Open Space education staff ran through activities that supported the field trip learning objectives and reviewed the field trip experience and pre-lesson. Dyane Sonier of Rio Rancho Parks, Rec and Community Service introduced

resources and materials available to teachers on the Rio Rancho workshop date (Oct 1). Teachers enjoyed lunch overlooking migrating birds and explored the visitor center. Everyone left with swag-bags!

Teachers from Valle Vista, MLK, Colinas del Norte and Maggie Cordova map the middle Rio Grande Watershed. (top left and center). Dyane Sonier presents CoRR education programs (top right). Teachers rain on their polluted watershed model of the MRG (middle left). Teachers share their capstone project ideas (middle center). Teachers from Duranes and Zia brainstorm capstone projects together (middle left).

II. EVALUATION

TEACHER FEEDBACK

Teacher feedback is an invaluable resource for program evaluation and it continues to help us understand what teachers value and where we can improve. This year's feedback continues to reinforce that RiverXchange® remains relevant and impactful in curriculum and content. Feedback demonstrates the RiverXchange program is highly valued by teachers for its ability to provide hands-on and experiential activities that expose students to local watershed issues, reconnect them to the natural world, and demonstrate career opportunities in the science and conservation fields. RiverXchange continues to be a valuable curriculum that teachers use to stimulate the personal and collective growth of their students by encouraging them to use teamwork, adaptability, and communication skills to engage in and build an understanding in complex and new topics. In addition, the capstone project has provided an additional opportunity for teachers and students to engage their greater school community in project based learning that occurs in the program through education, research, and community service. Feedback also demonstrates the RiverXchange continues to be valued for its ability to bring hands-on science in the classroom and teach about water resources issues, while addressing both Common Core English Language Arts Standards and Next Generation Science Standards.

Additionally, when asked to share what successes teachers and the students had with integrating the capstone project, teachers reported that students really enjoyed using the capstone to engage with RiverXchange by creating deeper connections to water issues through direct action and demonstration. Teachers described how their students used the project to educate others about environmental issues,

organize campus-wide clean-ups, and build interactive models to demonstrate key watershed science concepts.

Lastly, when asked how RiverXchange could be improved to support teachers in future years, teachers reported difficulty with virtual programming due to COVID and a desire to return to more in person presentations and field trips next year. Teachers also indicated that more physical supplies for hands-on learning and greater support for the capstone project would help them with supporting their students in meeting program objectives.

Below are a few highlights from the teachers:

What are the greatest learning outcomes for your class as participants in RiverXchange?

The exposure to the environmental issues and understanding the environmental issues in the state of New Mexico. - Detrick, Colinas Del Norte

Seeing career opportunities outside of what they know. Giving them the chance to interact with environments that they may not have. - Shafer, Maggie Cordova

Understanding the science of conservation and the importance of valuing life. - Hodges, MLK

My students are more aware of how their behaviors impact the environment.- Granstrom, Seven Bar

I think the hands-on learning approach is the greatest learning outcome. -Filkins, MLK

Please share any feedback you have concerning your experience with the program this year.

RiverXchange was extremely successful because my students were enthusiastic to learn about several ways to take care of our natural resources. Example: fixing water leaks, conserving energy by turning off lights and technology, picking up their animal's waste. - Sanchez, Duranes

This has been a wonderful and helpful way to teach about our local water system. It makes a difference if students can see the river itself and know they have a part to play in keeping the Rio Grande! - Beer, Cochiti

We love the program and would like to continue participating in it, hopefully doing it entirely in person for the following school year. - Ceballos, La Mesa

I would like to see a more streamlined, organized program. Having the presentations in person would be best as well. - Marquez, John Baker

Each year, it seems the program continues to improve. The resources and activities were invaluable.- Turrietta, MLK

Great job and thank you for everything you did for us RiverXchange! - Hornbecker, Colinas Del Norte

CAPSTONE PROJECT

In RiverXchange, our goal is that students not only understand their local watershed but that they use their voice to advocate for conservation and proper management of our watershed in their community. This year we integrated the capstone projects to provide a fun and engaging opportunity for students to learn about and advocate for their watershed.

To provide a variety of opportunities for teachers to meet the capstone project requirements, teachers selected from 3 different capstone project levels, each with its own set of criteria. Each level is tied to a particular level of engagement achieved by each class's capstone project. The different levels are described below.

Level 1: In RiverXchange, we want students to be as aware of their local watershed as they are about other environmental issues like climate change. Through creating hands-on projects, students are able to demonstrate what they learn in a fun and tangible way.

- Criteria: Create something new that teaches others about what you learned

Level 2: RiverXchange was founded on the idea that learning is more powerful when students make meaningful connections between their local ecosystem and themselves and then communicate what they learn with others.

- Criteria: Create something new that teaches others about what you learned, Communicate what you learned with your community

Level 3: What sets RiverXchange Excellence projects apart from the others is that they have a stewardship component along with a communication component. We want to support and celebrate classrooms that take education outdoors and convert what they learn into a hands-on, community-based project.

- Criteria: Create something new that teaches others about what you learned, Communicate what you learned with your community, Design a stewardship project that includes aspects of conservation and sustainability in your local community

Engagement

Of the teachers that completed the capstone, most projects addressed criteria 1&2, while only a few extended to criteria 3. Being that this was the first year of integrating capstone projects, staff understood the need to create a laddered system of capstone project engagement for the teachers and students. Having multiple levels of engagement facilitated various kinds of participation based on teacher and student interest and capacity- from presentations and posters to campus-wide clean ups. Some teachers used the capstone project to assess if students achieved the NM Stem Ready/Next Generation Science Standards. Students were engaged by the different capstone projects offered by their teachers, practicing skills in leadership, stewardship, and teamwork. One teacher expressed how the capstone project gave the students the chance to use their talents in new ways.

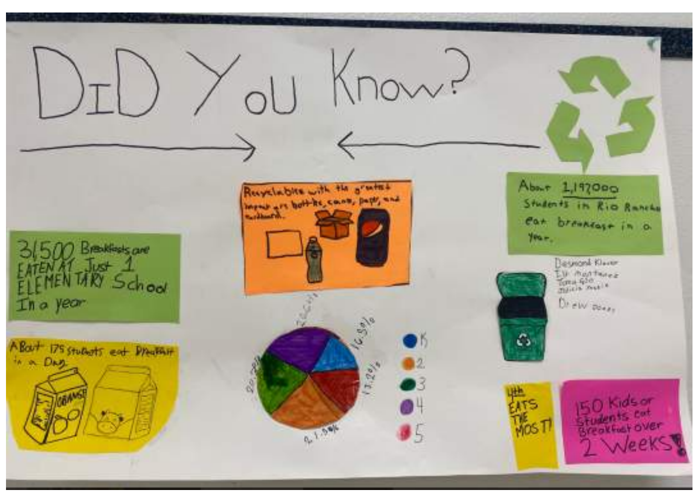
Beyond the impact to the students, the projects engaged the local community. When asked who in the community the class capstone project reached, teachers shared that often the entire 5th grade, students' families, or in some cases the whole school were reached during the course of the project. Students also expressed wanting to increase their reach to the greater public.

The challenging circumstances of virtual learning the last couple of years made it difficult for some teachers to complete the capstone project with their students. Some teachers expressed how their students had fallen behind in particular content areas and they weren't able to focus on the project due to the extra effort needed to bring students back to grade-level knowledge. One teacher requested additional support in designing and carrying out the capstone project.

Overall, the majority of teachers appreciated the hands-on and outdoor education focus of the capstone project criteria and felt their students gained meaningful experiences in the process.

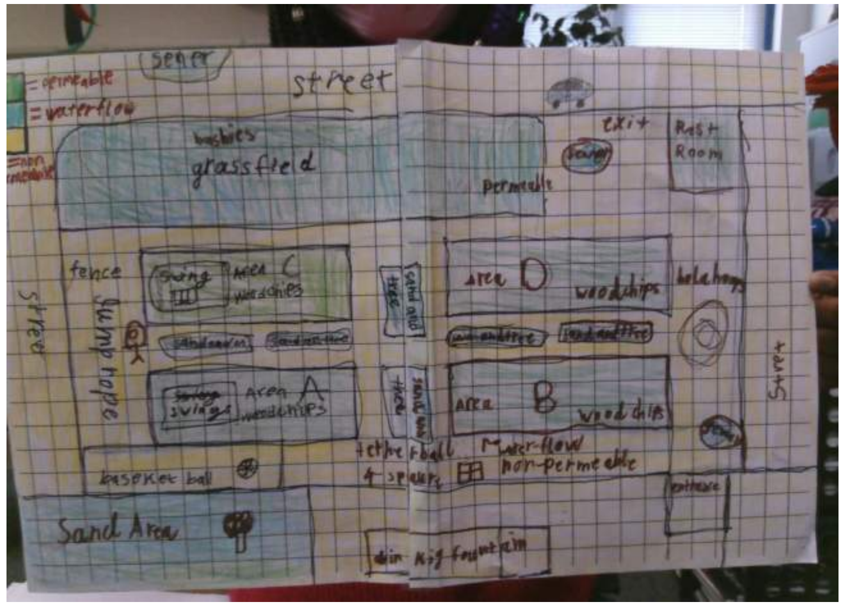
Capstone Project Images

Campus Clean Up- Whole team, Cochiti Elementary

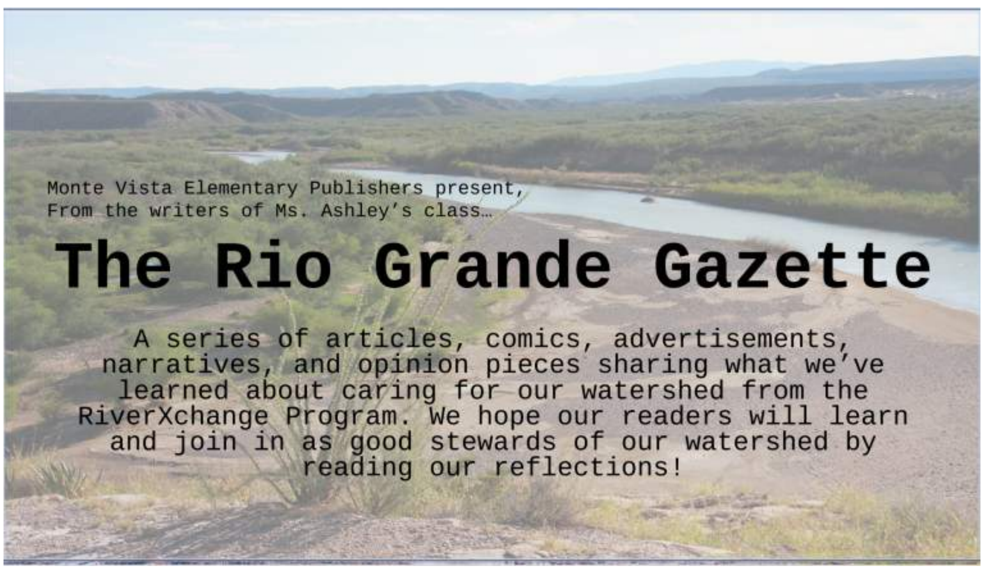


Recycling Project and Posters- Schapekahm, MLK

Green City Design- Chacon, Zia



Watershed mapping - Ackerman, La Mesa



The Rio Grande Gazette, Whole team, Monte Vista

Plantings using recycled plastic bottles- Gold, La Mesa

STUDENT SURVEYS

A key component of RiverXchange is its 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 observing the work submitted via the Capstone Projects. The survey includes questions that relate to environmental attitudes and behaviors as well as knowledge gained relating to our learning objectives.

Pre/Post Behavior Survey

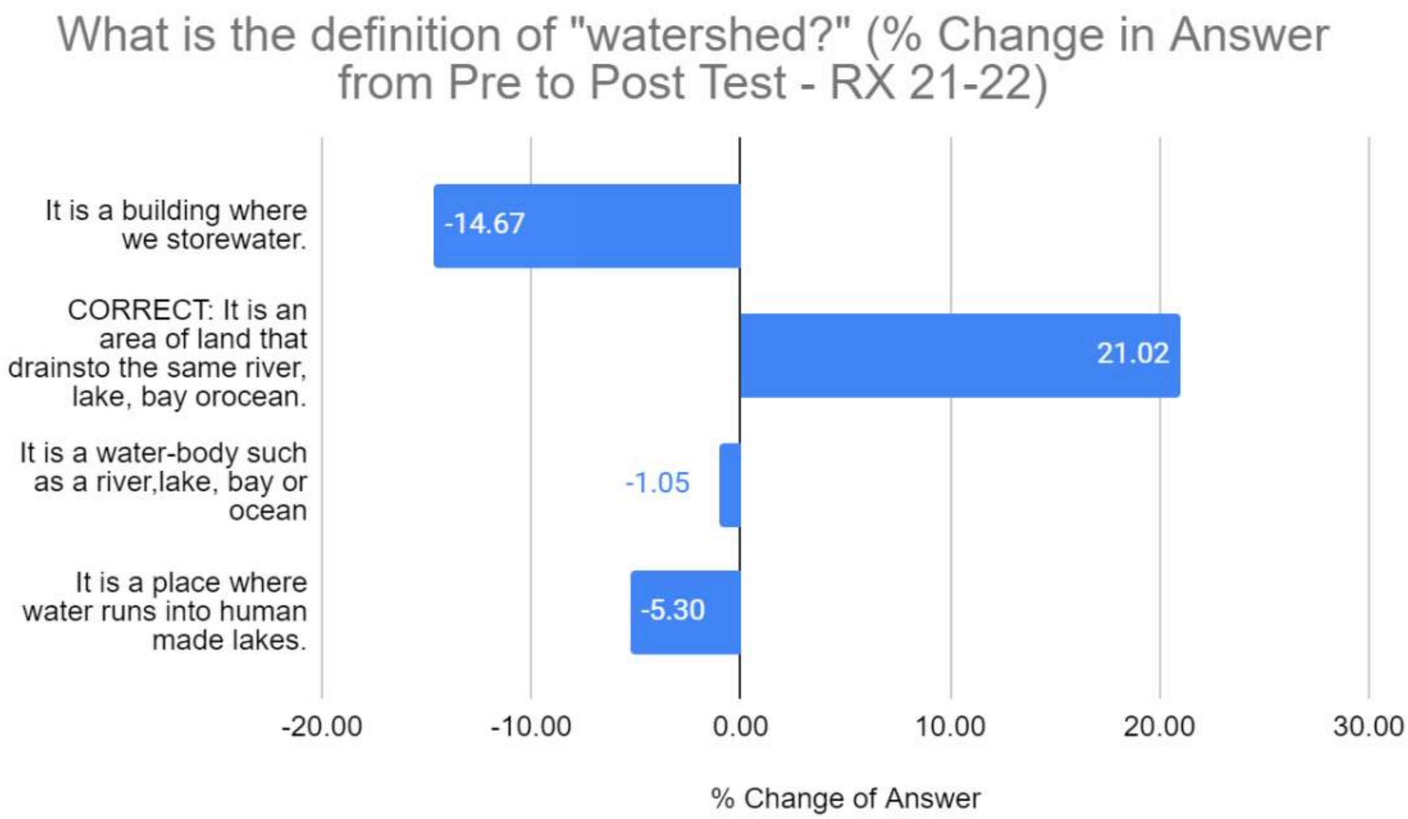
In order to quantify the learning outcomes achieved through RiverXchange, we ask our teachers to have their students fill out a survey prior to and upon completion of the program. Below, you will find a series of graphs used to illustrate the perfect change in responses between the pre and post surveys, as well as some breakout pie charts for further clarification on important topics. This year, 673 students completed the pre-survey, while 669 completed the post-survey. We continue to refine the survey and our programming year after year based on teacher feedback and metrics gathered from these surveys. To view this year's survey questions, use the following hyperlink: RX 21-22 Survey.

This year, we reframed the survey questions using a likert scale (with varying responses) with the hopes of demonstrating more range in growth across knowledge, attitudes and behaviors. In viewing other similar watershed program surveys, like the Watershed Project from the Bay Area in California, we hoped to look beyond our learning objectives and explore what kind of beliefs students had around water conservation behaviors. For example, in the question that asks how important/impactful are the following actions in protecting and conserving water, we were hoping to see increases from some or mild importance to high importance. Since the questions students had to respond to were all individual actions they could take, this movement to high importance, in theory, would demonstrate that they would feel more conviction to take those actions since they find them important and impactful.

As discussed with the MRGSQT general public survey, beyond collecting general knowledge about stormwater issues or watershed health, surveys can be educational tools as well. For example, asking students to select the positive water conservation behaviors they do "often" suggests that both these behaviors are important and desired. So even if students are answering how they think they should behave versus their action behaviors, this is still an effective tool to increase knowledge about behaviors that are positive for water conservation and watershed health.

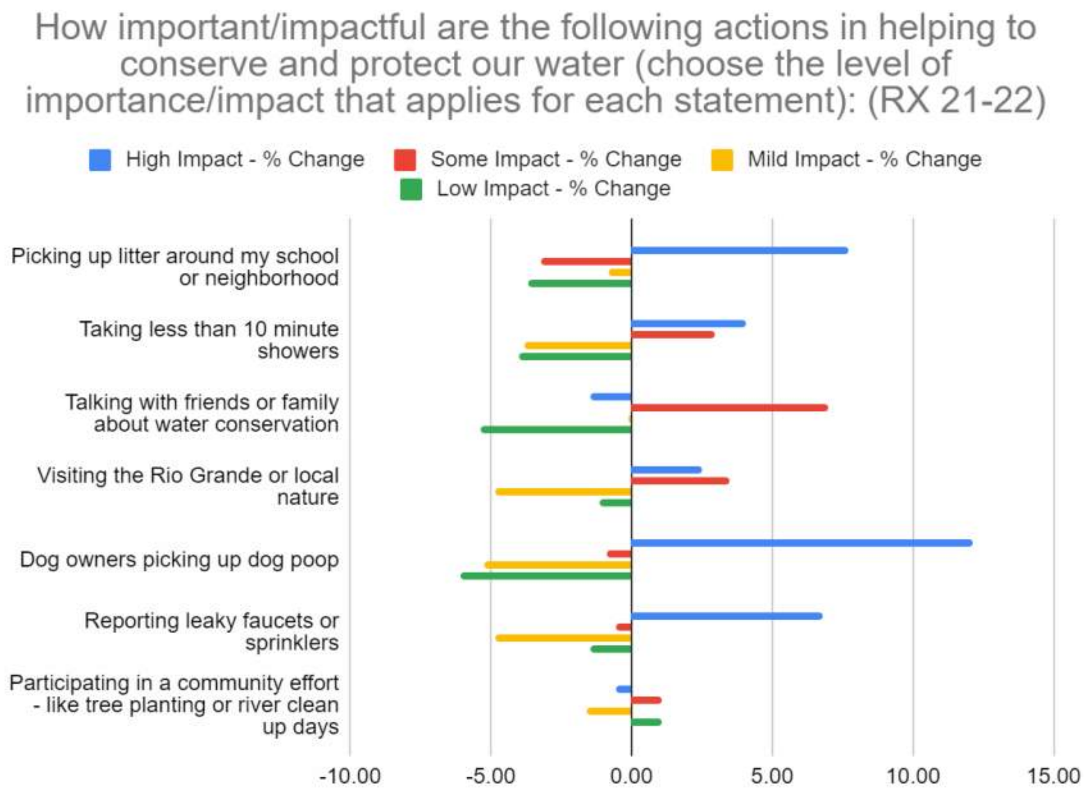
RiverXchange Percent Change Graphs for Pre-Post Surveys for 2021-2022

<u>Watershed Definition</u>

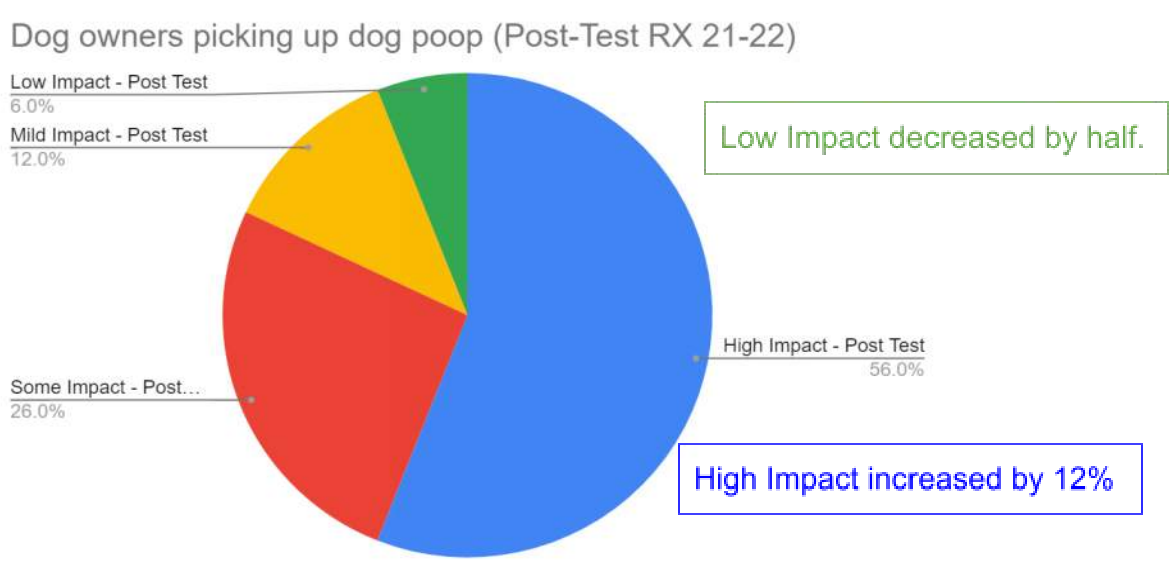


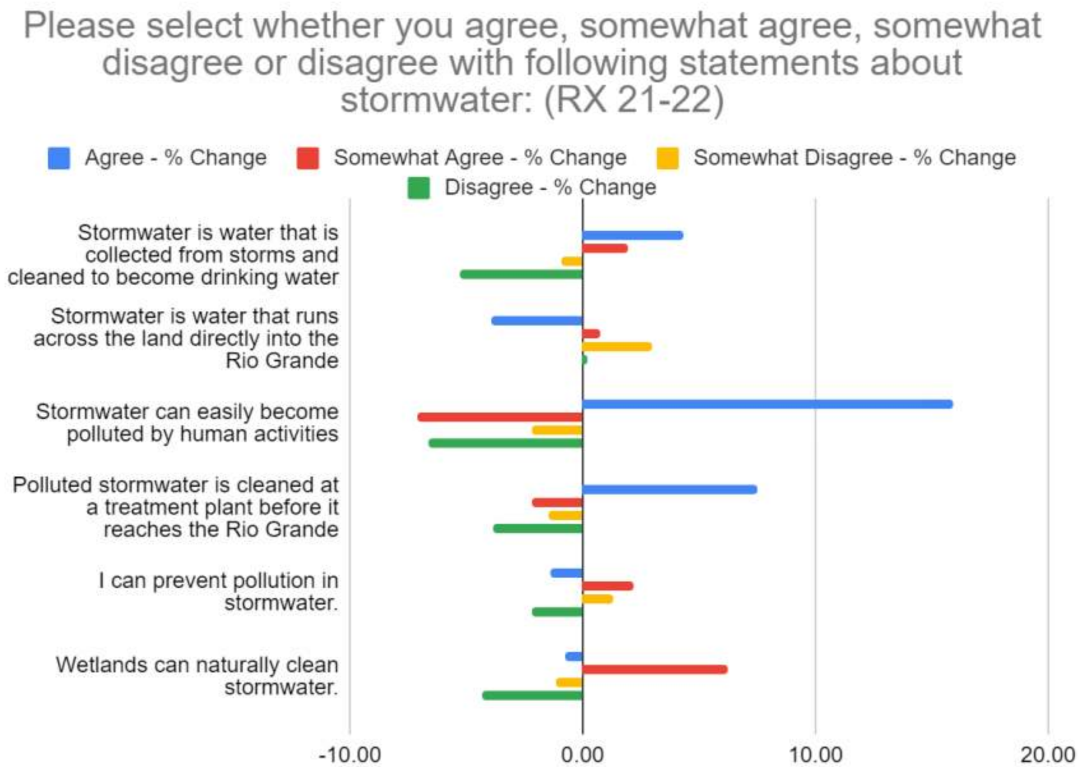
Results: We see over a 20% increase of correct answers for a watershed.

RX Stormwater & Pollution

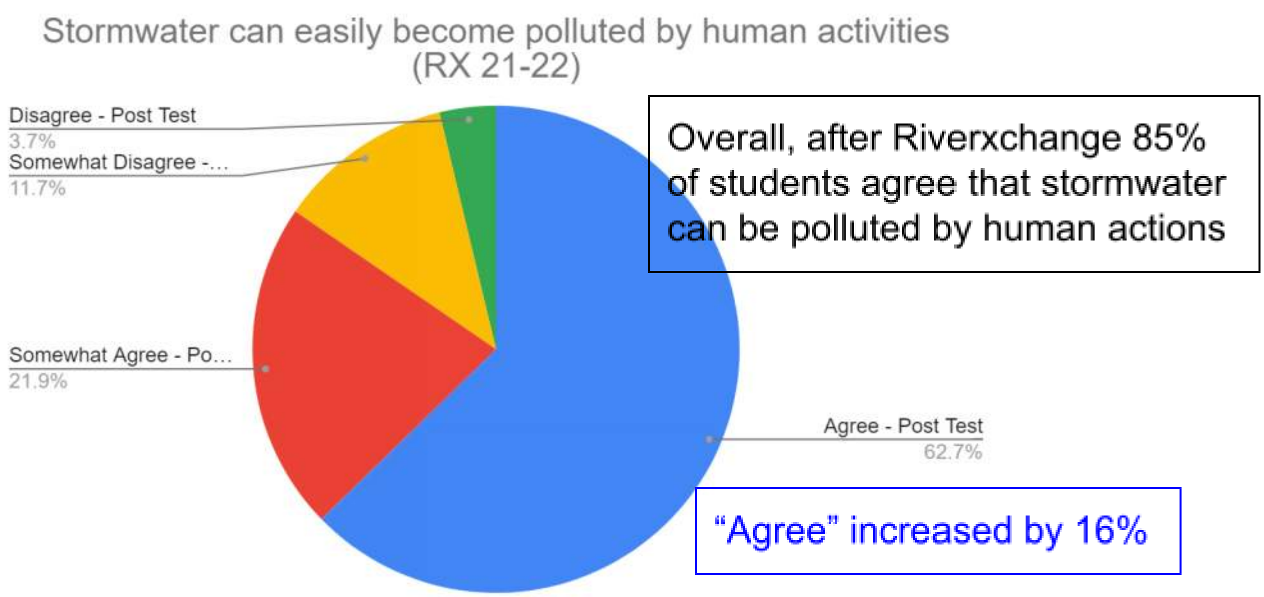


Results: Positive attitudes about picking up litter, taking shorter showers, picking up dog waste and reporting leaky faucets all increased after the program. There was also an increase in the belief that talking with friends and family can have some impact in water conservation. Breakout pie chart: In total over 90% of students believe picking up dog poop is impactful in helping protect water.

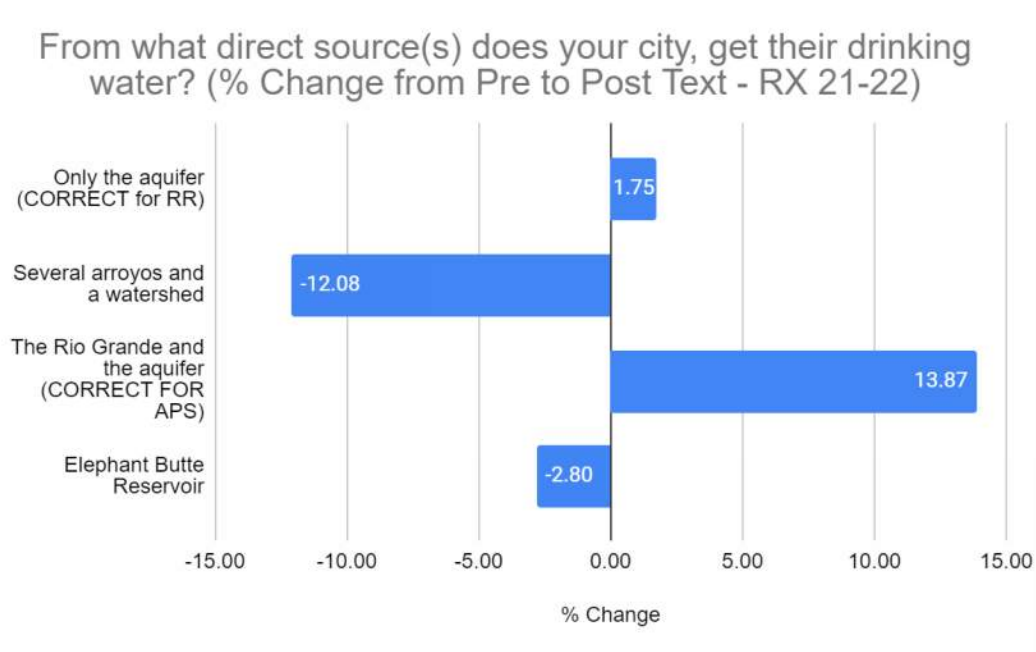




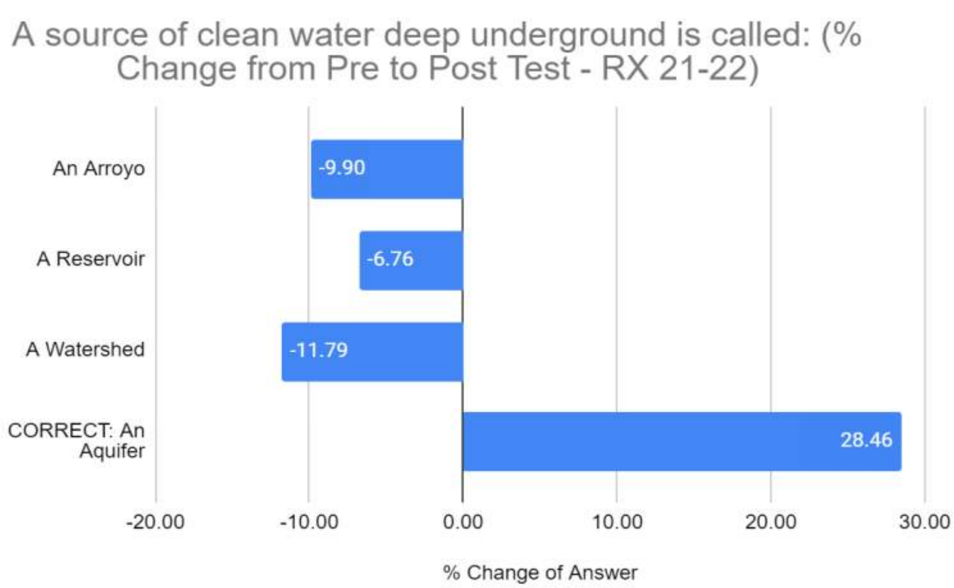
Results: Over the past few years, students seem to struggle with understanding the definition of Stormwater. However, more students agreed that stormwater can be polluted by human activities after the program and over 85% of students agree in total.



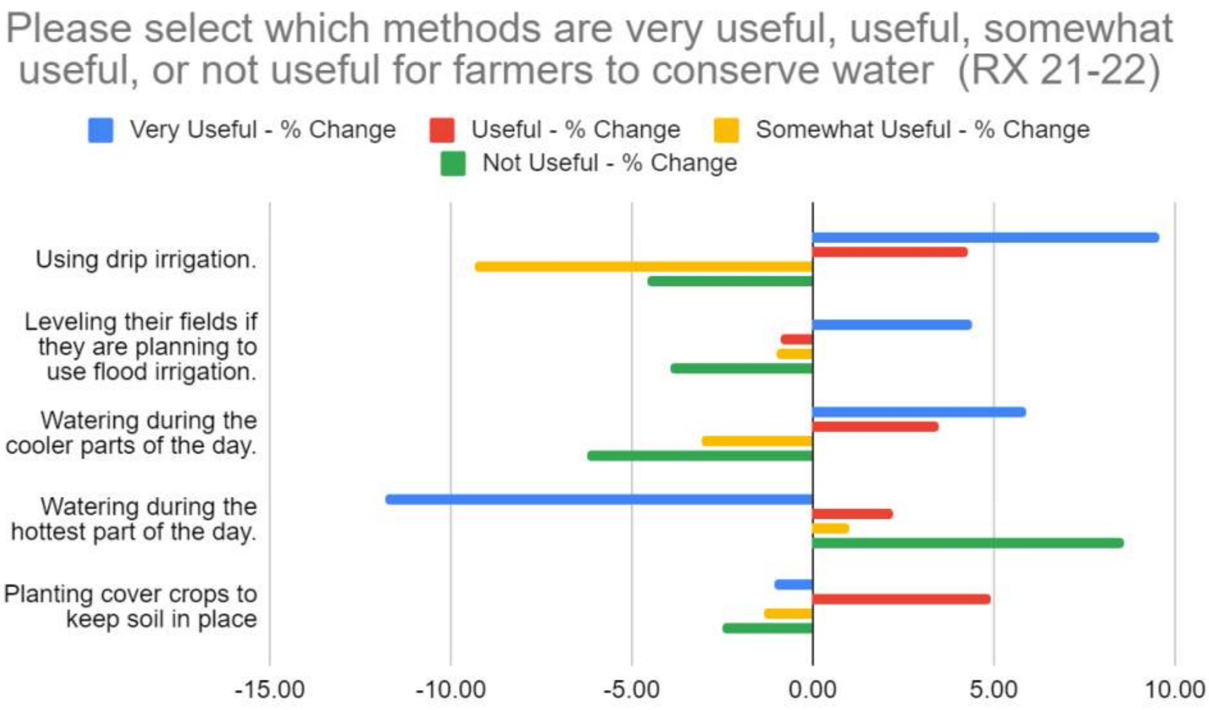
RX Watersource



Results: In looking at the totals separate by school district, APS overwhelmingly answered the drinking water question correctly. RRPS did not do as well selecting only the aquifer, this could possibly be because this isn't reinforced as much as it is in APS with other programs like The Water Utility Authority Rio Field Trip, and could also be because this lesson was in a pre-recorded video format. However, over 75% of students correctly answered the definition of an aquifer, with a 28% increase post-program.

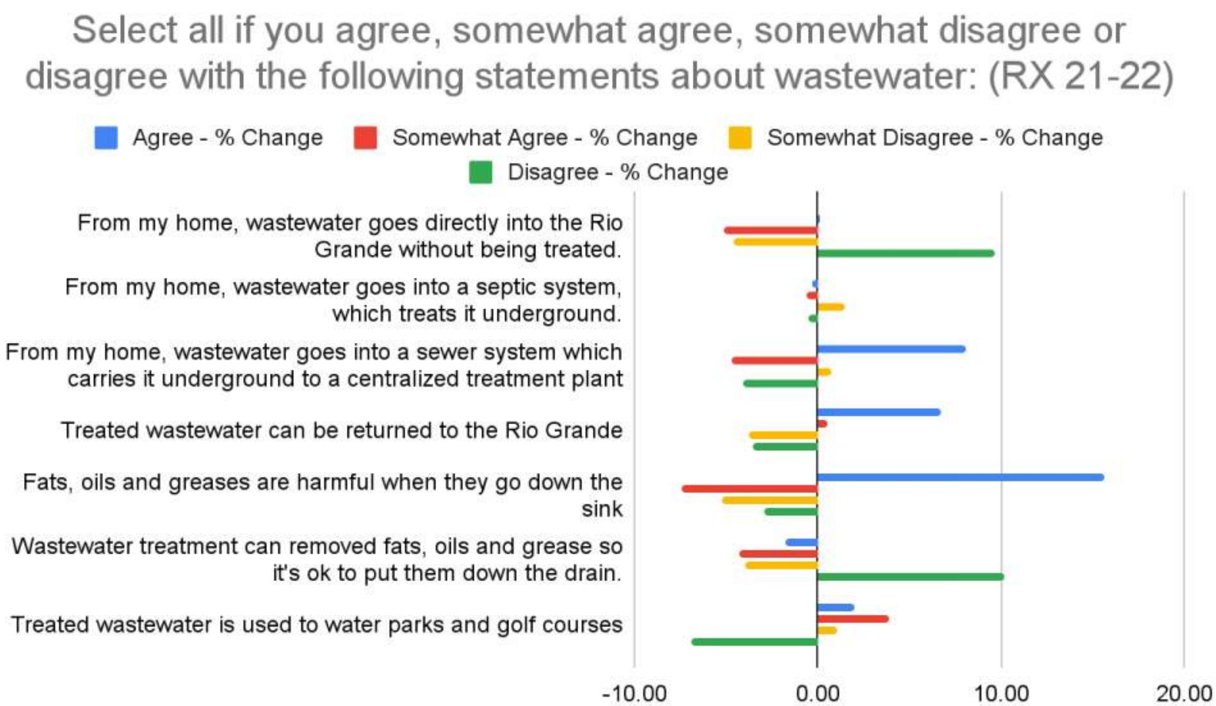


RX Farmers



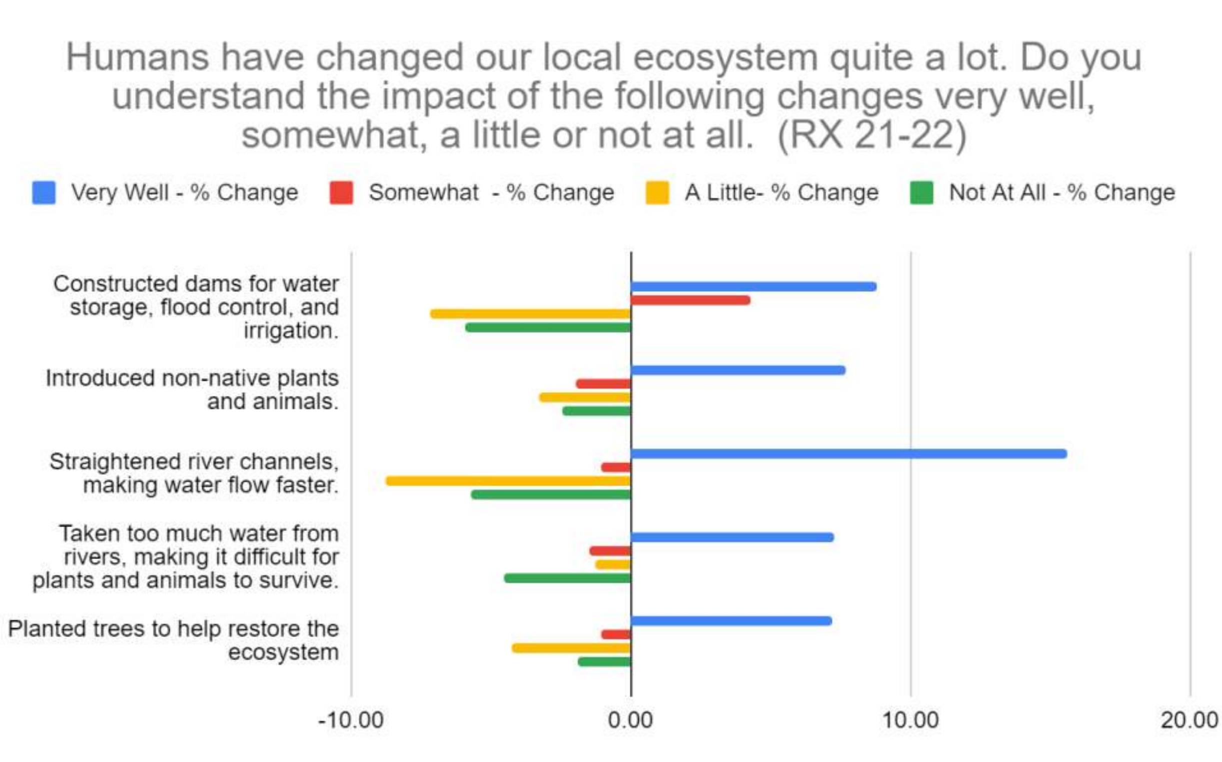
Results: Generally speaking students demonstrate an increase in selecting water conservation strategies in agriculture as "very useful" or "useful" post-program. They also increased the choices of not useful and decreased their choice of highly useful for watering during the hottest part of the day. The agriculture presentations may have touched briefly on the use of cover crops for soil health as a water conservation topic, so while selections of "very useful" decreased, "useful" increased more students may have been considering the topic in the moment, relying on previous knowledge to answer that question.

RX Wastewater

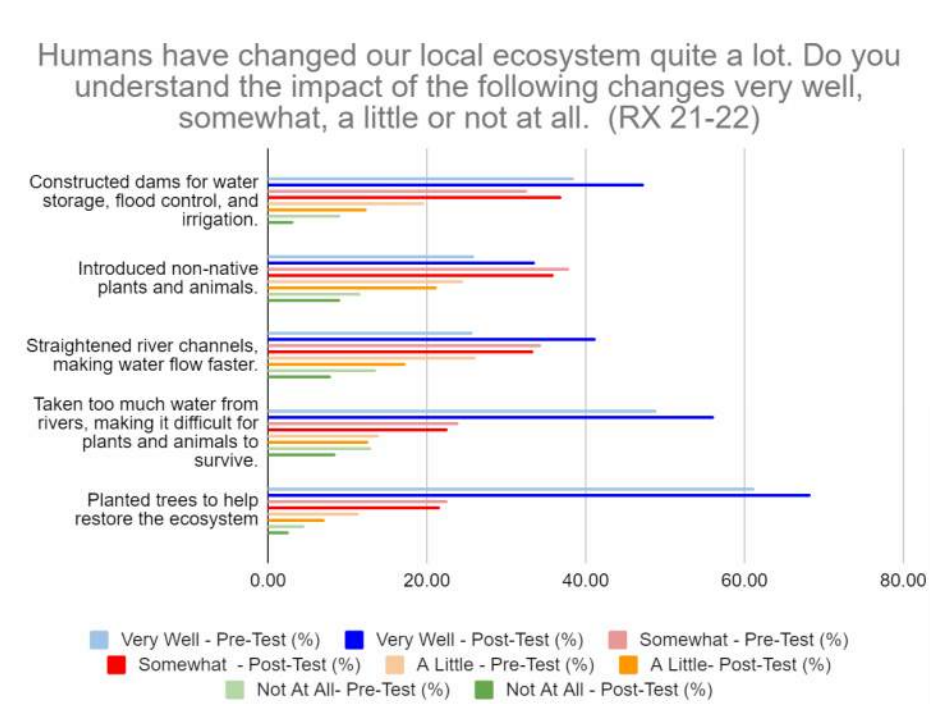


Results: Positive growth is demonstrated across all questions except the septic question which may just be confusing because it doesn't apply to every student.

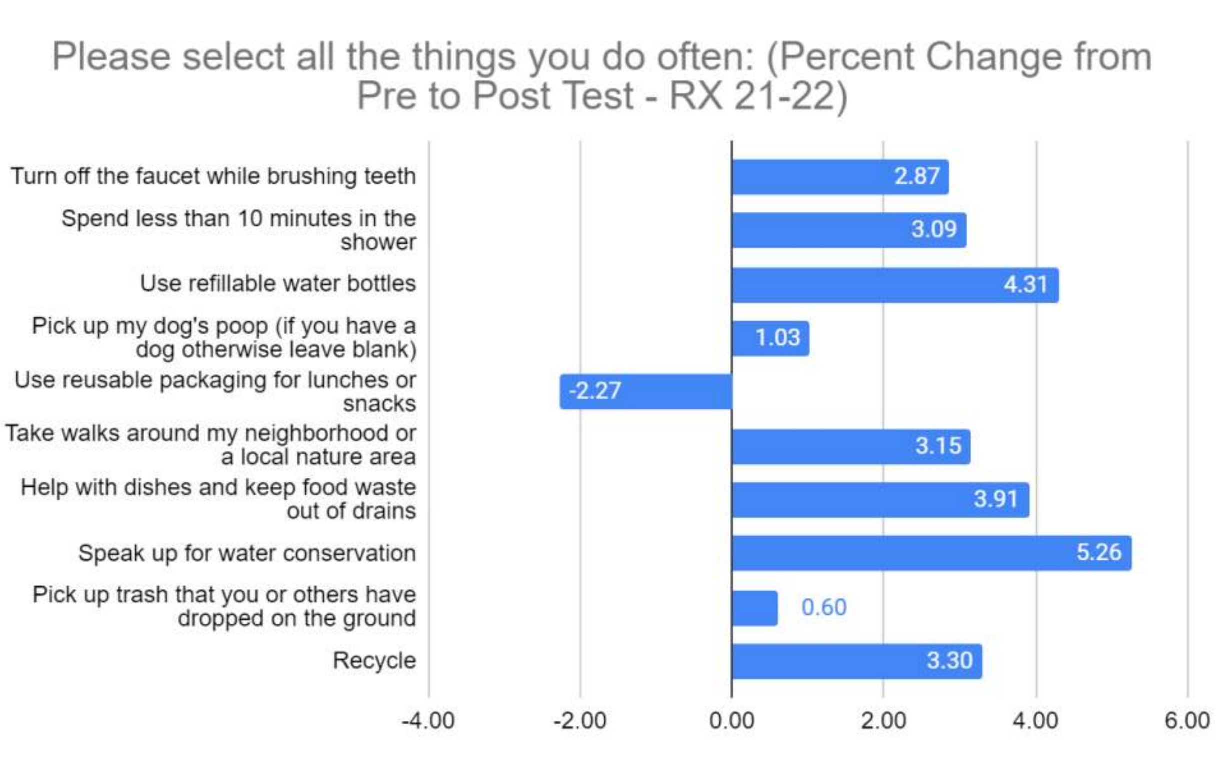
RX Confidence



Results: The goal of this question was to determine student confidence in RiverXchange learning outcomes. When you look at the percentage of total responses below a lot of students seemed pretty confident that they understood these concepts before the program - which is great! It is also great that after the program in general students increased their confidence and decreased their lack of confidence across all topics. This demonstrates they found the program helpful in supporting their understanding of human impacts on our ecosystem.



RX Behaviors



Results: Seeing around 5% change in behaviors from pre to post surveys has been consistent with past years findings. As a fifth grader you might not be changing your behaviors significantly due to family and community behaviors and culture. However, it is exciting to see that the largest percent change was in students speaking up more for water conservation. At this age, this has the potential to shift family and community behaviors more than other behaviors due to the rippling effects of more people taking other actions to conserve and protect water.

The decrease in using reusable packaging could be due to students' increased awareness of food packaging in the cafeteria or home packed lunches or an increased use of single use plastics due to covid concerns.

Appendix A

RiverXchange Virtual Field Trip 2021-2022

1. What are we trying to teach students in this activity?

Essential questions:

- · What is a floodplain and why is it important? (Rio Bravo)
- · How has the Rio Grande floodplain been changed by humans? (Rio Manso)
- · What efforts are being made to conserve the Rio Grande Floodplain? (Rio Nuevo)

2. How can we tie this activity to our teaching goals:

Learning Objectives	**Methods**
The riparian ecosystem of the Rio Grande is shaped by natural flooding.	Observation and finding evidence of: ● riparian habitat - plants and animals that depend on the ecosystem. ● the role of the Cottonwood tree as a keystone species and its dependence on flooding for its life cycle.
Human impacts have reduced or eliminated flooding.	Observation and finding evidence of: ● Human impacts ● Reduced flooding
Conservation efforts are now being made to rehabilitate and strengthen the riparian ecosystem	● What monitoring methods can be used to determine the health of the ecosystem? ● What is being done to restore this ecosystem?

3. How can we tie this activity to standards?

Using the NGSS framework to explore **Phenomena** and support **Claims** based on **Evidence** and **Reasoning.**

Performance Expectations	**DCIs**
5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers and the environment	LS2.A Interdependent Relationships in Ecosystems
5-ESS2-1 Develop a model using an example to describe ways in which the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	ESS2.A Earth Materials and Systems ESS2.C The Roles of Water in Earth's Surface Processes
5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment	ESS3.C Human Impacts on Earth Systems

4. How should this lesson be organized?

I. Introduction
   a. First, the presenters should introduce themselves by name, position, and organization.
   b. A presenter will take the students through the agenda.
      i. Ask students what they have already done in class—this should be the Rio Bravo and Rio Manso activities. Today, we will be taking them through the timeline again, reviewing and demonstrating aspects of both models that are still present in the Bosque still today. Then, we will be introducing a new concept—Rio Nuevo and doing the model with the river as it is today!
   c. Pan the camera around, can students identify where we are? It is the Bosque!
      i. Give the students a brief history of the Open Space Division and its connection to the Bosque and other public lands.
      ii. Describe the importance of understanding and connection to the land. The land needs us just as much as we need it. Part of understanding the land is making observations and questioning the world around us. This will lead directly into the next activity "I notice, I wonder, it reminds me of"

II. "I notice, I wonder, It reminds me of"
   a. This activity is meant to engage students' observational and thinking skills - to turn on their "nature" brains!
      i. Let students know you will describe the activity first and then bring the camera to focus on a smaller, up-close frame of our object to be observed.
      ii. Walk students through each prompt. Describe how these prompts relate to the scientific method (observation, questioning, hypothesis)
      iii. I notice (the foundation of an observation): shape, size, texture, color, location, etc. These are simply what we see, without labeling their function or what we assume is the function.) Ex: "I notice a long, thin shaped object that is bumpy, brown colored with small lines on it."
      iv. I wonder (the foundation of questioning): Take any statement that we think applies to our object and turn it into a question. "I wonder if something was eating this object that caused the lines? I wonder if this is a plant? I wonder if it is alive? I wonder if it is dormant?
      v. It reminds me of: (the foundation of a hypothesis): Making connections to what we already know or can remember helps us make an educated guess to answer our questions. For the purpose of this exercise, we are simply practicing making connections. "It reminds me of a spiral. It reminds me of the colors of sunsets in Albuquerque."
      vi. Complete the activity, prompting and modeling as you go.

III. Rio Bravo
   a. Discussion: Students will have been taken through the Rio Bravo exercise. RX presenter will ask:

   i. Do you remember what Rio Bravo means?
   ii. How was the river shaped?
   iii. What did you place down in and around the river?
      1. Yes! You placed down animals and plants in and around the river. We can still find evidence of the wild river today even though it has changed. Can you name some of the plants or animals that you placed in the Rio Bravo?

b. Activity: What evidence can we find of the Rio Bravo and ecosystem in the floodplain? (A floodplain is a riparian ecosystem so what we are looking for is evidence of a variety of plants and animals that depend on the river).

   i. Plant #1 - Coyote Willow (walk around and "see" your first plant)
      1. "Look at this plant! Wow, it's everywhere here in the Bosque. It's here… over here… and even over there! (point camera.) Let's get a closer look. It has long skinny leaves and smooth bark on the branches.
      2. What do you think it is? Vote with your card or write the name on a paper and hold it up.
      3. You're right! It's a coyote willow! The way you can tell is that it's a shrub that always grows next to water, it's short, and it has long skinny leaves. It's one of the most common shrubs around water (riparian ecosystems) in New Mexico. Beavers LOVE to eat its branches, but it's also eaten by porcupines, deer, and rabbits.
   ii. Animal #1- Beaver (walk to an old beaver chew)
      1. "What do you think has been here?" It looks like something has used long incisors to chew horizontally through the bark. It is a beaver!
      2. Introduce the beaver skull and discuss other adaptations that beavers have that allow them to live in this riparian ecosystem.
         a. Castor oil that they use to waterproof their fur
         b. Ear flaps that close so they don't get water in their ears
         c. Extra eyelid to see underwater
      3. Could you live in a riparian ecosystem? What adaptations do you have?
      4. Coyote Willow is not the only plant that beavers will rely on!
   iii. Plant #2- Cottonwood
      1. "If the porcupine is living and eating this tree, we should probably know what it is. Let's look at the leaves and see if we can figure it out. The leaves aren't on the tree right now because it's winter, so let's find one on the ground. (get leaf). Okay, here it is - it has a heart-shaped (or triangular shaped) leaf with a flat stem that's also called a petiole. And if I look around, I see them everywhere in the Bosque. I can even see them on the other side of the river! (Span the Bosque then point camera to other side of river.)"
      2. "What do you think it is? Vote with your card or write the name on a paper and hold it up."
      3. "You're right! It's a cottonwood. And not just any cottonwood, but a Rio Grande cottonwood. These trees are a very important species in the Bosque. They provide food for many animals, like the porcupine, beaver, deer, rabbits, and insects. Birds eat the insects that feed on the cottonwood. PLUS, many animals use them for their homes! Porcupines sleep in them, and so do great horned owls. Birds make their nest in them. Squirrels live in them. They are a

very important part of a healthy Bosque ecosystem. And the way you identify them is by looking for their heart shaped leaves."

iv. Animal #2- Porcupine

1. Look up in the cottonwood tree: do you see anything there?
   a. Option 1: I see a porcupine! It is just a small bundle of quills that is resting in the nook between two branches!
   b. Option 2: I see a bunch of branches without bark on them. Who did that? It was a porcupine!
2. Porcupines live in the canopies of cottonwood trees because that is where their food is! Porcupines eat the same thing as beavers, which is the cambium, or inner layer, of the tree behind the bark. Beavers are chunky and unable to climb, so they cut down trees to get to their food, whereas porcupines are able to climb trees.
3. Can we find any evidence of porcupines on the ground?
   a. Option 1: I found a track! This track has a bunch of texture on its paw pad. Do you have socks that have texture on the bottom? That helps you stick to the floor and not slide. I bet the texture on its paw pad will help it climb!
   b. Option 2: I found some scat! How do I know that it came from the porcupine? It's located in the middle of the trail, which is right under a big branch of the cottonwood tree. We can also distinguish scat by its shape, size, and color!

c. Conclusion

i. Even though the river might not be as wild as it used to be in Rio Bravo, we still have an interconnected system of animals and plants that still live here today! Let's investigate how humans have altered this system in our next section, Rio Manso.

IV. Rio Manso

a. Discussion: Students will have been taken through the Rio Bravo exercise. RX presenter will ask:

i. Do you remember what Rio Manso means?

ii. How did humans alter this ecosystem?

1. Yes! They used jetty jacks, added homes, dams, acequias, and invasive species.

iii. What happened to the river?

1. Yes! The river was channelized and no longer was the braided, meandering river that we once knew.

b. Activity: What evidence can we find of the Rio Manso in the Bosque today?

i. Plant #3- Ravennae grass. Ravennae grass is an invasive species that was brought to New Mexico from Africa as an ornamental and also for soil stabilization. Ravennae is drought tolerant, deer tolerant, and frost tolerant so it thrives in New Mexico. Although it doesn't allow other plants to thrive alongside it. It does such a good job, it outcompetes our native grasses.

1. Can you name some ways in which invasive species can travel?

a. Underneath boats/aircraft, hikers' shoes, bringing them on purpose (ornamental, biological control, soil stabilization)
b. So many more invasive species have made their way to the Middle Rio Grande, but most came on purpose. We just didn't know at the time how problematic they would be.

ii. What happened in the Rio Manso activity that allowed for the invasive species to move in? Yes, they took away vegetation like the cottonwood trees and native shrubs to make room for the expanded population and their homes! Let's take a closer look at the cottonwood trees here.
1. Cottonwood trees are a keystone species, which means this ecosystem largely depends on their existence and their removal would be catastrophic.
2. To understand better how our cottonwood trees are doing I want to measure their height. Height in a cottonwood tree doesn't necessarily determine its age, but rather how many resources are available to it.
a. Explain to students how we use a tangent gauge in order to measure a tree's height. All staff to measure distance to a tree, have students guess the presenter's heights, and then have the students add the measurements to get a calculation.
b. Trees that are between 60-70 feet are full grown cottonwoods, but with limited resources. Those old cottonwoods that were close to the water will reach up to 90 feet tall! We can't determine if the whole forest has insufficient resources by just one tree. Let's measure the height of another!
i. Proceed with the same process with another nearby tree.
c. See how those two trees have a very similar height? Look around at the canopy, what do you notice about the height of all of these trees? Yes, they are mostly the same! We have a very uniform canopy in the Rio Grande Bosque. What resource do you think the trees are not getting enough of? Yes, water! Let's take a look at why these cottonwoods are not getting enough water.

iii. Do you remember what the impact of jetty jacks, levees, and dams did to the Rio Grande in the Rio Manso activity? Yes! They channelized the river or made it straight.
1. One reason that these cottonwood trees are not getting enough water anymore is because the river does not flood as it would have naturally done before construction.
2. I need your help to run a little science experiment! I want to see whether a meandering river or a channelized river goes faster.
a. I want you to form a hypothesis, can you share what you predict will be the answer?
b. Now, I am going to run two different tests. One in which I will walk in a curved line and one in which I walk in a straight line, both the same length. When I say go, begin counting with [presenter #2]

c. Was your hypothesis correct? The meandering river does run slower! When our river is allowed to meander in cycles slowly and then quickly throughout any given year, the outside to those curves it allows for sand to be deposited and then for cottonwood seedlings to grow. But without those sandbars and moist soil in the floodplain, what happens to our cottonwoods? The seeds cannot grow!

c. Conclusion
    i. Humans have fundamentally altered the Middle Rio Grande, but all it not lost! Humans have also begun to take measures to support a new relationship between our lives and the river. This next section, we have not discussed yet and it is called Rio Nuevo or new river.

V. Rio Nuevo
  a. In the last two models, we were describing what had happened in the past. Rio Nuevo is happening right now and you will ultimately be the ones that get to decide what our river looks like in the future. I want you to be the engineer for me. What would you do to restore the river and make it look more like Rio Bravo?
    i. As the students submit their answers, we will go one by one and explain how that would alter the model. The model will have been already set up as Rio Manso prior to the field trip starting.
    ii. Overbank flooding: during years with high winter snowpack there will be lots of water melting and flowing down into the watershed. Engineers could decide to allow for overbank flooding, which would give the Rio Grande cottonwood seedlings a chance to grow! It would also allow for a better cycling of nutrients so that native species have a better chance of competing with the invasive ones.
    iii. Pole plantings: one way to counteract the decreasing number of cottonwoods is by cutting a long, young branch of an existing cottonwood tree and planting it directly into the ground so that it touches the water table. This branch will then grow roots and form its own, independent tree without the need to grow the trees from seeds.
    iv. Wetland construction: land managers can create new ponds and wetlands that support the variety of wildlife that used to have a home in the Bosque. Some of these are created by allotting space, constructing the ditch with big machines, and providing water as has been done at the Open Space Visitor Center.
    v. Fuel-wood reduction: in earlier years, the overbank flooding that would occur would saturate the branches and leaves that had fallen on the ground and allow them to decompose. It would also act as fire suppression. We now need to manually need to stop these fires because the Bosque is dry and has a lot of fuel. One way to stop these fires is by cleaning the area of downed trees and branches, reducing the fuel.
    vi. Creation of secondary channel: the river used to have many channels as it flowed down the valley. In areas in which a bank may be too high, land managers can remove the excess bank and create a side channel that has enough flow to allow cottonwoods

to germinate and establish themselves. Sediment from these banks can be replaced in the river to provide for sandbars, which is habitat for certain species (silvery minnow).

vii. Removal of exotic species: Many different groups have taken to removing a number of invasive species such as saltcedar, Russian olive, Siberian elm, and others. The Open Space Division hosts spring cleanups every Saturday from April through mid-may in which families are welcomed to come out and help remove invasive species. This is something you can learn how to do!

viii. Water conservation: the amount of water that people use along the river has a large impact on the health of the Bosque and river life. Pumping more water than is being replenished each year has caused the water table to drop and has made it more difficult for native species to survive. Planting low-water use landscaping, installing rain barrels, low-flow toilets, turning off the water while brushing teeth, and taking shorter showers are things that we can do personally. We can also ask businesses and other entities to self-impose water-use limits so that we are all working together.

ix. Jetty Jack Removal: Today, the riverbanks and levees are quite stable. The jetty jacks are seen as a danger to emergency vehicles moving through fires, eye sores, and ultimately the channelization of the river does not benefit the Bosque. Land managers can try to remove the jetty jacks, although it is difficult to do given their size, weight, and difficult access.

x. Monitoring: an important part of managing the Bosque is to understand what is happening to the plants, animals, water table, and other ecological functions. Monitoring is the process of collecting, compiling, and analyzing that information. There are many organizations that will do monitoring throughout Albuquerque in order to ensure that what we do going forward will only benefit the Bosque. So many of our previous actions had unintended consequences and monitoring is one way of making sure that we do not repeat mistakes.

VI. Conclusion

RiverXchange Virtual Field Trip Synopsis 2021-2022

I. Introduction (Ellie: 10 minutes)

II. "I notice, I wonder, It reminds me of" (Erin: 10 minutes)

III. Rio Bravo
   a. Discussion: (Ellie)
   b. Activity
      i. Plant #1 - Coyote Willow (Ellie: 5-7 minutes)
      ii. Animal #1- Beaver (Ellie: 5-7 minutes)
      iii. Plant #2- Cottonwood (Erin: 5-7 minutes)
      iv. Animal #2- Porcupine (Erin: 5-7 minutes)
   c. Conclusion (Erin)

IV. Rio Manso
   a. Discussion (Ellie)
   b. Activity:
      i. Plant #3- Ravennae grass. (Ellie: 5-7 minutes)
      ii. Plant #4- Cottonwood tree / Tangent gauge (Erin: 7-10 minutes)
      iii. Model of river shape- (Erin: 5-7 minutes)
   c. Conclusion (Ellie)

V. Rio Nuevo (Ellie- 30 minutes)

VI. Conclusion (Erin)

Southern Sandoval County Arroyo Flood Control Authority

Poop fairy signage placed throughout SSCAFCA flood channels.

Arroyo Classroom

2021-2022 final report

submitted by
Erin Blaz, CSWCD
June 2022

SUMMARY

The Arroyo Classroom program utilizes our natural arroyos as outdoor classrooms and brings local animals into the classroom to motivate 3rd graders to respect the arroyos as important wildlife habitat. Orilla Consulting, LLC developed the program in 2012 and initially implemented the program for 7 classes at Maggie Cordova Elementary in Rio Rancho. In 2013, the program grew to serve 20 classes. On July 1st, 2015, Orilla Consulting, LLC transferred the program to Ciudad Soil and Water Conservation District as part of the larger education and outreach efforts we are involved in throughout Bernalillo and Sandoval Counties. In the 2021-2022 school year, we served 31 classes within Rio Rancho Public Schools, reaching approximately 32 teachers and 638 students. Funding was provided for 35 classes, however one school did not follow through on the registration process. Communication was made until December of 2021, but it was clear there were significant obstacles to getting the school onboard. Beyond that, Arroyo Classroom had a successful year and continued to bring important watershed education to local schools.

Participating Schools

SCHOOL * Title 1 school	**Number of classes**	**Number of Students**
Enchanted Hills Elem.	5	122
Martin Luther King Elem.*	5	114
Sandia Vista Elem.	6	134
Maggie Cordova Elem.*	5	106
Puesta del Sol Elem.*	5	89
Colinas del Norte*	5	73
TOTALS	**31**	**638**

Sponsor

- Southern Sandoval County Arroyo and Flood Control Authority (SSCAFCA)

Sponsor provided a total of $19,300.63 in cash.

Deliverables:

All presentations were offered virtually or in-person and completed.

- Watershed Presentations: 31:31
- Arroyo Walk: 30:31
- Bird Presentation: 31:31
- Reptile Presentations: 31:31

Program Description

Essential Questions: What is a watershed and how does water move across it? What important functions do arroyos provide for humans and other creatures? In what ways can we enjoy arroyos safely and learn new things?

- Students characterize arroyos as ecosystems as well as drains
- Students identify arroyo features that support wildlife
- Students describe the plants, animals, birds and insects that depend on the arroyo ecosystem
- Students explain the ways in which arroyos receive water and the dangers of arroyos
- Students recite the rules for arroyo safety

The program consists of a four-part series of lessons, based on grade-level science standards and addressing areas of interest to SSCAFCA, such as bats, burrowing owls, ATV use, pet waste, and arroyo safety. Erin Blaz delivered two of the lessons – an introductory lesson about watersheds, and either an in person arroyo walk or a virtual arroyo walk that tours an arroyo via Google Earth. Hawks Aloft, Inc. provided the virtual bird presentations as they were prepared to and experienced in delivering virtual presentations with live birds. All lessons were adapted for the virtual setting.

This year the virtual watershed lesson expounded on the water cycle and aimed for students to recognize how water moves across hard (impermeable) or soft (permeable) surfaces. Students made predictions about how water sprayed on a sponge and a stone tile (both at an angle) would move differently to represent the function of a watershed. Then we added more to the stone tile to elaborate on the built environment, including buildings, cars and dogs. Finally, we added “pollution” using similar materials to the enviroscape to create oil, dog poop, pesticide and construction waste. In summary, this lesson introduced the concept of a watershed to students, demonstrated how surface water becomes polluted through various human impacts, and discussed the importance of keeping our arroyos clean.

The virtual arroyo walk this year began with a google earth tour of an arroyo to observe its pathway through Rio Rancho, any visible human impacts and demonstrate the draining power of arroyos into the Rio Grande. We also observed tire tracks in the arroyos and talked about not using motorized vehicles in arroyos, as they are not permitted or allowed in the arroyos, and discussed the impacts of illegal use of arroyos. We observed where the mouth of the arroyo meets the Rio Grande and observed that there was not any kind of infrastructure to clean the water as it enters the river on this particular arroyo. All classrooms received a link to SSCAFCA's Arroyo Safety video as a follow-up to the final presentation.

The in-person Arroyo Walk was approved and completed with 17 total classes. This lesson is about the unique adaptations of arroyo animals and plants, incorporates a walk out to a nearby arroyo from the school and extensive discussion about arroyo safety. The walk starts with a safety discussion about the difference between concrete-lined channels and sandy-bottomed arroyos, and emphasizes that it is never safe to go into concrete-lined channels, while sandy-bottomed arroyos can be visited when there are no clouds in the sky. Students searched for evidence of animals living in the arroyo banks, learned about how lizards and other cold-blooded animals are adapted to the desert environment by moving about to regulate their temperature. They also looked for certain adaptations of desert plants to minimize water loss in the desert. This year, students were extremely excited to go on the walking field trip, as many schools only approved the field trips in spring. A few classes even had a gray fox sighting in a stand of Elms in a drainage area used for the walking field trip.





Top left- Gray fox in Elm spotted by students at Puesta del Sol. Middle top and bottom: Students from Puesta read thermometers to learn about reptile adaptations. Right top and bottom: Students from Colinas look for wildlife evidence on Arroyo.

Evaluation

Teacher feedback for 2021-2022 was collected from 18 participating teachers. Teachers overwhelmingly say they choose to participate in Arroyo Classroom to teach about local ecology and conservation issues, incorporate more science in the classroom, to offer experiential learning opportunities and to offer learning opportunities that connect to the community. They find the presentations to be uniquely engaging and meaningful for their students, however, across the board, teachers requested for the return to in-person learning. Teacher's find that Arroyo Classroom is complementary to other 3rd grade units of study such as life cycles and animal and plant adaptations. Teachers cite that the program is particularly helpful in achieving or developing the following skills: critical thinking and program solving, communication, assessing and analyzing information, and curiosity/imagination.

Highlights from teacher feedback:

What are the greatest learning outcomes for your class as participants in Arroyo Classroom?

- "That students can take what they learned and apply it to their daily lives."
- "Students truly enjoy learning about their environment, animals and how to actively educate others."
- "My class really seemed to learn the most about how the water system within Albuquerque worked."
- "My class has become more aware of how humans can impact wildlife. They remember the animals we have learned about and are determined to keep the environment clean for them."
- "They learned a lot about their local area from habitats for rivers to arroyos."
- "Most of my students could share that the arroyos were important animal and plant habitats and that they had a responsibility to keep them clean, free of pollution and that it wasn't an area for off roading."
- "My students are more aware of their environment and are more knowledgeable."
- "They learn about arroyo safety and also about the local animals. They grow their understanding in conservation as well."
- "That they learn about the environment around them and are more aware of how to take care of it."
- "Students understand their place in protecting our arroyos."
- "Learning about the environment in which my students live. Being able to take what they learn and see it around their houses and school."

Survey Summary

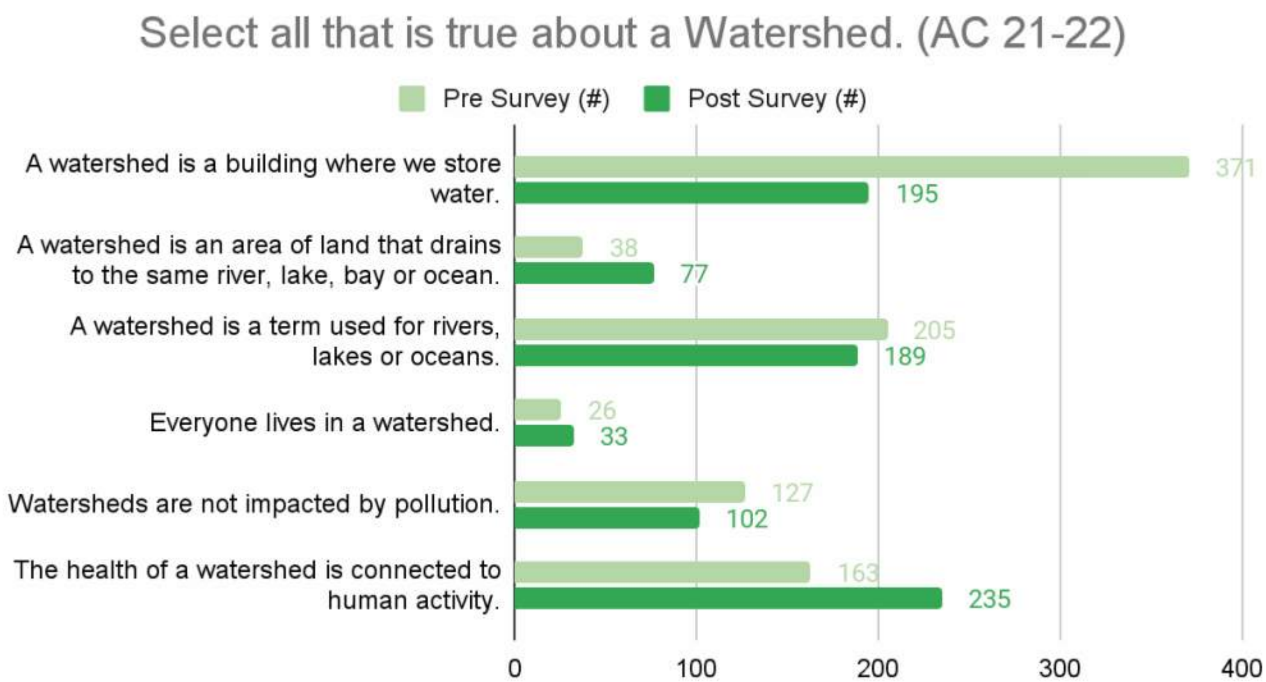
This is the third year that we've administered the pre and post surveys for Arroyo Classroom. Due to some changes in the program content for this year's virtual program, such as the availability of certain species and specimens offered by our presenters for their virtual presentations, we made some adjustments to the pre and post survey to reflect the content of the program. The survey questions were slightly more generalized and used a "check all the apply" format to address different learning

objectives.

This year we had 605 pre-survey responses and 492 post-survey responses. This we formatted the survey responses by total number of responses, rather than percentages.

Survey Metrics:

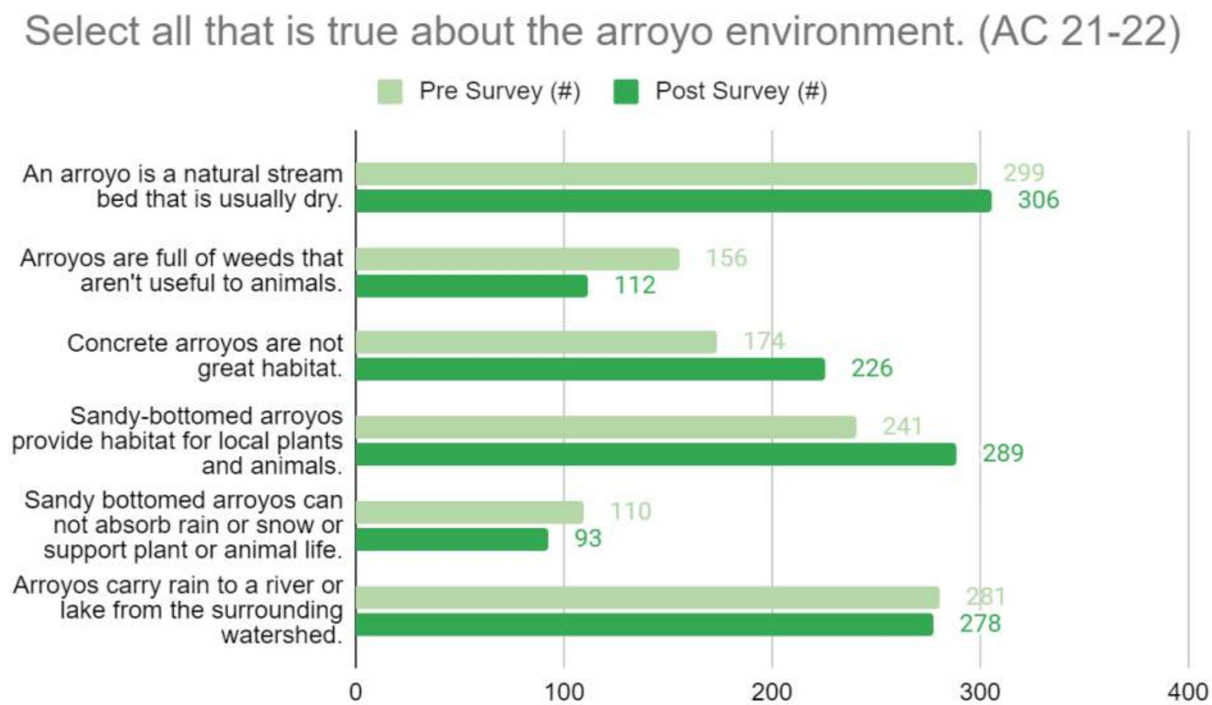
Item 1 Watersheds



Comments

This year we do see an increase in correctly defining a watershed (an area of land that drains to the same waterbody) and a decrease in the wrong answer (a building that stores water) but not a lot of students choose the correct definition of a watershed. More students seem to understand that watershed health is connected to human activity, with almost 50% of students choosing this response. This is an important success as ultimately we want them to see themselves as a part of the watershed and that their actions matter.

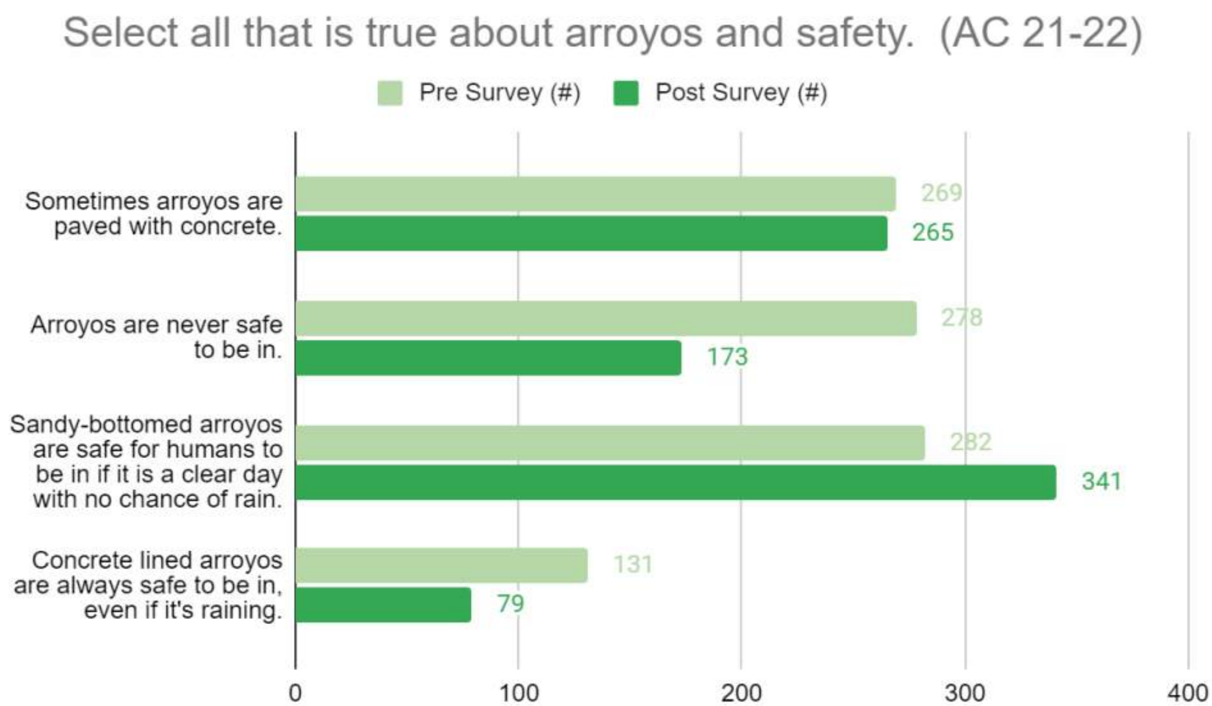
Item 2 Arroyo Function and Environment



Comments

Based on pre and post answers, it looks like the students already know what arroyos are or can easily assume based on “natural stream bed” and “carry rain” responses. There wasn’t much movement from pre to post test. However, with an increase in responses about habitat and concrete arroyos not being beneficial to animals, along with a decrease in the question about weeds, students did demonstrate more knowledge about arroyos post program.

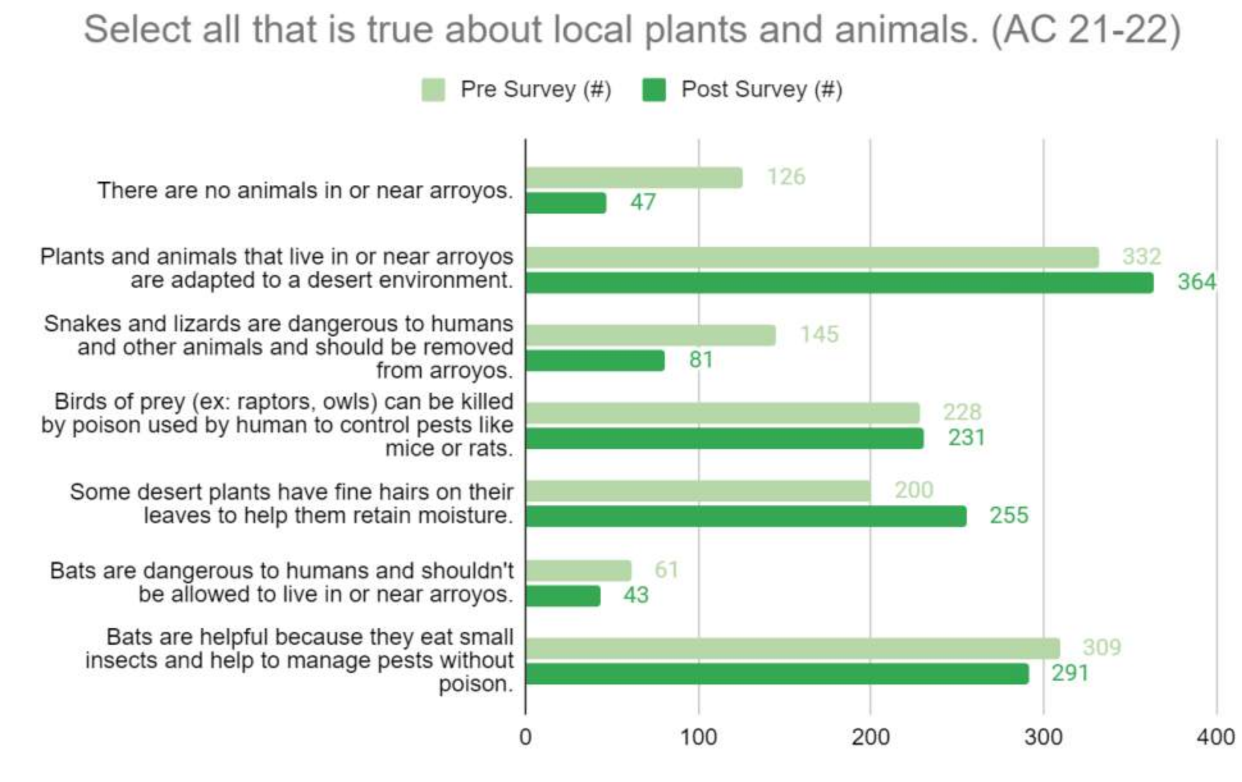
Item 3 Arroyo Safety



Comments

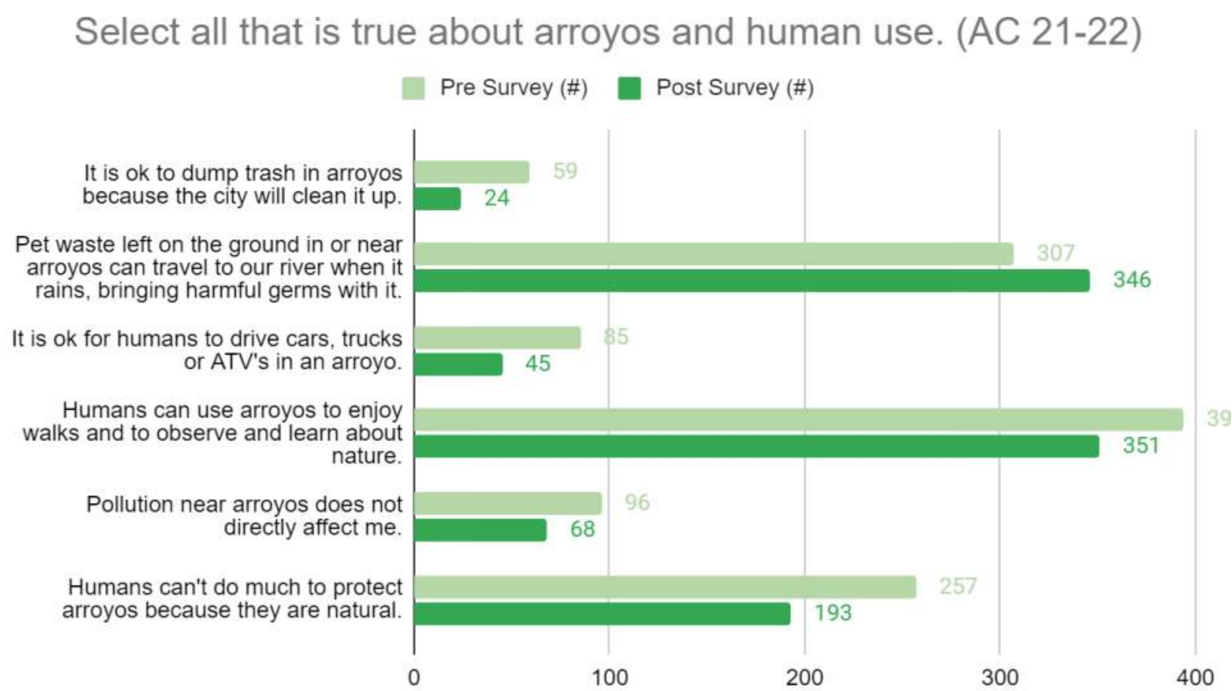
Positive outcomes of this graph are that more students understand the specifics of arroyo safety, demonstrated by a decrease in answers "arroyos are never safe" and an increase in "arroyos can be safe when there is no chance of rain." However, cultural beliefs and folklore may continue the narrative that arroyos or ditches are never safe to be in, as La Llorona might come for you!

Item 4



Comments
Generally positive outcomes are displayed from these results. Possibly since the 3rd grade curriculum covers adaptations and habitats students are already primed to answer correctly on the pre-survey.

Item 5 Arroyos and Human Use



Comments

Positive outcomes for this question sequence are that there was an increase in students answering more correctly about pet waste as a river contaminant.

Appendix A

Lesson Plans (Ciudad SWCD delivered lessons)

Activity Guide for 3rd Grade – Building a Watershed

1. What are we trying to teach students in this activity?
A watershed is an area of land where all the water flows (or sheds) into a common body of water. We live in the Middle Rio Grande watershed. A natural watershed has many permeable surfaces that help to clean water. Human's build a lot of hard-scapes. As water moves downhill, it carries sediments and other materials to the river. Water is a precious resource and we can help improve the quality of the river by picking up after our pets and not littering or throwing trash on the ground.

2. How can we tie this activity to our teaching goals:

Learning Objectives	Methods
We all live in a watershed. A healthy watershed keeps water clean.	Using models to demonstrate: ● elements of a "watershed" and how natural watersheds help to clean water and move water around. ● Humans have impacts on the watershed (i.e. Hardscapes, Pollution)
The amount of permeable and impermeable surfaces in an area impact the watershed.	We observe and make claims about: ● What happens as water moves across "Hard" vs "Soft" surfaces ● The proportion of hard and soft surfaces around us. ● How this may impact our watershed.
Pollution increases in human environments. What we can do about it.	Using models we aim to demonstrate: ● Water can be polluted in human areas and is harder to clean with impermeable surfaces. All this polluted water flows to the river. Through discussion we: ● Talk about the importance of being responsible and how caring for the watershed in this way not only protects the water, but also helps the people and plants and animals that depend on the water as well. ● Picking up after our pets and minimizing our trash, and the trash on the ground helps keep our river clean

3. How can we tie this activity to standards?

Performance Expectation	
5-ESS2 Earth's Systems	**Disciplinary Core Ideas**

3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the world.	**ESS2.C:** The roles of water in Earth's surface processes **ESS2.D:** Weather and climate
5-ESS3 Earth and Human Activity	
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	**ESS3.A**: Natural resources **ESS3.B**: Natural hazards **ESS3.C**: Human impact on Earth systems

What we do (Science and Engineering Practices)	How we think (Crosscutting Concepts)
Developing and Using Models Analysing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Systems and Systems Models Stability and Change

4. How should this activity be organized?

Supplies:

- Large Sponge
- Baking tray
- Filter model (2 liter bottle, upside down with cotton ball, sand, rocks, leaf litter)
- Spray bottle with colored water
- hard surface (flat piece of tile, stone, concrete)
- Slideshow

I. Introduction *(5 minutes)***: Hi everyone, I'm ------- and I'm here from a program called Arroyo Classroom - a program where you get to learn about your local environment. We are going to learn about your local environment and what you can do to protect and conserve it (Define conservation). You can ask what kids do to help the environment as an ice-breaker.**

Open Presentation

1. **Ask if they know what an Arroyo is. Picture on 1st slide.**
   An **Arroyo** is a dry stream bed. We don't get a lot of rain here, but water can flow here when it rains. Arroyos flow to the Rio Grande. Arroyo's are a part of the watershed, but we will define that shortly.
2. First, let's get a discussion going:
   - How many of you used water before you came to school? How did you use it? Where do you think all this water comes from?
   - Where do you get your water? How is it cleaned? (Rio Rancho = Aquifer)
   - Can we all agree it is important to have clean water for all (including plants and animals)?

II. What is a Watershed? What role does it play in the water cycle? (20 min)

Part A: *(5 minutes)* We are going to learn about how the land around us helps to clean water.

1. **Review the Water Cycle - precipitation, evaporation, condensation (water cycle dance video)**
   - **Important to remember water can't be created or destroyed. We are drinking the same water dinosaurs used. We have to keep what we have clean.**

Part B: *(5 minutes)*

2. **Introduce the Watershed**
   - **What is Watershed video**
   - Anywhere water falls on land is a watershed. What isn't absorbed will continue to run or shed downhill until it collects in a body of water. A watershed is an area of land that drains to the same body of water.
   - Watershed has different names based on the body of water water ends up in. We live in the **Middle Rio Grande Watershed.** Write down the name of our watershed.

STOP PRESENTATION

Part C: *(10 minutes)*

3. **Natural Watershed Helps to Clean Water. Ask students, before each demo what they think will happen and why? What evidence or prior experiences inform them?**
   - Absorbs- permeable surfaces (spray water on sponge)

        - Moves and Collects Water- (saturation of sponge) Arroyos, Wetlands, Rivers
            - Wetlands attract water loving plants that help filter and clean the water
        - What happens to water that soaks in the ground- Filter demonstration - connect it to the aquifer.

Learning Objective: Permeable surfaces are important for filtering and cleaning water, and slowing it down.

- **Human impacts** - less natural features in watersheds, more impermeable surfaces, density of pollution
    - Demonstrate water sprayed on hard surface
    - Water doesn't absorb and it moves faster.

4. Compare water in a concrete arroyo and sand-bottomed arroyo, which moves faster?

Learning Objective: Concrete Arroyos are never safe. Sandy bottomed arroyos are ok to go in if no chance of rain.

III. Activity: What is the proportion of permeable to impermeable surfaces outside our home or school? *(10 minutes)*

1. **Observe outside -** look at the ground. How much is covered by surfaces that can absorb water like soil, sand, dirt, grass, small rocks, etc. How much is covered by hard surfaces- pavement (driveways, streets, etc). Talk about compacted soils.
2. **Guess the percentage of hard vs soft based on observations.** Students create their own pie chart- labeled Hard and Soft.
3. **What claims can we make about our watershed? What evidence supports our claims**

IV. What's In the Water?

(10 minutes)

1. **Discuss pollutants. Discuss what happens to polluted water.**
   Experiment with how "pollutants" might travel through their watersheds.
    - What is pollution?
    - What forms of pollution exist in our city? Discuss each pollutant:
        - Plastic
        - Factories
        - Motor Oil (suggest a tray under or cat litter to clean it up)
        - Fertilizers (use recommended amount) - eutrophication
        - Herbicides or Pesticides (use recommended amount)
        - Dog Waste
        - Construction Erosion/Sediment

Learning Objective: With more hard surfaces - water moves faster, picks up pollutants and heads to Rio Grande without being cleaned.

V. Conclusion (10min)

- <u>What do you think this means for our watershed - the Middle Rio Grande?</u>

The water we drink comes from our watershed. Animals and plants also depend on this water. That's why it's important that we try not to pollute either the water or the land. Anything that pollutes the land will eventually wind up in the water.

- <u>What might be ways we could reduce pollution in our watershed?</u>

By picking up trash and picking up dog poop if we have dogs.

Activity Guide for 3rd Grade – Virtual Arroyo Walk

1. What are we trying to teach students in this activity?
Arroyos function as an important flood control measure and are essential landforms in the upland desert of Rio Rancho. Arroyos are also habitat to plants that have specific adaptations for living in a desert environment that experiences infrequent flooding. We can protect arroyos as habitat and take care of them so they help with flood control.

2. How can we tie this activity to our teaching goals:

Learning Objectives (Students will be able to:)	**Methods**
Describe arroyos function as flood control.	Using visual models (google earth and drone fly-overs) to demonstrate: ● Arroyos are caused by water flows from precipitation. ● Arroyos are dry when there is no precipitation. ● Arroyos lead to a larger water source- the Rio Grande
Describe who arroyos are habitat for.	Using their experience from previous Arroyo Classroom presentations: ● Student recall animals that live in or near arroyos Using models of different climates: ● Students can state plant needs in an arid climate
Desert plants have adaptations that allow them to survive in a climate with a great temperature range, high solar impact and little precipitation. Name a local plant species	Using models we aim to demonstrate: ● Various plant adaptations such as deep vs wide roots, small leaves, fine hairs and spines. Through discussion we: ● Explore how plants can survive in the desert climate, unique traits of cactus, name a specific native plant- Four Wing Saltbush and some ways to identify and find it.

3. How can we tie this activity to standards?

Performance Expectation	
5-ESS2 Earth's Systems	**Disciplinary Core Ideas**
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the	**ESS2.C:** The roles of water in Earth's surface processes **ESS2.D:** Weather and climate

world.	
5-ESS3 Earth and Human Activity	
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	**ESS3.A**: Natural resources **ESS3.B**: Natural hazards **ESS3.C**: Human impact on Earth systems

What we do (Science and Engineering Practices)	How we think (Crosscutting Concepts)
Developing and Using Models Analysing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Systems and Systems Models Stability and Change

4. How should this activity be organized?

Materials:

- **Google Earth maps slideshow of arroyo in Rio Rancho**
- **Native Plant and Desert Adaptation slideshow**

I. **Introduction**: This is our final presentation for Arroyo Classroom. Today we are going to learn more about the geography of arroyos and native plants that live in arroyos. Icebreaker: What have you learned so far?

II. **Google Earth Arroyo Tour**
   A. Introduce map and landmarks (Albuquerque, Rio Rancho, Sandia Mountains, Have students recall the name of our river)
   B. Review Watershed: discuss where the water flows to from different points in the land, begin to draw attention to arroyos on the map.
   C. Upper Watershed: Discuss how the arroyos are converging from smaller arroyos, note the area around the arroyo has roads but isn't developed yet. Remind students how

important our voices can be to help share what we've learned in Arroyo Classroom so everyone who lives here and might eventually live here can do their part in caring for our environment.

D. Middle Watershed: Point out that there is more housing, development and hard (impermeable) surfaces at this point in the watershed. Bring their attention to the tire tracks in the arroyo.
    - What are these tracks from?
    - What might the impact be from driving motorized vehicles in the arroyos?
    - Share that it is illegal and why. Discuss other options for those kinds of activities where it is legal.

E. Lower Watershed: Show the mouth of the arroyo meeting the Rio Grande
    - Ask: Do you see anything in place that would remove garbage?
    - Poll students: 1. Who has seen trash in an arroyo? 2. Who has seen trash larger than a television or microwave? 3. Who has seen trash larger than a couch?
    - What can we do to help keep our arroyos clean and safe for all?

III. Adaptations of native and drought-tolerant plants

A. Introduce desert plants, share some fun facts about Yucca - state flower, edible roots - yucca fries.

B. Compare climates - show side-by-side of a tropical climate (dense vegetation, cloudy, waterfall) vs. arid climate (sparse vegetation, sunny, no water). Talk about how plant's needs are different in these climates.

C. Plant Adaptations
    i. Dormancy
    ii. Root systems (tap root or surface)
    iii. Small leaves
    iv. Fine hairs on plants

D. Cactus
    i. True or False Game
    ii. Why do Cacti have spines video
    iii. Photosynthesis and stomata

E. Four Wing Saltbush
    i. Adaptations and traditional uses of fourwing saltbush.

Arroyo Classroom Scavenger Hunt 

Draw or describe each finding, such as size, color, shapes, texture, smells, location and more. You can even write questions you have about what you found! Please respect the wildlife and take an adult. Good luck!

- ❑ Wild animals tracks
- ❑ A plant without leaves
- ❑ A rock that feels warm or cold
- ❑ Cactus
- ❑ A plant with a color other than brown or green. What color?
- ❑ A wild animal on the ground
- ❑ A narrow leaf on a plant
- ❑ A hole in the ground made by an animal
- ❑ A bird in the sky

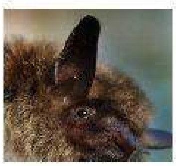
Appendix B
Supplemental Materials

-SSCAFCA Activity Book and Educational Videos:

KNOW YOUR ARROYOS

ENJOY • RESPECT • PROTECT

-SSCAFCA handouts:



Did you know?

SSCAFCA protects our community from flooding and erosion caused by big rain storms, and works to keep stormwater clean. Stormwater flows down arroyos into the Rio Grande.

Bugs like to live in stagnant water that collects in ponds and low places in the arroyos. Insects like mosquitoes can carry diseases that make us sick.

Brought to you by:

SSCAFCA

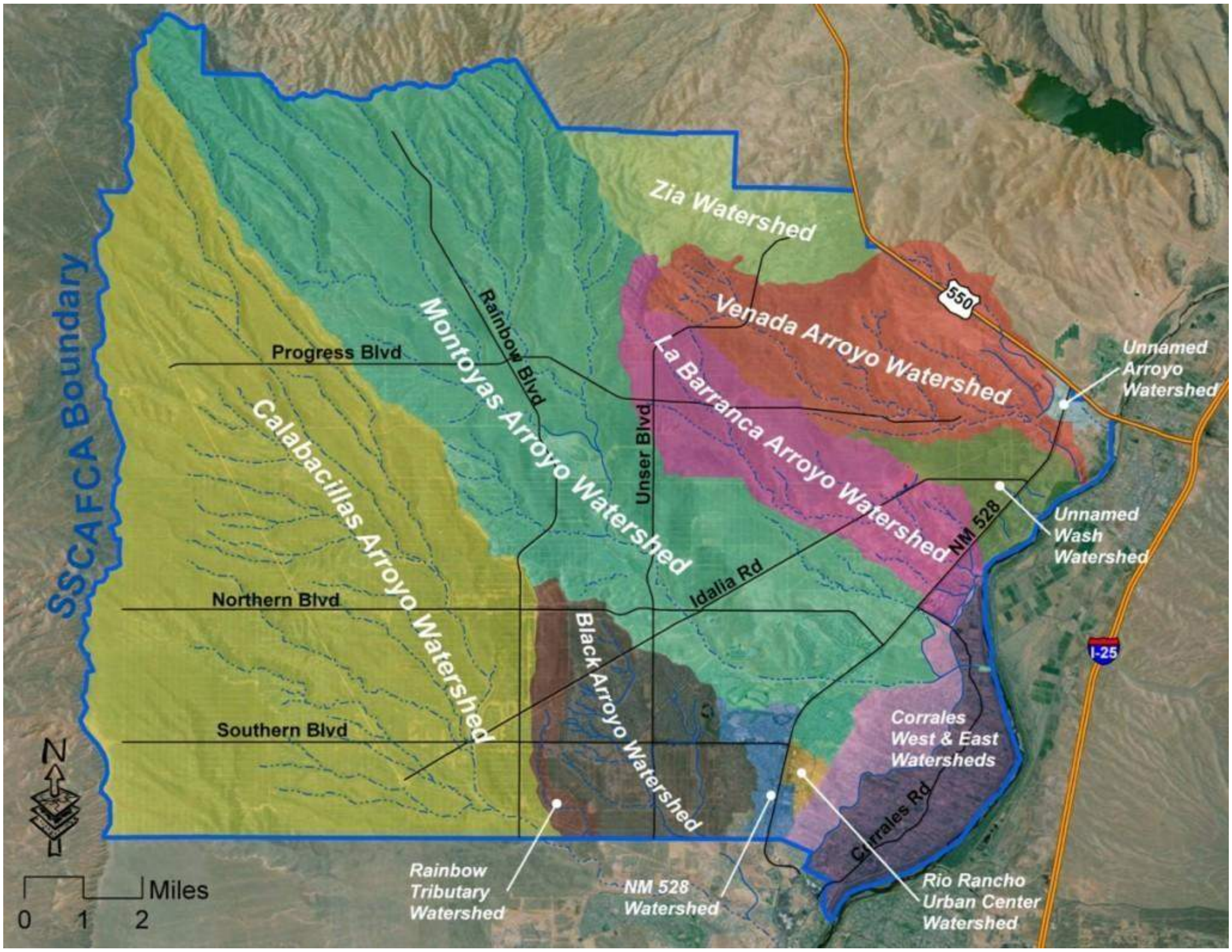
SOUTHERN SANDOVAL COUNTY ARROYO FLOOD CONTROL AUTHORITY

Almost all U.S. bats feed exclusively on bugs, and 1 bat can eat between 600 and 1,000 mosquitoes and other insect pests in just one hour. One bat can eat its own weight in insects in a single night!

SSCAFCA provides bat houses to encourage bats to make their homes near our arroyos, and especially near detention ponds where stormwater runoff is captured and allowed to slowly drain.

The more we help bats, the more pests they eat, so we don't have to spray pesticide that could wash down to the Rio Grande and pollute it.

SSCAFCA watershed map:



Arroyo Safety Video:
Arroyo Safety

Albuquerque Bernalillo County
Water Utility Authority

Water Authority distributed educational bill stuffers, ran radio ads and television advertising.

See the Water Authority television advertising at https://youtu.be/AJojsyJfnK4.

Town of Bernalillo

"The City of Coronado"

Stormwater tips are printed and distributed in the town's water bills throughout the year. This includes 3,500 copies each month.

Town of **BERNALILLO**

SEPTEMBER 2022

"The City of Coronado"

MAYOR
JACK TORRES

COUNCILMEMBERS
DALE PRAIRIE
SHARON TORRES-QUINTANA
PHILLIP VALVERDE
VINCENT MONTOYA

Town of Bernalillo Recreation Department Presents:

BERNALILLO YOUTH BASKETBALL PROGRAM 2022-2023

Registration begins Monday, September 12, 2022
Last Day to Register: Friday, September 30, 2022

PROGRAM OPEN TO BOYS & GIRLS AGES 5-13 YEARS OLD

Participants must be 5 years old by October 1, 2022.

Participants turning 14 before January 1, 2023 will not be eligible.

PREVIOUS BASKETBALL EXPERIENCE IS NOT REQUIRED.

No late registration applicants will be accepted.

PROGRAM FEES:
$60.00 per participant (*Due at Registration*)

SEASON DURATION:
10 game regular season

DIVISIONS:
Peewee Division - Ages 5 & 6
Junior Division - Ages 7 & 8
Minor Division - Ages 9 & 10
Senior Division - Ages 11-13

Register at:
THE TOWN OF BERNALILLO RECREATION CENTER
370 Rotary Park Road
Call for more information:
(505) 771-2078 or (505) 771-1262

Town of Bernalillo's Annual

SCHOOL SUPPLY DRIVE

Accepting school supply donations for the young students of Bernalillo. Supplies are given to students at La Escuelita, Carroll Elementary, and Bernalillo Elementary.
Drop off supplies at Town Hall.

ALL BRAND NEW SUPPLIES SUCH AS: BACKPACKS, COLORED PENCILS, CRAYONS, MARKERS, PAPER, GLUE STICKS, AND SO MUCH MORE IS NEEDED! CALL 867-3311 FOR MORE INFO

BERNALILLO KIDS COAT DRIVE

We are collecting new coats for the youth of Bernalillo.
Please drop off donations at Town Hall now through November 18th
All child sizes are needed!
If your child needs a coat, please contact 867-3311 or stop by Town Hall at 829 Camino del Pueblo, Monday-Friday, 8am-5pm.
SHARE THE WARMTH!

-NOTICE - ROAD RUNNER WASTE - TRASH SERVICE FEE INCREASE

There will be a service fee increase of for trash services for each resident in the Town.

This is due to fee increase in several areas:

- Cost of fuel per gallon
- Disposal at landfill
- Disposal for recyclables

The new price for residential cart fee is $18.42.

THIS WILL GO INTO EFFECT ON SEPTEMBER 1, 2022 & WILL BE REFLECTED IN THE BILL PROVIDED IN OCTOBER 2022.

YOU MIGHT SEE A CREDIT ON YOUR WATER BILL!

The Town's Utility Billing Department has been hard at work auditing our history files and making sure our customers are being charged correctly on their billing statements. This audit process has indicated that ***some*** customers will be receiving a credit to their account. **If you are one of the customers who will receive a water credit, you will see that reflected beginning in the statement for this month!** The Utility Billing Department *will not* be issuing checks or cash for these credits, we will be applying them directly to the account – which is why your bill may be a little lower than you expected. **Any further inquiries about this can be made in writing to joshua.lujan@tobnm.gov, you must include your utility billing account number, name, contact information, and inquiry request.** *Disclaimer: not every utility billing customer will be receiving this credit.*

KEEP IT CLEAN BERNALILLO

Did you know that fats, oils and grease are draining our drains and sewers? Avoid pouring FOG (Fats, Oil, Grease) down the drain!

Fats, Oils, and Grease are bad for the community. When FOG is washed down pipes, it sticks and hardens. Water in the sewer slows down and starts to produce a foul odor. The FOG can block up the entire pipe, causing sewer backups which are dangerous and cost you a lot of money. Follow these simple steps:

- Pour all greasy/oily waste from pots/pans/fryers into a grease waste container (like a recycled coffee tin can).
- Scrape all food wastes into the trash
- Clean spills with towels and absorbent materials, then throw into trash
- Get on a schedule for regular grease cleaning.

Fats, Oils, and Grease (FOG) can:

- Congeal in underground pipes, cause blockages, and possibly damages pipes and cause sewage to contaminate the area.

For more info contact Public Works Department at 505-771-4832

THE UNIVERSITY OF NEW MEXICO

BEMP
Bosque Ecosystem Monitoring Program

BOSQUE SCHOOL
Challenging Education

Middle Rio Grande Stormwater Quality Team Final Report prepared by the Bosque Ecosystem Monitoring Program

JULY 30, 2022

1

1.1 COMPREHENSIVE OVERVIEW

Historically, culturally, ecologically - the Rio Grande is the heart of our region and the primary resource by which New Mexico's young people familiarize themselves with water. Utilizing its ecosystem as "classroom", BEMP's stormwater science outreach education program aims to teach young people how the health of the Rio Grande is directly related to the health of the surrounding watershed and how they can be stewards in helping to keep the Rio "Grand".

To this end, **7,840 students** throughout Bernalillo and Sandoval counties connected with their local watershed through participation in BEMP activities throughout the 2021-2022 school year. 845 contacts of this total were engaged through purely stormwater science specific lessons.

Due to ongoing pandemic restrictions in the 2021-22 school year, our curriculum shifted to virtual and physical formats to make our activities more equitable and accessible, including adaptations to our stormwater science curriculum to best fit the ongoing COVID-19 scenario. However, as in-person programming became more possible in the 2021-22 school year, in-person visitation to school campuses and the bosque once again became a successful venue for stormwater science education.

In consideration of the implications of COVID-19 on our communities, BEMP's stormwater science program featured synchronous and asynchronous learning resources, as well as in-person programming opportunities. Synchronous resources are remote, live, lessons that include stormwater science concepts and/or projects. Asynchronous curricular components are self-led, virtual lessons that represent a version of the regular stormwater science class and 1-page summer activities; BEMP currently offers five different, 30-minute asynchronous lessons.

Throughout the pandemic, BEMP has continued to support students with accessible, equitable education, including community disseminated educational materials that are actively featured on BEMP's website and social media platforms (See sections 2.2 and 3.0 of this document for more

detailed information). Successful adaptation of BEMP annual events into virtual formats was again necessary to ensure the safety of its participants (Luquillo-Sevilleta Virtual Symposium and Crawford Symposium; see section 2.3). All activities and materials, virtual and printable, are available in English and Spanish to better support inclusion and accessibility to STEM resources for New Mexico's diverse communities.

1.1.1 *Delivery of BEMP Annual Report*

The Bosque Ecosystem Monitoring Program (BEMP) mailed out the BEMP 2021 Annual Report on June 11, 2022. This provides a comprehensive overview of the work done during the performance period up through December 31, 2021. The key sections of that report for MRGSQT include:

Pg. 60 Total outreach numbers and list of schools served

Pg. 61 Community Events and Student Presentation Outreach

2

2.1 STORMWATER SCIENCE EDUCATION AND CURRICULUM

2.1.1 *In-person and synchronous learning.*

3,117 students served
In response to the COVID-19 pandemic, BEMP education continues to pivot to better support the diverse needs of New Mexico's students, teachers and families by offering a multi-level educational pathway to engage with BEMP programming.

For students able to access the field, classes returned to monthly monitoring whereby lessons were taught in data collection procedures, phenological changes, and stewardship initiatives. Additionally, lessons focused on the geographical origins of the Rio Grande and our local drinking water, watershed

dynamics, and the stability of the Rio Grande's water composition throughout the year. Water input fluctuation was discussed in relation to pollution impacts and other bioindicators of watershed health.

For students who were restricted in ability to leave campus, listening to the needs of its audiences, BEMP education re-invisioned in-person classroom sessions to in-person, outdoor lessons on students' campuses. This was done in conjunction with remote lessons that leverage learning and connection within a student's own place-based residence. For example, for students unable to attend monthly data collections onsite in the bosque, a modified version was established to engage students in precipitation, litterfall and arthropod data collections on their own school campuses. Via exposure to data collection in their own neighborhoods, students gain first hand scientific experience while broadening their awareness of the ecosystem all around them rather than as something distant. Other curriculum development examples include a modified stormwater science activity for elementary ages to invent an arthropod while highlighting the connectivity of macroinvertebrate communities to water health, and an asynchronous series analyzing multiple years of groundwater monitoring data in the Rio Grande Valley to discuss the relationship of resource depletion and potential pollution influences.

Additionally, through this multi-level pathway, stormwater science curriculum was offered during the 2021-22 school year paired as an in-person school visit alongside a remote classroom lesson series. Students engaging in these lessons investigate how storms impact river health by looking at a watershed model, varying community sizes, and the pollutants each one produces. Students then utilize data analysis and data visualization components to learn about permeable and impermeable surfaces to better understand how storms impact the overall water quality of the Rio Grande. Through a cumulative in-person activity, students test water quality samples and macroinvertebrate populations hands-on while learning about environmental justice and water health in downstream communities.

Previous in-person lessons that were re-envisioned to become remote, multi-part, synchronous lessons (Exploring the Outdoors and Bosque Data Jam) remained a success. Both lessons focus on water quality and storm impacts, phenological observation, ecosystem monitoring, climate change, scientific processes, graphing and data analysis, encouraging a deeper understanding of nature in students' backyards while developing career-based skills in the sciences, public-speaking and presentation delivery. As in previous years, at the end of their educational process, students come up with a creative piece to represent the results of their scientific projects that are then presented at one or both of our annual events, BEMP Crawford Symposium (April-May) and/or the Luquillo-Sevilleta Virtual Symposium (April-May - presentations in Spanish). This year, College Career High School focused their research

projects on water quality/storm impact topics where students collected and analyzed their own data as a way to better understand first hand the impacts of storms in their own neighborhoods. Through their projects, students broadened community awareness about this topic with the hope of empowering future generations to make a more positive impact.

Throughout the 2021-2022 school year, BEMP served 3,117 students in 32 different schools and community organizations within Bernalillo and Sandoval counties through these lessons.

Funds that would have covered partial costs for some BEMP educational outreach events (Student Congress or Otter Day) were reallocated for the development and execution of new educational resources, printing and other materials, additional translation efforts to support accessible and equitable education, and staff time in order to continue to support the stormwater science program.

2.1.2 *Asynchronous learning.*

4,209 students served, 88,973 indirect interactions
Asynchronous curricular components continue to be designed to meet the diverse needs of students and teachers that otherwise cannot interact with BEMP directly due to timing, scheduling, or pandemic restrictions. As self-led, virtual or printable lessons, BEMP's asynchronous lessons cover a broader array of water quality concepts through various means.

Throughout the 2021-2022 school year, BEMP served 4,209 students within Bernalillo and Sandoval counties through these lessons.

> *Virtual Lessons* **233 students** This year, BEMP educators have been expanding on previous remote stormwater science lessons to include groundwater datasets, including what it is, how it is measured and why it is important. Through use of an aquifer model, students look at several years of data to discuss the relationship between groundwater and river health. Additional lesson concepts include watershed model before and after storm events, environmental justice in downstream communities and stewardship components. These lessons are remote, multi-part, asynchronous lessons offered through Edpuzzle, an interactive video lesson platform.

Self-directed Printable Activities **3,976 downloads** BEMP has been creating and distributing self-led, printable activities to help students and their families become engaged outside and explore their yards, neighborhoods and public lands while also collecting their own data. Subject examples include stormwater pollution sources and watershed heath via the observation of trash accumulation. All activities created have been translated in both English and Spanish and have been uploaded to our website for increased accessibility. Educational resources can be found here.

Social media **88,403 interactions** In maintaining initiatives to make educational materials more accessible to members of our community, BEMP has increased its presence on social media channels and continues to grow. Every day of the week, BEMP staff highlight ecological findings, time in the field, educational activities, and resources from partners. Stormwater science related concepts are consistently presented in Water Wednesday posts including topics such as educational resources from RiverXchange, evidence of water pollution and its effect on wildlife, aquatic invertebrate populations and water health, and stewardship opportunities to reduce impacts on water quality and consumption habits. All materials are provided in English and Spanish.

YouTube channel activity videos **570 views** BEMP's YouTube channel contains videos of our events as well as instructional videos that supplement activities to help guide students through their lessons. Those videos can be found on our YouTube channel, BEMP (Bosque Ecosystem Monitoring Program).

2.1.3 *Events*

281 students served

Providing the community with an opportunity to learn how important student-collected data are for informing the management of our urban riparian system, BEMP's annual community events were successfully adapted for another year to include both virtual and in-person components. Featuring a culmination of student presentations that relied heavily on student collected data and employed their professional development and presentation skills, both the Luquillo-Sevilleta Virtual Symposium and Crawford Symposium were a success in emphasizing the importance of water quality and Stormwater Science concepts.

Additionally, BEMP participated in several other community events and educational festivals to spread community awareness of watershed health, monitoring efforts, and inspire stewardship therein. Some examples include participation in Environmental Justice Week with Valle De Oro, tabling events at Jefferson Middle School, and Valencia Soil and Water Conservation District's Earth Day Science Fiesta.

2.1.4 *Watershed Education Collaboration Group*

Ongoing collaboration with the Ciudad Soil and Water Conservation District and the Valencia Soil and Water Conservation District as part of the Watershed Education Collaborative Group continues. Mutual collaboration rests on the goal of increasing student awareness about water, watersheds and other related components (historical, present and future) related to stormwater in New Mexico.

Of particular note, two separate activities were developed to support student learning throughout Outdoor Learning Week 2021, Environmental Justice Day with Valle De Oro, and Valencia Soil and Water Conservation District's Earth Day Science Fiesta. These lessons encouraged students' awareness of the water cycle, emphasizing the journey of raindrops and the various point and nonpoint pollution sources encountered on their way to the river. Students also participated in a scavenger hunt to become familiar with stormwater control structures, evidence of erosion, and potential sources of water waste.

Moving forward, we would like to continue building a K-12+ water curriculum that scaffolds student learning about stormwater and water related concepts by age group. In utilizing our partnership, we will collectively discern where each of our organizations educational programming best fit within student's experience and build from those strengths while attending to any gaps in student learning we discover. Our collective aim is to offer continuous exposure to stormwater and water quality subjects throughout each grade level while improving New Mexican youth's accessibility to these subjects.

2.1.5 *Assessment tool - IRB update*

This addresses section 2.1.10 in previous reports: Assessment tool of overall effectiveness. BEMP continues to pursue IRB certification so as to officially assess our educational programming and its effectiveness amongst student populations. It is currently being edited to more narrowly refine

questions asked of participants and will again be submitted for review by the IRB governing board; we anticipate its successful acceptance.

3

3.1 OUTREACH NUMBERS

3.1.1 Table(s) of Educational and Indirect outreach numbers for FY 21-22

Education and Curriculum

	Synchronous	Asynchronous		Events	Total
		Virtual Lessons	1-page Activities		
Students	3,117	233	3,976	281	**7,607**
Adults**	859	N/A	N/A	83	**942****
Total (Including Adult Contacts)	3,976	233	3,976	364	**8,549****

** Adult contacts not included in total contacts reported

Social Media

	Reaches	Engagements	Views	Total
Instagram	43,697	7,574	N/A	51,271
Facebook	33,925	3,207	N/A	37,132
Youtube	N/A	N/A	570	570
Total	77,622	10,781	570	**88,973**

AMAFCA

Albuquerque Metropolitan Arroyo Flood Control Authority

Middle Rio Grande Watershed-Based MS4 Permit

General Permit Requirements

Special Conditions

- Compliance with water quality standards (Download PDF)
- Discharges to impaired waters with and without TMDLs (Download PDF)

Monitoring and Assessment

SWMP Minimum Control Measures

- Construction site stormwater runoff control (Download PDF)
- Post-construction stormwater management in new development and redevelopment (Download PDF)
- Illicit discharges and improper disposal (Download PDF)
- Control of floatables discharges (Download PDF)
- Public education and outreach (Download PDF)
- Public involvement and participation (Download PDF)

Watershed Stewards

2021-2022 Final Report

Submitted by
Erin Blaz, Ciudad SWCD
June 2022

SUMMARY

The overall intent of this program is to educate the public on the all-encompassing importance of watershed health, SSCAFCA's role in local watershed management, and to encourage personal commitment to watershed stewardship. This year's program focused on delivering watershed stewards in partnership with activity coordinators at the Meadowlark Senior Center in Rio Rancho and Del Webb Alegria Community in Bernalillo. The program consisted of lecture-style presentations and field trips to local open spaces and other sites of interest, and also included an outreach activity for Pollinator Day at Meadowlark Senior Center in the spring.

The program required funding in the amount of $10,249.05 generated $599.00 in-kind match, and reached 135 senior citizens, significantly more than our original target of 25 seniors. A few of the participants returned for multiple events. There were 17 presentations/field trips that lasted from 1-2 hours for participants, reaching beyond our target of offering 25 hours of program this year.

2021-2022 Themes and Locations

The theme of this year's fall program centered on Green Stormwater Infrastructure (GSI) and included educational presentations and field trips that were specific and relevant to the concepts of GSI and the role of GSI in watershed health. The theme of spring's program was "Walks and Talks" which focused on local wildlife, native and medicinal plants, and brought participants to Arroyo and Riparian areas located within Rio Rancho Open Spaces. All presentations were able to integrate and connect watershed stewards learning objectives to the content, such as stormwater pollution prevention and local habitat protection.

We also offered two events at the Rio Rancho WaterWise Garden, which is an excellent demonstration space for a range of topics. In the fall, the Master Gardeners gave a tour of the garden with a focus on water conservation, plant selection for drought tolerance with a preference on native species and green stormwater infrastructure. In addition to the tour, Sandoval County presented the Rolling River, and discussed the importance of residential and municipal GSI in watershed health. In the spring, Dara Saville of the Yerba Mansa Project completed a very well received talk and tour at the Waterwise garden about native and medicinal plants.

In addition to our normal programming, we also celebrated pollinators at the Meadowlark with a talk about honey bees and a presentation by ABQ Backyard Refuge. During this time we also made bee hotels with participants and passerby's out front of Meadowlark.

Building Partnerships
This year we increased partner support from Sandoval County Master Gardeners and Cooperative Extension office, Dyane Sonier of City of Rio Rancho Parks, Recreation and Community Services and Dave Gatternman of SSCAFCA, which generated some in-kind match to support the program. Discussions with Dyane Sonier focused on taking a reciprocal approach to engaging the local community in areas where our different programs align. There was hope to invite watershed stewards to help plant the new pollinator garden at the WaterWise Garden, but timing did not allow for this event to include Watershed Steward participants this fiscal year.

Stewardship Opportunities
One of the goals of the Watershed Stewards Program is to encourage personal commitment to watershed stewardship, and while the presentations and field trips offered build knowledge around stewardship strategies, program staff continue to seek out ways to engage our participants in hands-on projects that support watershed health.

This year one participant was interested in applying some GSI techniques to an erosion problem behind his house. Dave Gatterman and Erin Blaz met with this participant and Mr. Gatterman was even able to get City of Rio Rancho approval to apply some mitigation and restoration strategies. This was an exciting opportunity to engage participants in a project, however during the process of planning the city applied an erosion treatment to the hillside and it was determined best to wait and see the results of that effort.

During the pollinator day, we also hosted ABQ Backyard Refuge at Del Webb Alegria. This was a very interesting and fruitful conversation. 11 community members participated from Alegria and discussed the need for support in some of their open spaces within the Del Webb development. There was high interest in creating wildlife refuges in these spaces, but they cited challenges within their own HOA and community perceptions - like a desire for lawns and manicured spaces.

Evaluation
Considering we were able to bring in-person programming back safely to this community after a year of virtual programming due to the pandemic, this year's program reached a larger than expected audience and offered more hours of program than anticipated. However, there are certainly ways to improve. Watershed Stewards will benefit from continued support or partnership with other local entities in Rio Rancho and Town of Bernalillo so that we can collectively reach more people with a wider range of content. Watershed Stewards would also benefit from tracking participant contacts across all programs by Ciudad to be able to maintain correspondence, build community around action and stewardship, and survey folks to increase our understanding of our audience and impacts. In response to this FY22 funding was used to purchase a tablet that can be used in the field to track participant signs-in and survey participants. Additionally, finding ways that are of interest and well-suited to the senior community to engage with hands-on projects will need to continue through relationship and rapport building within the community and local partners.

Program Pictures

Prior page: WWG program with tour and rolling river. Top this page: Mikal Deese with a local bird. 2rd row: Justin shows bats & scat comparisons.
3rd row: Justin does Bosque and Arroyo Habitat walks. Bottom row: Dara Saville at WWG and Bee Hive for Pollinator Day.

Making Meaningful Connections by Integrating Water Resources Topics with Language Arts & Science

2022 Report

Presented by
Ciudad Soil & Water Conservation District
Erin Blaz, Education Manager
Saleema Robinson, Assistant Education Coordinator

June 2022

CONTENTS

SUMMARY

This year, funding enabled 39 NM classes (866 students and 41 teachers) to participate in a combination of *virtual and in-person programming* RiverXchange® program. 38 classes were funded for the program, but 39 were placed in the program considering the likelihood that not all bus and substitute funding was going to be used due to the uncertainty of field trip approval and substitute availability. Eight of the fourteen schools we served were Title 1. All program costs and coordination are provided free of charge to teachers. The program required $56,218.89 in cash and generated a total match valued at $67,351.11 in the form of in-kind contributions including teacher workshop attendance, presenter time and preparation for virtual presentations, as well as volunteer time from students and adults on the field trips to plant 495 trees in the bosque. Student Capstone Projects reached at total of 3,090 community members about stormwater and watershed health related topics.

RiverXchange® continued to have a successful year, even in light of the on-going global pandemic. One of the challenges this year was managing diverse policies for presentations and field trips across schools and presenter preferences and capacity. The result of these variations meant that students experienced varying levels of contact with the program. For example Rio Rancho schools primarily had video presentations and virtual field trips with live presenters, while one Rio Rancho school actually went on a field trip to Candelaria Nature Preserve. APS students primarily had virtual presentations with a live presenter and almost all APS schools did pole planting. However, in evaluating the program metrics both districts demonstrated knowledge gains and improvements in positive water conservation behaviors and attitudes.

Another significant change to the program this year was the evolution from blogging to the Capstone Project. With the inundation of technology and virtual learning in schools as a result of the global pandemic, it was time to rethink the goals of the blogging component and determine if they really support making meaningful connections for students in water resource education. The goal of the Capstone Project was to pilot a language arts component that would support making meaningful connections with students' immediate community- such as the larger school community or neighborhood. Results from the Capstone Project are shared further on in this report. In summary, much of the work we see is similar to the work that was posted on the blog, except many of the teachers that were able to integrate the Capstone Project challenged their classes to share their work with other classes at the school or even the school administration. This meant the work wasn’t going into a digital void where only RiverXchange® staff would view it, but that it rippled out to more local students and adults!

In addition last year RiverXchange®, Bosque Ecological Monitoring Program and Valencia SWCD staff met monthly to discuss watershed and stormwater education collaboration opportunities, such as program continuity across grades and program assessment strategies. This effort continues to help support and improve core aspects of our programs and outreach.

RiverXchange® has demonstrated that its collaborative efforts with partner agencies to bring effective presentations to schools, funding structure to support teacher professional development and field

trips, and management by the Ciudad Soil and Water Conservation District, has allowed it to be not only resilient during times of uncertainty but a valuable resources for teacher and students alike. In fact, RiverXchange® has emerged as a strengthened program that will continue to evolve for years to come and improve how it engages our local community with watershed health and stewardship.

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 optional 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 K12 water resources outreach in NM since 2007, the RiverXchange program creators 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, they continued to find that upper elementary students had little or no understanding of major water resources topics unless the teacher specifically integrated a wide range of water topics into the curriculum. For this reason, as well as successful festival work with upper elementary students, this age level was selected as the focus for the RiverXchange program.

RiverXchange was created to provide a free program that is fun, interesting, and easy to integrate into the normal curriculum. The hope was to motivate participants to explore water resources topics in depth. The program was originally designed to be 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. Today RiverXchange runs over the course of 3-4 months, as a response to the challenges of implementing a year-long curriculum with the ongoing demands on teachers and students time and requirements for testing and other curriculum.

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 tele-conferencing to present what they had learned.

After the pilot project, RiverXchange transitioned to a web-based technology called a wiki. This enabled the program 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 classroom guest speakers were introduced to reduce teacher workload and bring up-to-date technical information into the classroom. In 2017, the program switched to a blogging platform called Kidblog and in 2021 Kidblog rebranded to Fanschool. Due to the inundation of technology from virtual learning in the global pandemic and the continued barriers to connecting classes on Kidblog/Fanschool, RiverXchange piloted integrating a Capstone Project into the

program instead of the blog in 2021-2022.

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. In 2020, ownership and the trademark registration of RiverXchange® was transferred fully to Ciudad Soil and Water Conservation.

Since 2007, we have served over 20,166 students!

This year, the program featured the following components:

- Optional standards-based curriculum including hands on science, math, and social studies lessons, as well as writing assignments
- Teacher training on curriculum and Capstone Project implementation
- Ongoing motivational support and Capstone Project monitoring
- End of year teacher survey
- Pre and post student surveys
- Coordination of at least four guest speakers into the classroom
- Coordination of a virtual field trip or in person field trip to the local river or important watershed feature
- Field trip leadership and activity planning

2021-2022 PROGRAM OVERVIEW

I. Program Management and Financial Support

The program timeframe was July 1, 2020 through June 30, 2021. All components including fundraising, design, planning, implementation, and analysis were carried out by employees and contractors of Ciudad Soil & Water Conservation District, including:

Erin Blaz
Jenny Lloyd-Strovas
Astrid Hueglin
Saleema Robinson

SPONSORS

- Southern Sandoval County Arroyo and Flood Control Authority (SSCAFCA)
- Middle Rio Grande Stormwater Quality Team (MRGSQT)

Sponsors provided a total of $56,218.89 in cash.
MRGSQT - $38,532.98 | SSCAFCA - $17,683.04

Program expenses included:

- Technology services
- Office and educational supplies
- Teacher workshop materials and food
- Coordination services (planning, implementing and assessing all program components)
- Bus funding
- Substitute funding

IN-KIND PARTNERS

- Albuquerque Water Utility Authority
- City of Albuquerque – Open Space Division
- City of Rio Rancho – Environmental Programs Office
- City of Rio Rancho — Parks, Recreation and Community Services Department
- Sandia Labs
- Sandoval County Cooperative Extension
- Bernalillo County Cooperative Extension
- Rio Grande Return

In-Kind contributions totaled $67,351.11

In-kind contributions included virtual guest speaker coordination, prep and presentation time. The City of Albuquerque significantly increased their match this year by including a pre-lesson kit and/presentation to classrooms. Additionally, in-kind match was able to return to a pre-2020 range due to the allowance of pole planting field trips, where student and adult time and trees are counted as match through volunteer time and materials.

PARTICIPANT SELECTION

All 39 participating NM classes were fifth grade classes, distributed as follows:

FUNDER	MRGSQT		SSCAFCA	
	SCHOOL - Number of classes	**Number of Students**	**SCHOOL - Number of classes**	**Number of Students**

*Title 1 school	La Mesa* - 4	92	Colinas del Norte* - 5	109
	Valle Vista* - 3	53	MLK* - 4	98
	Duranes* - 1	19	Sandia Vista - 4	92
	Seven Bar - 3	79		
	John Baker- 3	67		
	Zia- 2	40		
	Monte Vista - 2	52		
	Cochiti* - 2	27		
	North Valley Academy - 2	52		
	Manzano Mesa* - 3	61		
	Maggie Cordova* - 1	25		
TOTALS	**26 classes**	**567**	**13 classes**	**299**
RX Total Classes	**39 classes**	**RX Total Students**	**866 students**	

PRESENTATION TOTALS

Program presentations were completed as follows:

Agriculture: 39/39
Stormwater: 39/39
Wastewater: 39/39

Drinking Water: 39/39
Landfill Presentation: 14/14 (Rio Rancho only)

Field Trips

Virtual: 14/14

Pole Planting: 21/21

Candelaria Nature Preserve: 4/4

I. Program Components

The core curriculum of RiverXchange® is delivered through a series of in-class presentations provided by our partner agencies that are guided by the "Big Water Questions" that aim to build an understanding of watershed health. Additionally the field trip, in partnership with City of Albuquerque Open Space, has remained a core component of our program by offering students the opportunity to participate directly in a restoration project to understand the value of action and stewardship as a community effort. The field trip also offers an opportunity for participating students, who come from diverse backgrounds and have varied relationships with the outdoors, a chance to connect with an important, local watershed feature and build a connection to their local river. Furthermore, beyond the core components of RiverXchange®, the program also supports a more robust understanding of watershed health through teacher facilitation of the Capstone Projects and other additional lessons that are demonstrated at the teacher workshop. Extensive resources can be found on the RiverXchange® website but we have found teachers are at their capacity often don't utilize those resources. Each year we continue working on developing a more streamlined program.

A review of this year's program components follows.

PARTNER AGENCY PRESENTATIONS

APS

The Water Utility Authority has a new presenter, Rhea Trotman, who is replacing Theresa Dunn - the long time WUA educator for RiverXchange. Ms. Trotman provided the drinking water and wastewater presentations. Brittany Johnson at Bernalillo County Coop Ext. provided the virtual agriculture presentation. The stormwater presentation will continue to be offered via a video recording from Sandia Labs.

RRPS

The city of Rio Rancho offered pre-recorded videos of their drinking water, wastewater and landfill presentations as this year's presentations. Students will also receive the stormwater video from Sandia Labs. The agriculture presentation will be offered virtually by Steve Lucero and Nicole Lujan from the Sandoval County Coop Ext.

Field Trip Pre-lesson

City of Albuquerque Open Space Division Educator Ellie Althoff provided significant support to students understanding the "why" behind planting cottonwoods and willows in the Bosque by offering a River of Change Kit (a model and lesson derived from the Bosque Education Guide). This kit and lesson was provided to classes for their own use or as an in-person presentation with Ellie to explore the first two segments of the lesson - Rio Bravo and Rio Manso - which discuss the pre-settlement ecology of the Middle Rio Grande and flood control impacts due colonization and non-native settlement of the Middle Rio Grande Valley. The final segment of this lesson called Rio Nuevo, where students are prompted to consider the possible restoration and mitigation strategies for flood control impacts on the ecosystem, was completed either on site at the field trip or during the virtual field trip presentation.

FIELD TRIPS

POLE PLANTING

A total of 417 students and 56 adults attended pole planting field trips from APS schools. With the support of Albuquerque Open Space, 495 total trees were planted in an area of the Bosque just north of I-40 on the east side of the Rio Grande. Images of students pole planting are in Appendix XXXX.

VIRTUAL FIELD TRIPS

This year we continued to offer virtual field trips for schools that were not allowed to go on in-person field trips. City of Albuquerque Open Space generously contributed another educator, Ellie Althoff to join Erin Blaz in facilitating these field trips. The virtual field trip spanned 1.45 hours and explored evidence of the flora and fauna in the existing riparian ecosystem, identification of invasive species, strategies for managing forest health and the Rio Nuevo activity.

CANDELARIA NATURE PRESERVE (CNP)

In March, Martin Luther King Elementary School notified RiverXchange® staff that they were just approved for in-person field trips. Pole planting does not have demonstrated success rates into the warming spring months, so we had to come up with field trip location and activities that would work in April. As Ciudad SWCD is now the land manager of Candelaria Nature Preserve in partnership with COA OSD and Rio Grande Return, we collaborated to deliver two field trip dates to serve four classes at this site. Students were able to contribute some hands-on work by mulching berms alongside basins created for nucleated habitats, as well as nature journaling to envision the future of CNP as an agricultural land converted to wildlife habitat, and the Rio Nuevo activity. Wildlife Biologist Kyle Faig also gave a wildlife talk to students. The event was a great success!

Top row: Ellie Althoff and Kyle Bality from Open Space teaching students to pole plant properly. Middle rows - students from various schools planting in varying weather. Bottom 3 pictures: Field trips to Candelaria Nature Preserve

CAPSTONE PROJECT

This year RiverXchange piloted a new approach to maintain the language arts component that has been meaningful to teachers across the years and to strive to achieve a new kind of meaningful connection between RiverXchange students and their community. The coordination budget that has been used in the past for blog support and evaluation went to supporting teachers in the process of completing this capstone project and acquiring documentation of their class projects. The criteria for the capstone project are:

- (1) Students create something new that teaches other about what they learned in RiverXchange
- (2) Students communicate what they learned beyond their classroom in their community (i.e. other classes at school, your neighborhood or city)
- (3) Students design a stewardship project of their own that includes aspects of conservation and sustainability in their community.

Teachers were asked to update staff on their projects in December and March and to share the context of the project as well as who the project would reach and impact. In April teachers submitted their projects via email to staff and 6 classes were awarded with pizza parties to celebrate their project completion. In total, student capstone projects reached 3,090 community members about stormwater and watershed health topics.

RIVERXCHANGE COMMUNITY DAY

As a strategy to both motivate and celebrate the Capstone Projects, staff offered a Community Day at the end of the year where the class projects were highlighted. The event was held on April 23 in conjunction with the Earth Day Celebration at Agri-nature Center in Los Ranchos. The event was publicized to all RiverXchange® classes and families were encouraged to attend.

TEACHER WORKSHOP

Teacher workshops were held Sept 24, 2021 and October 1st, 2021 at the Open Space Visitor Center with RiverXchange facilitators Jenny Lloyd-Strovas and Erin Blaz. The teacher workshops were highly successful, with 19 participants on the 9/24 and 15 participants on 10/1. We found that there were a lot of new teachers this year, not only new to RiverXchange but also new to the field of teaching. The RiverXchange program was introduced and reviewed, with many returning teachers expressing their appreciation for and confidence in the program. The capstone project was introduced, was well-received, and teachers spent time working in groups to plan their projects. We ran through a few teaching strategies for lessons about the watershed using a 3-D model of the Middle Rio Grande Watershed for integrating geographical mapping and layering of life zones, historical development, biological features, etc, with the final layer demonstrating pollution on our watershed model. City of Albuquerque Open Space education staff ran through activities that supported the field trip learning objectives and reviewed the field trip experience and pre-lesson. Dyane Sonier of Rio Rancho Parks, Rec and Community Service introduced

resources and materials available to teachers on the Rio Rancho workshop date (Oct 1). Teachers enjoyed lunch overlooking migrating birds and explored the visitor center. Everyone left with swag-bags!





Teachers from Valle Vista, MLK, Colinas del Norte and Maggie Cordova map the middle Rio Grande Watershed. (top left and center). Dyane Sonier presents CoRR education programs (top right). Teachers rain on their polluted watershed model of the MRG (middle left). Teachers share their capstone project ideas (middle center). Teachers from Duranes and Zia brainstorm capstone projects together (middle left).

II. EVALUATION

TEACHER FEEDBACK

Teacher feedback is an invaluable resource for program evaluation and it continues to help us understand what teachers value and where we can improve. This year's feedback continues to reinforce that RiverXchange® remains relevant and impactful in curriculum and content. Feedback demonstrates the RiverXchange program is highly valued by teachers for its ability to provide hands-on and experiential activities that expose students to local watershed issues, reconnect them to the natural world, and demonstrate career opportunities in the science and conservation fields. RiverXchange continues to be a valuable curriculum that teachers use to stimulate the personal and collective growth of their students by encouraging them to use teamwork, adaptability, and communication skills to engage in and build an understanding in complex and new topics. In addition, the capstone project has provided an additional opportunity for teachers and students to engage their greater school community in project based learning that occurs in the program through education, research, and community service. Feedback also demonstrates the RiverXchange continues to be valued for its ability to bring hands-on science in the classroom and teach about water resources issues, while addressing both Common Core English Language Arts Standards and Next Generation Science Standards.

Additionally, when asked to share what successes teachers and the students had with integrating the capstone project, teachers reported that students really enjoyed using the capstone to engage with RiverXchange by creating deeper connections to water issues through direct action and demonstration. Teachers described how their students used the project to educate others about environmental issues,

organize campus-wide clean-ups, and build interactive models to demonstrate key watershed science concepts.

Lastly, when asked how RiverXchange could be improved to support teachers in future years, teachers reported difficulty with virtual programming due to COVID and a desire to return to more in person presentations and field trips next year. Teachers also indicated that more physical supplies for hands-on learning and greater support for the capstone project would help them with supporting their students in meeting program objectives.

Below are a few highlights from the teachers:

What are the greatest learning outcomes for your class as participants in RiverXchange?

The exposure to the environmental issues and understanding the environmental issues in the state of New Mexico. - Detrick, Colinas Del Norte

Seeing career opportunities outside of what they know. Giving them the chance to interact with environments that they may not have. - Shafer, Maggie Cordova

Understanding the science of conservation and the importance of valuing life. - Hodges, MLK

My students are more aware of how their behaviors impact the environment.- Granstrom, Seven Bar

I think the hands-on learning approach is the greatest learning outcome. -Filkins, MLK

Please share any feedback you have concerning your experience with the program this year.

RiverXchange was extremely successful because my students were enthusiastic to learn about several ways to take care of our natural resources. Example: fixing water leaks, conserving energy by turning off lights and technology, picking up their animal's waste. - Sanchez, Duranes

This has been a wonderful and helpful way to teach about our local water system. It makes a difference if students can see the river itself and know they have a part to play in keeping the Rio Grande! - Beer, Cochiti

We love the program and would like to continue participating in it, hopefully doing it entirely in person for the following school year. - Ceballos, La Mesa

I would like to see a more streamlined, organized program. Having the presentations in person would be best as well. - Marquez, John Baker

Each year, it seems the program continues to improve. The resources and activities were invaluable.- Turrietta, MLK

Great job and thank you for everything you did for us RiverXchange! - Hornbecker, Colinas Del Norte

CAPSTONE PROJECT

In RiverXchange, our goal is that students not only understand their local watershed but that they use their voice to advocate for conservation and proper management of our watershed in their community. This year we integrated the capstone projects to provide a fun and engaging opportunity for students to learn about and advocate for their watershed.

To provide a variety of opportunities for teachers to meet the capstone project requirements, teachers selected from 3 different capstone project levels, each with its own set of criteria. Each level is tied to a particular level of engagement achieved by each class's capstone project. The different levels are described below.

Level 1: In RiverXchange, we want students to be as aware of their local watershed as they are about other environmental issues like climate change. Through creating hands-on projects, students are able to demonstrate what they learn in a fun and tangible way.

- Criteria: Create something new that teaches others about what you learned

Level 2: RiverXchange was founded on the idea that learning is more powerful when students make meaningful connections between their local ecosystem and themselves and then communicate what they learn with others.

- Criteria: Create something new that teaches others about what you learned, Communicate what you learned with your community

Level 3: What sets RiverXchange Excellence projects apart from the others is that they have a stewardship component along with a communication component. We want to support and celebrate classrooms that take education outdoors and convert what they learn into a hands-on, community-based project.

- Criteria: Create something new that teaches others about what you learned, Communicate what you learned with your community, Design a stewardship project that includes aspects of conservation and sustainability in your local community

Engagement

Of the teachers that completed the capstone, most projects addressed criteria 1&2, while only a few extended to criteria 3. Being that this was the first year of integrating capstone projects, staff understood the need to create a laddered system of capstone project engagement for the teachers and students. Having multiple levels of engagement facilitated various kinds of participation based on teacher and student interest and capacity- from presentations and posters to campus-wide clean ups. Some teachers used the capstone project to assess if students achieved the NM Stem Ready/Next Generation Science Standards. Students were engaged by the different capstone projects offered by their teachers, practicing skills in leadership, stewardship, and teamwork. One teacher expressed how the capstone project gave the students the chance to use their talents in new ways.

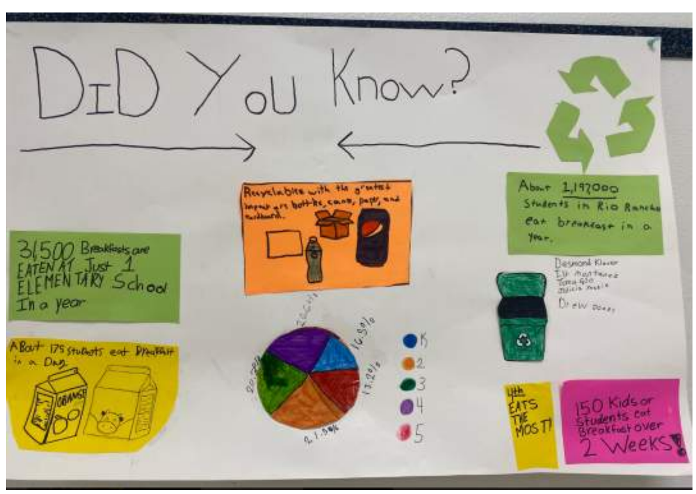
Beyond the impact to the students, the projects engaged the local community. When asked who in the community the class capstone project reached, teachers shared that often the entire 5th grade, students' families, or in some cases the whole school were reached during the course of the project. Students also expressed wanting to increase their reach to the greater public.

The challenging circumstances of virtual learning the last couple of years made it difficult for some teachers to complete the capstone project with their students. Some teachers expressed how their students had fallen behind in particular content areas and they weren't able to focus on the project due to the extra effort needed to bring students back to grade-level knowledge. One teacher requested additional support in designing and carrying out the capstone project.

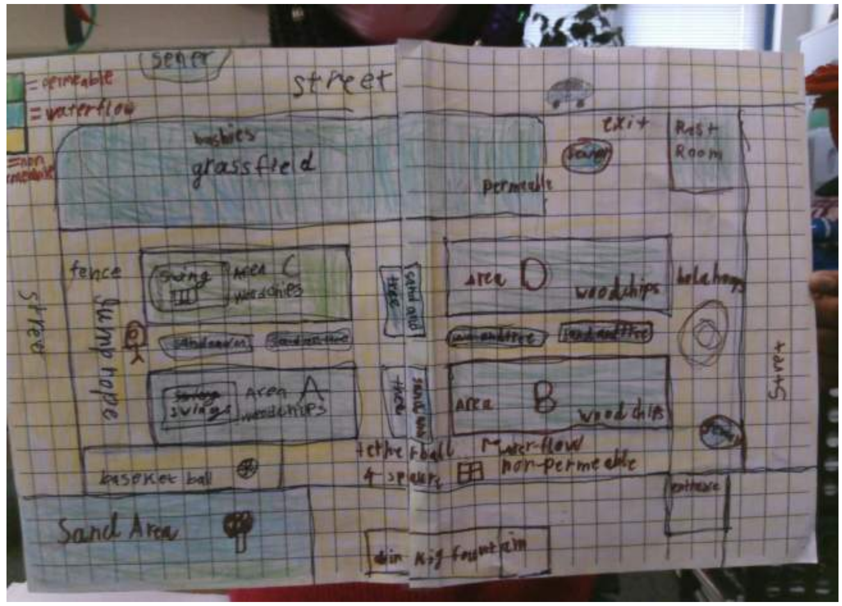
Overall, the majority of teachers appreciated the hands-on and outdoor education focus of the capstone project criteria and felt their students gained meaningful experiences in the process.

Capstone Project Images


Campus Clean Up- Whole team, Cochiti Elementary

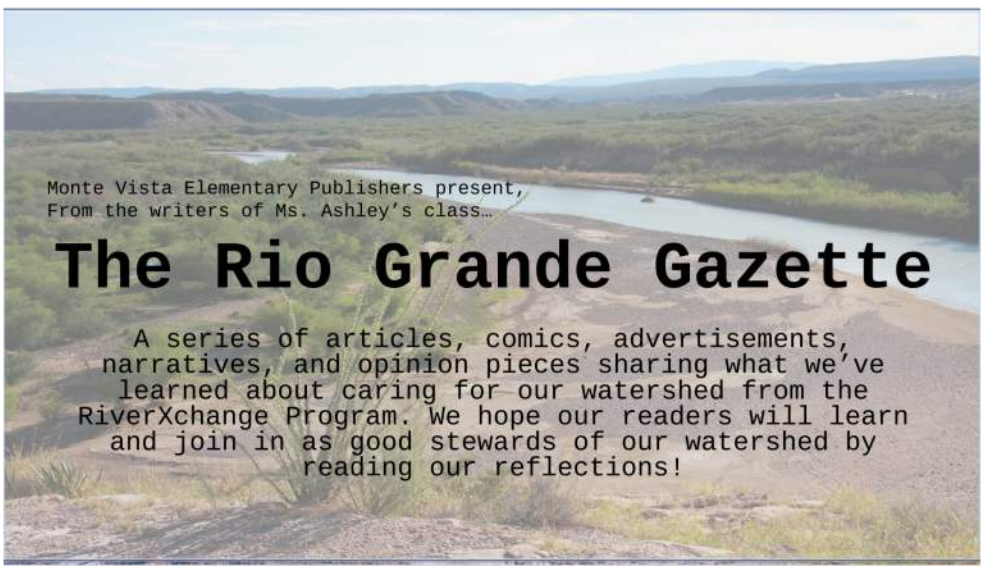



Recycling Project and Posters- Schapekahm, MLK



Green City Design- Chacon, Zia

Watershed mapping - Ackerman, La Mesa



The Rio Grande Gazette, Whole team, Monte Vista

Plantings using recycled plastic bottles- Gold, La Mesa

STUDENT SURVEYS

A key component of RiverXchange is its 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 observing the work submitted via the Capstone Projects. The survey includes questions that relate to environmental attitudes and behaviors as well as knowledge gained relating to our learning objectives.

Pre/Post Behavior Survey

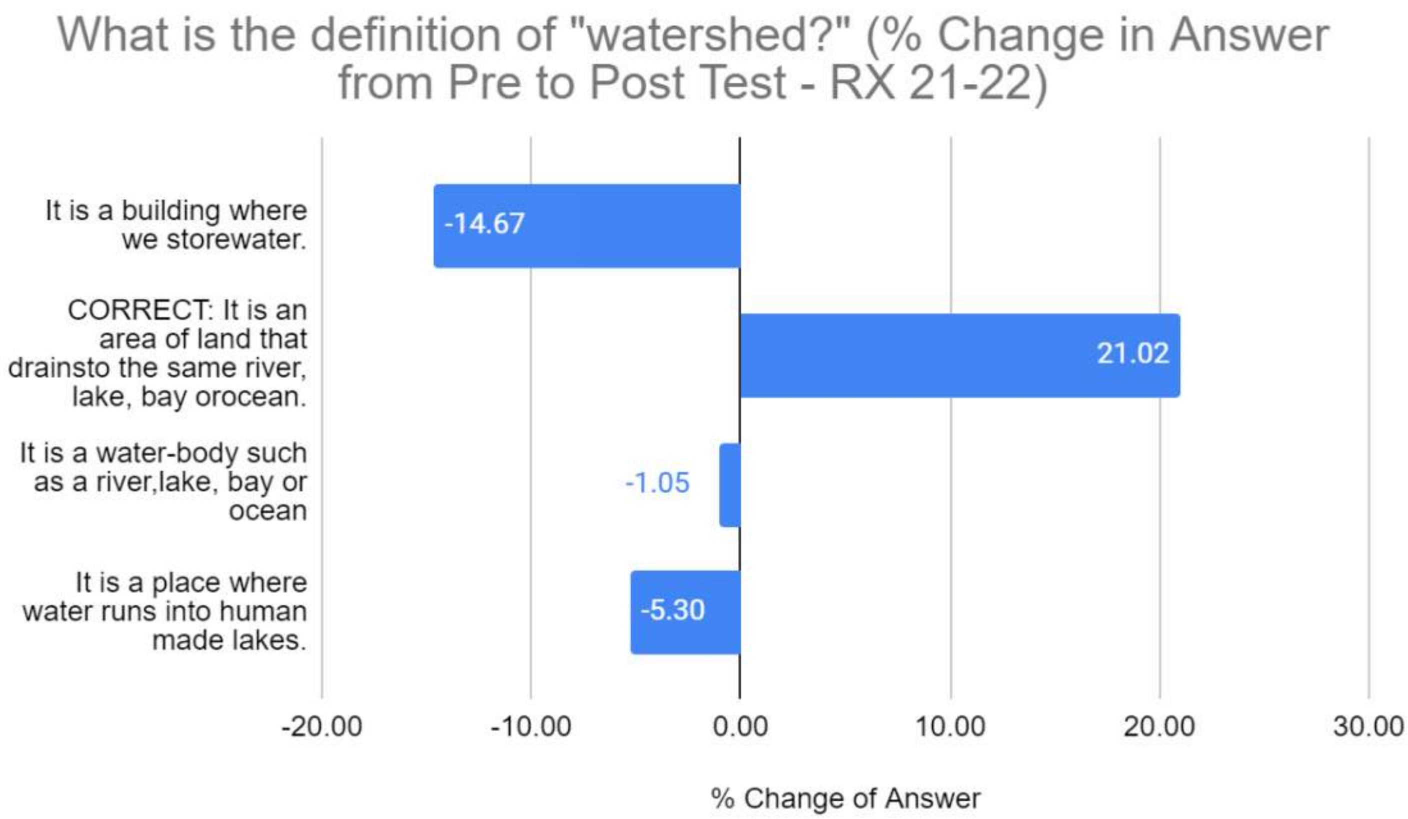
In order to quantify the learning outcomes achieved through RiverXchange, we ask our teachers to have their students fill out a survey prior to and upon completion of the program. Below, you will find a series of graphs used to illustrate the perfect change in responses between the pre and post surveys, as well as some breakout pie charts for further clarification on important topics. This year, 673 students completed the pre-survey, while 669 completed the post-survey. We continue to refine the survey and our programming year after year based on teacher feedback and metrics gathered from these surveys. To view this year's survey questions, use the following hyperlink: RX 21-22 Survey.

This year, we reframed the survey questions using a likert scale (with varying responses) with the hopes of demonstrating more range in growth across knowledge, attitudes and behaviors. In viewing other similar watershed program surveys, like the Watershed Project from the Bay Area in California, we hoped to look beyond our learning objectives and explore what kind of beliefs students had around water conservation behaviors. For example, in the question that asks how important/impactful are the following actions in protecting and conserving water, we were hoping to see increases from some or mild importance to high importance. Since the questions students had to respond to were all individual actions they could take, this movement to high importance, in theory, would demonstrate that they would feel more conviction to take those actions since they find them important and impactful.

As discussed with the MRGSQT general public survey, beyond collecting general knowledge about stormwater issues or watershed health, surveys can be educational tools as well. For example, asking students to select the positive water conservation behaviors they do “often” suggests that both these behaviors are important and desired. So even if students are answering how they think they should behave versus their action behaviors, this is still an effective tool to increase knowledge about behaviors that are positive for water conservation and watershed health.

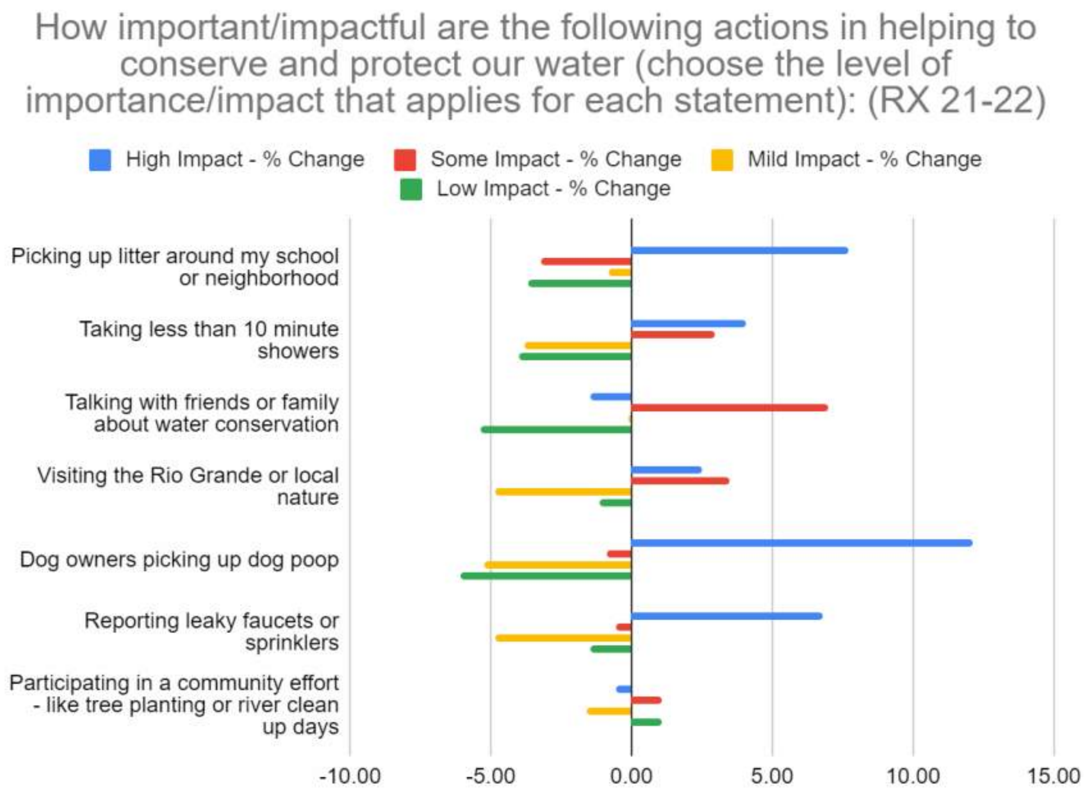
RiverXchange Percent Change Graphs for Pre-Post Surveys for 2021-2022

<u>Watershed Definition</u>

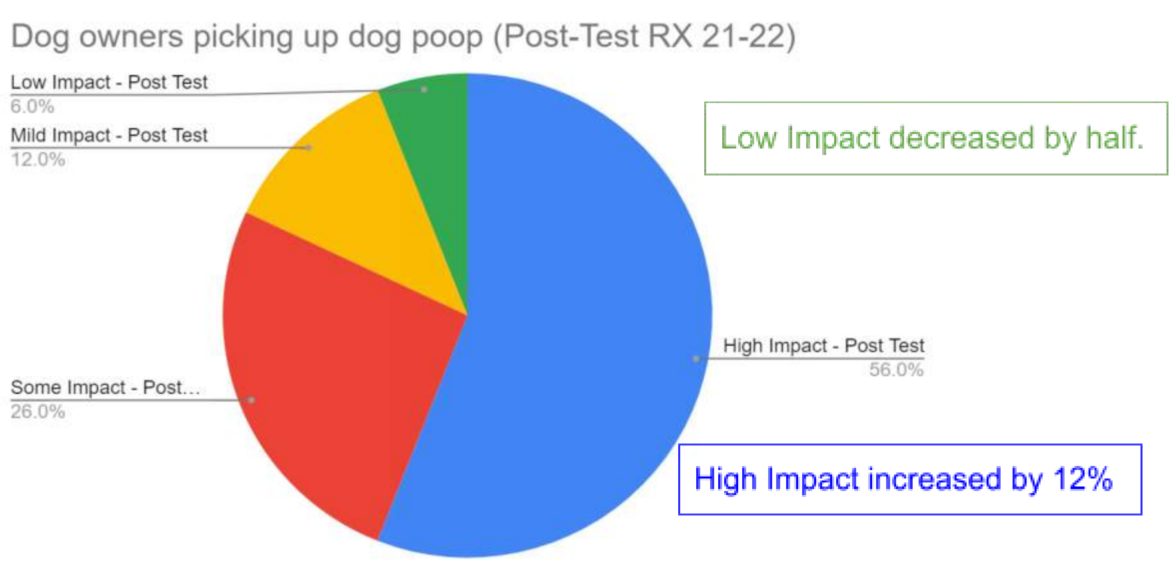


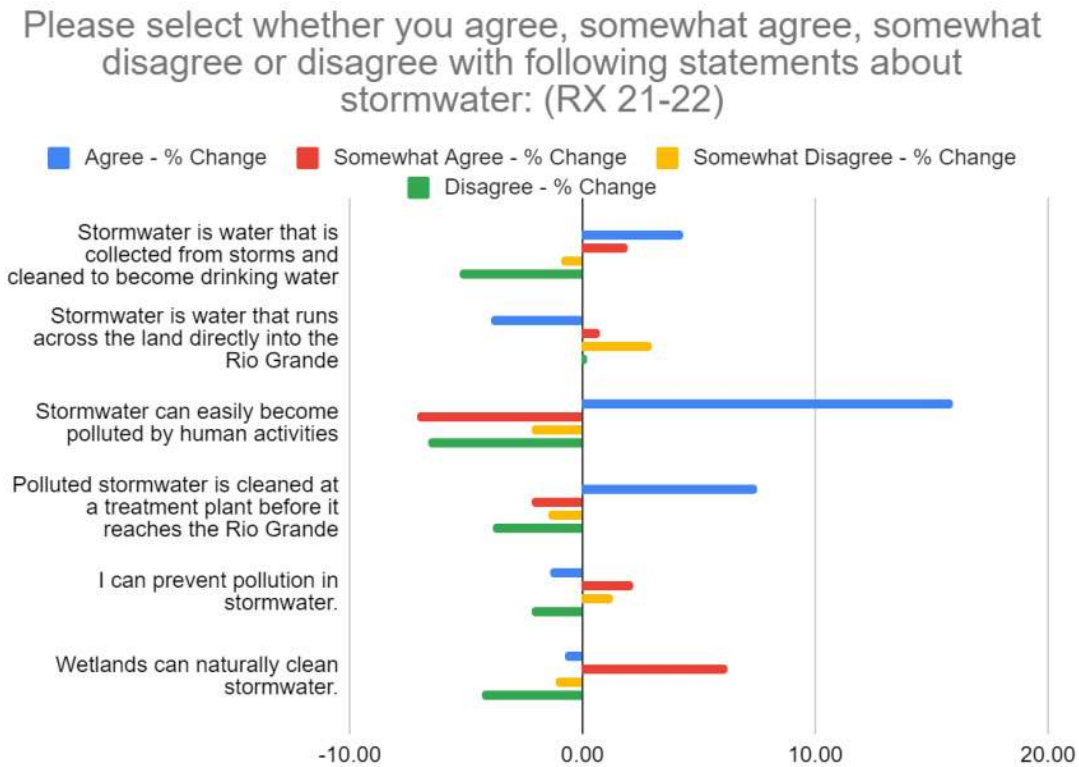
Results: We see over a 20% increase of correct answers for a watershed.

RX Stormwater & Pollution

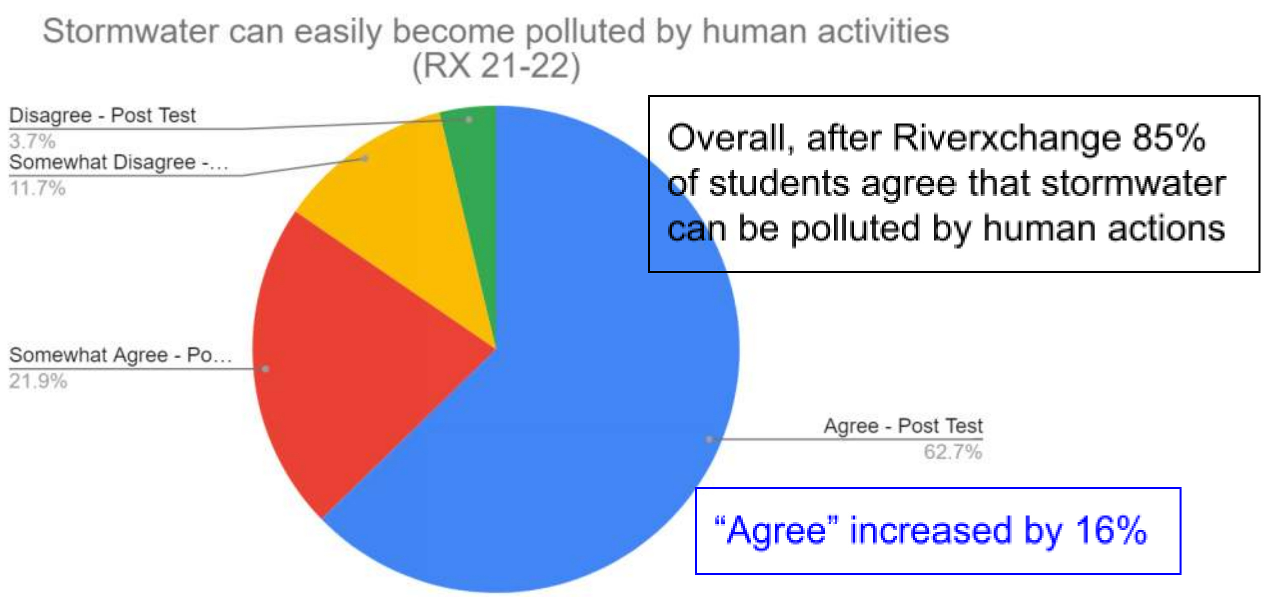


Results: Positive attitudes about picking up litter, taking shorter showers, picking up dog waste and reporting leaky faucets all increased after the program. There was also an increase in the belief that talking with friends and family can have some impact in water conservation. Breakout pie chart: In total over 90% of students believe picking up dog poop is impactful in helping protect water.

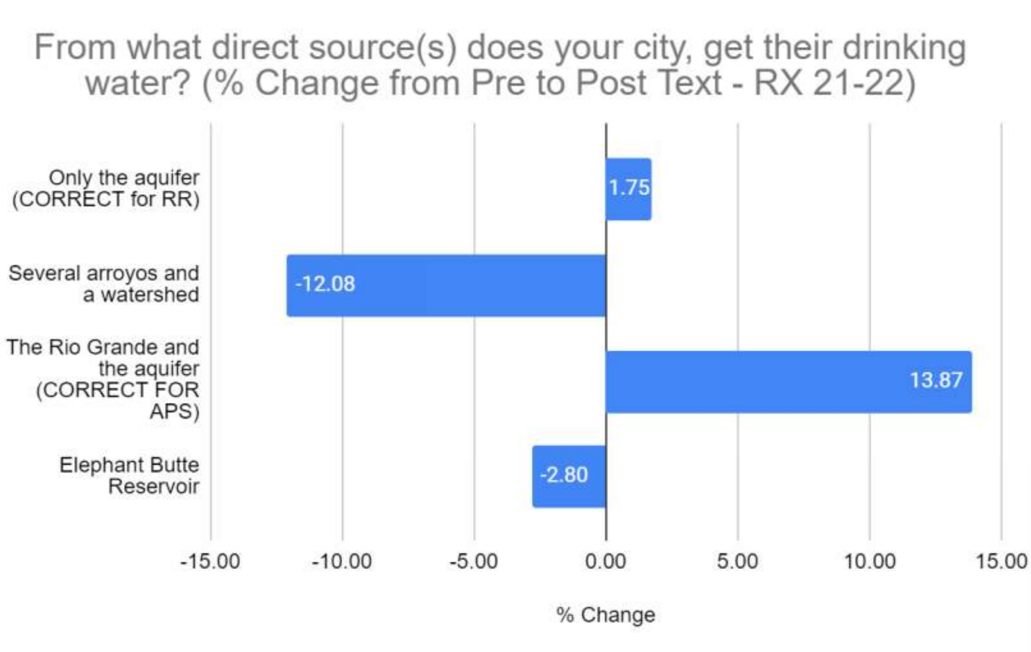




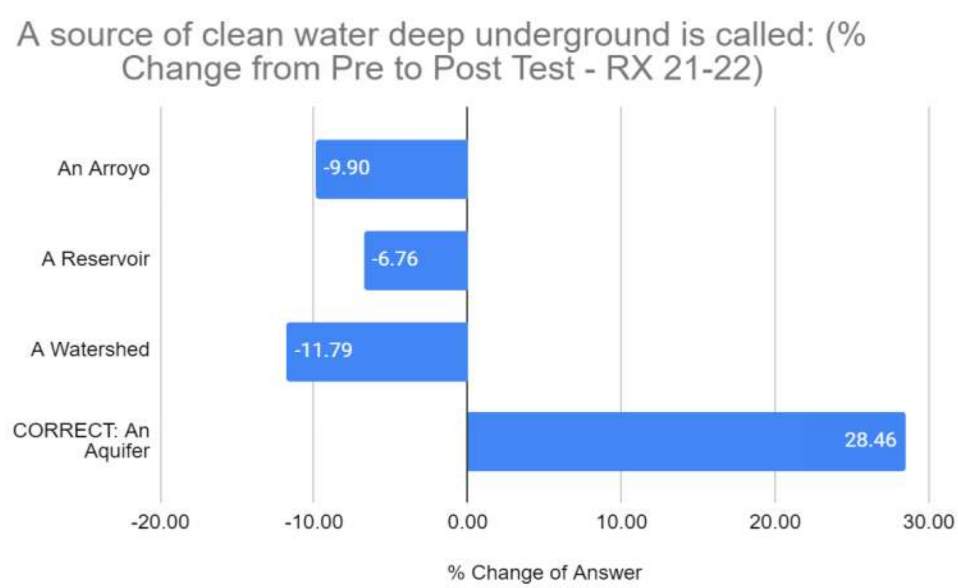
Results: Over the past few years, students seem to struggle with understanding the definition of Stormwater. However, more students agreed that stormwater can be polluted by human activities after the program and over 85% of students agree in total.



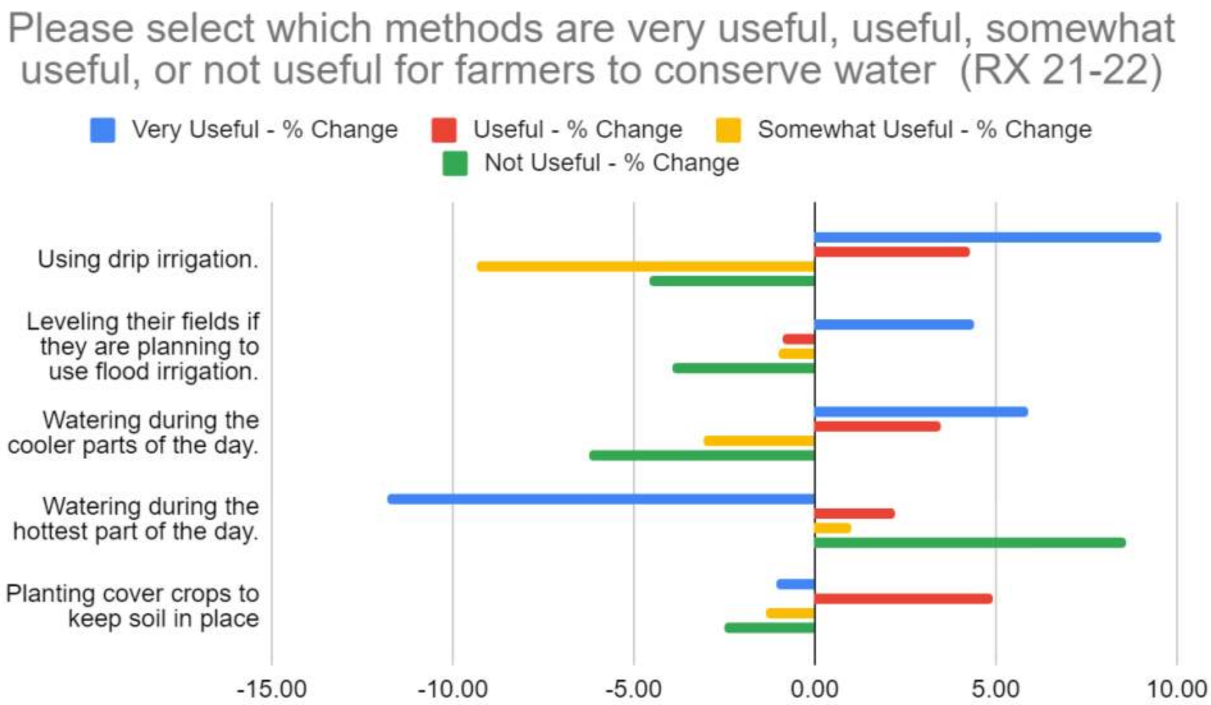
RX Watersource



Results: In looking at the totals separate by school district, APS overwhelmingly answered the drinking water question correctly. RRPS did not do as well selecting only the aquifer, this could possibly be because this isn't reinforced as much as it is in APS with other programs like The Water Utility Authority Rio Field Trip, and could also be because this lesson was in a pre-recorded video format. However, over 75% of students correctly answered the definition of an aquifer, with a 28% increase post-program.

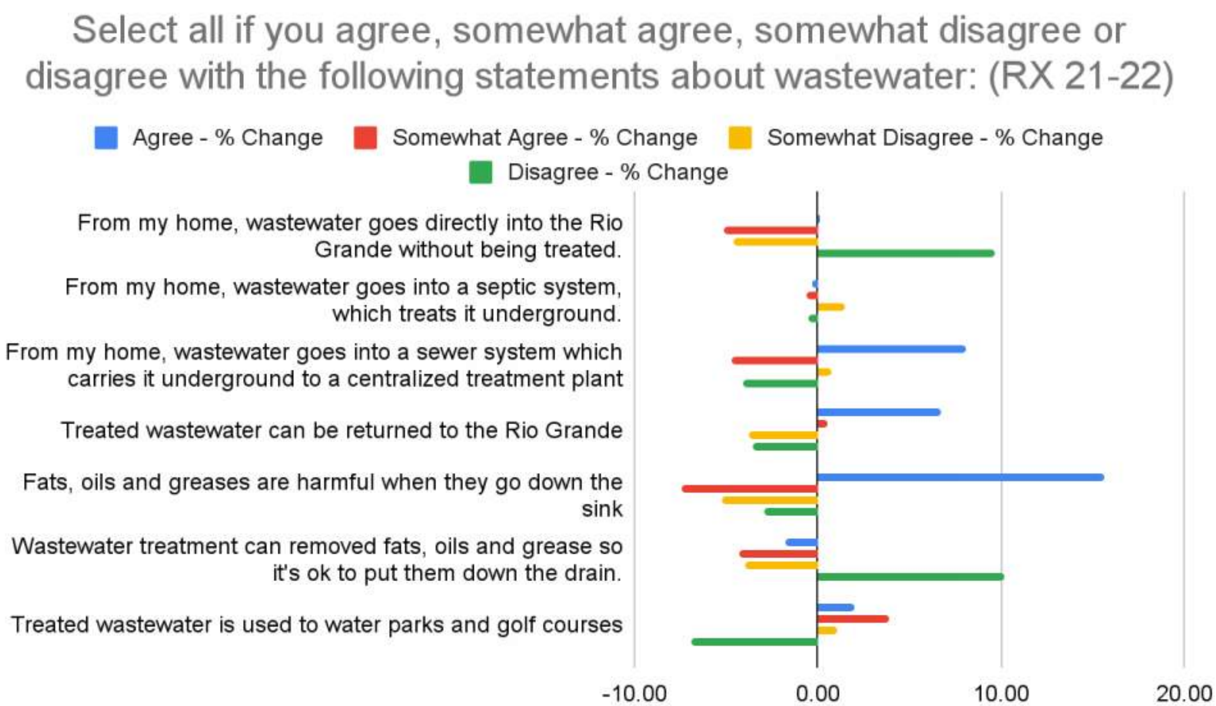


RX Farmers



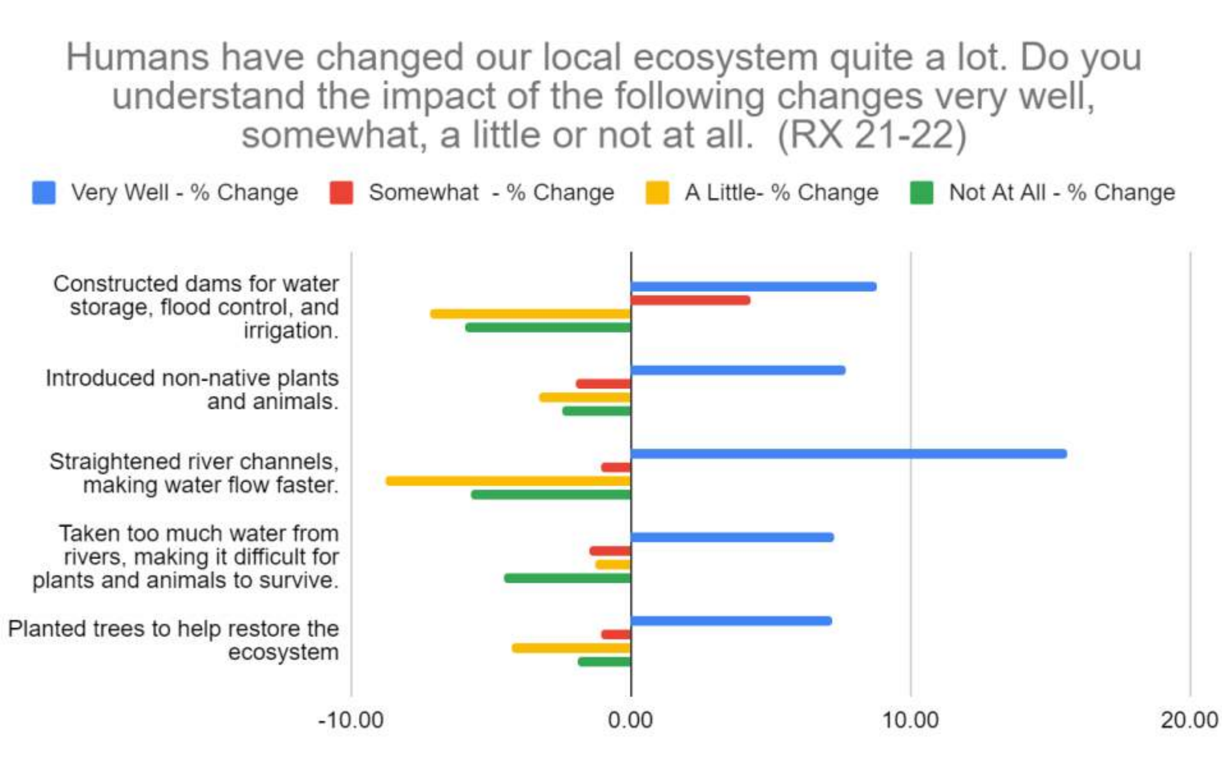
Results: Generally speaking students demonstrate an increase in selecting water conservation strategies in agriculture as "very useful" or "useful" post-program. They also increased the choices of not useful and decreased their choice of highly useful for watering during the hottest part of the day. The agriculture presentations may have touched briefly on the use of cover crops for soil health as a water conservation topic, so while selections of "very useful" decreased, "useful" increased more students may have been considering the topic in the moment, relying on previous knowledge to answer that question.

RX Wastewater

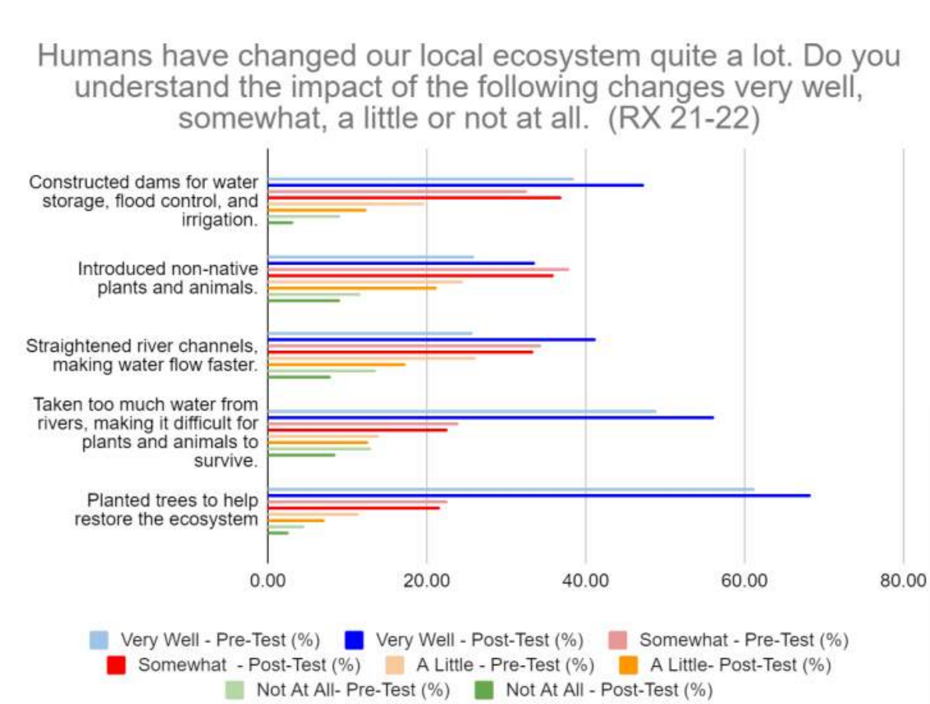


Results: Positive growth is demonstrated across all questions except the septic question which may just be confusing because it doesn't apply to every student.

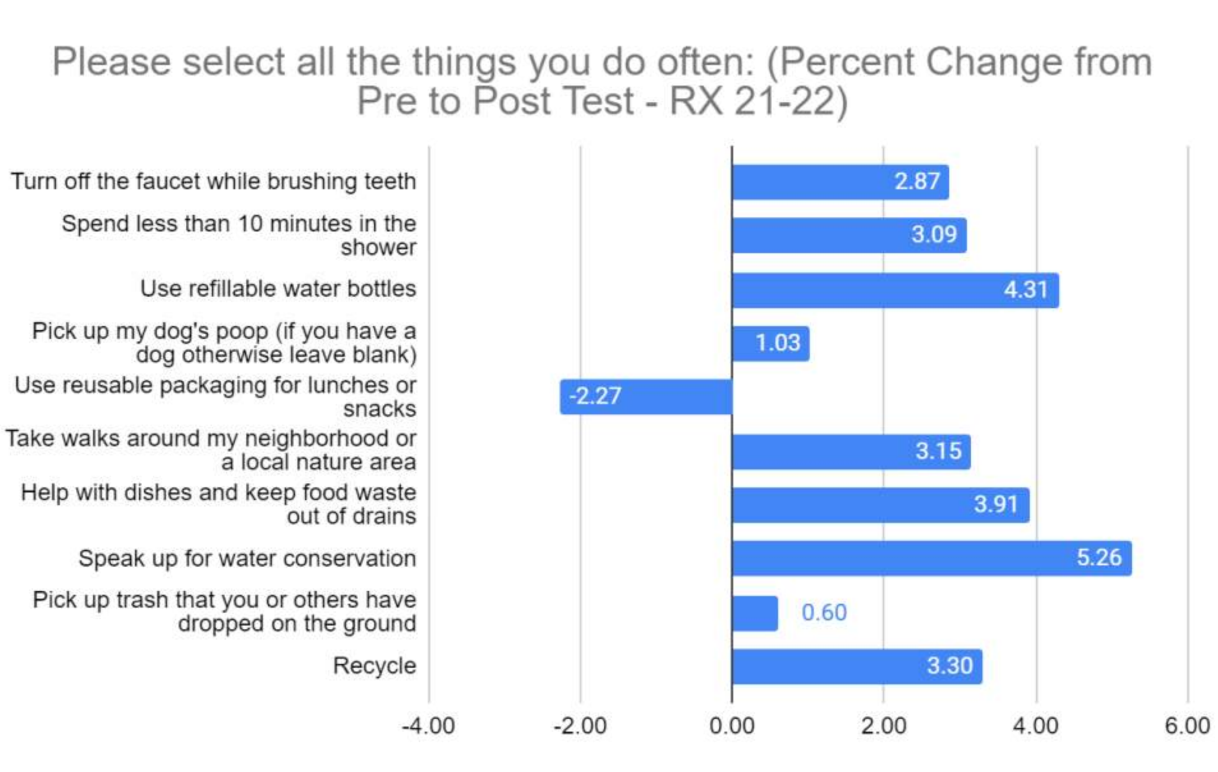
RX Confidence



Results: The goal of this question was to determine student confidence in RiverXchange learning outcomes. When you look at the percentage of total responses below a lot of students seemed pretty confident that they understood these concepts before the program - which is great! It is also great that after the program in general students increased their confidence and decreased their lack of confidence across all topics. This demonstrates they found the program helpful in supporting their understanding of human impacts on our ecosystem.



RX Behaviors



Results: Seeing around 5% change in behaviors from pre to post surveys has been consistent with past years findings. As a fifth grader you might not be changing your behaviors significantly due to family and community behaviors and culture. However, it is exciting to see that the largest percent change was in students speaking up more for water conservation. At this age, this has the potential to shift family and community behaviors more than other behaviors due to the rippling effects of more people taking other actions to conserve and protect water.

The decrease in using reusable packaging could be due to students' increased awareness of food packaging in the cafeteria or home packed lunches or an increased use of single use plastics due to covid concerns.

Appendix A

RiverXchange Virtual Field Trip 2021-2022

1. What are we trying to teach students in this activity?

Essential questions:

· What is a floodplain and why is it important? (Rio Bravo)
· How has the Rio Grande floodplain been changed by humans? (Rio Manso)
· What efforts are being made to conserve the Rio Grande Floodplain? (Rio Nuevo)

2. How can we tie this activity to our teaching goals:

Learning Objectives	Methods
The riparian ecosystem of the Rio Grande is shaped by natural flooding.	Observation and finding evidence of: ● riparian habitat - plants and animals that depend on the ecosystem. ● the role of the Cottonwood tree as a keystone species and its dependence on flooding for its life cycle.
Human impacts have reduced or eliminated flooding.	Observation and finding evidence of: ● Human impacts ● Reduced flooding
Conservation efforts are now being made to rehabilitate and strengthen the riparian ecosystem	● What monitoring methods can be used to determine the health of the ecosystem? ● What is being done to restore this ecosystem?

3. How can we tie this activity to standards?

Using the NGSS framework to explore **Phenomena** and support **Claims** based on **Evidence** and **Reasoning.**

Performance Expectations	DCIs
5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers and the environment	LS2.A Interdependent Relationships in Ecosystems
5-ESS2-1 Develop a model using an example to describe ways in which the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	ESS2.A Earth Materials and Systems ESS2.C The Roles of Water in Earth's Surface Processes
5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment	ESS3.C Human Impacts on Earth Systems

4. How should this lesson be organized?

I. Introduction
   a. First, the presenters should introduce themselves by name, position, and organization.
   b. A presenter will take the students through the agenda.
      i. Ask students what they have already done in class—this should be the Rio Bravo and Rio Manso activities. Today, we will be taking them through the timeline again, reviewing and demonstrating aspects of both models that are still present in the Bosque still today. Then, we will be introducing a new concept—Rio Nuevo and doing the model with the river as it is today!
   c. Pan the camera around, can students identify where we are? It is the Bosque!
      i. Give the students a brief history of the Open Space Division and its connection to the Bosque and other public lands.
      ii. Describe the importance of understanding and connection to the land. The land needs us just as much as we need it. Part of understanding the land is making observations and questioning the world around us. This will lead directly into the next activity "I notice, I wonder, it reminds me of"

II. "I notice, I wonder, It reminds me of"
   a. This activity is meant to engage students' observational and thinking skills - to turn on their "nature" brains!
      i. Let students know you will describe the activity first and then bring the camera to focus on a smaller, up-close frame of our object to be observed.
      ii. Walk students through each prompt. Describe how these prompts relate to the scientific method (observation, questioning, hypothesis)
      iii. I notice (the foundation of an observation): shape, size, texture, color, location, etc. These are simply what we see, without labeling their function or what we assume is the function.) Ex: "I notice a long, thin shaped object that is bumpy, brown colored with small lines on it."
      iv. I wonder (the foundation of questioning): Take any statement that we think applies to our object and turn it into a question. "I wonder if something was eating this object that caused the lines? I wonder if this is a plant? I wonder if it is alive? I wonder if it is dormant?
      v. It reminds me of: (the foundation of a hypothesis): Making connections to what we already know or can remember helps us make an educated guess to answer our questions. For the purpose of this exercise, we are simply practicing making connections. "It reminds me of a spiral. It reminds me of the colors of sunsets in Albuquerque."
      vi. Complete the activity, prompting and modeling as you go.

III. Rio Bravo
   a. Discussion: Students will have been taken through the Rio Bravo exercise. RX presenter will ask:

i. Do you remember what Rio Bravo means?
ii. How was the river shaped?
iii. What did you place down in and around the river?
    1. Yes! You placed down animals and plants in and around the river. We can still find evidence of the wild river today even though it has changed. Can you name some of the plants or animals that you placed in the Rio Bravo?

b. Activity: What evidence can we find of the Rio Bravo and ecosystem in the floodplain? (A floodplain is a riparian ecosystem so what we are looking for is evidence of a variety of plants and animals that depend on the river).

    i. Plant #1 - Coyote Willow (walk around and "see" your first plant)
        1. "Look at this plant! Wow, it's everywhere here in the Bosque. It's here… over here… and even over there! (point camera.) Let's get a closer look. It has long skinny leaves and smooth bark on the branches.
        2. What do you think it is? Vote with your card or write the name on a paper and hold it up.
        3. You're right! It's a coyote willow! The way you can tell is that it's a shrub that always grows next to water, it's short, and it has long skinny leaves. It's one of the most common shrubs around water (riparian ecosystems) in New Mexico. Beavers LOVE to eat its branches, but it's also eaten by porcupines, deer, and rabbits.
    ii. Animal #1- Beaver (walk to an old beaver chew)
        1. "What do you think has been here?" It looks like something has used long incisors to chew horizontally through the bark. It is a beaver!
        2. Introduce the beaver skull and discuss other adaptations that beavers have that allow them to live in this riparian ecosystem.
            a. Castor oil that they use to waterproof their fur
            b. Ear flaps that close so they don't get water in their ears
            c. Extra eyelid to see underwater
        3. Could you live in a riparian ecosystem? What adaptations do you have?
        4. Coyote Willow is not the only plant that beavers will rely on!
    iii. Plant #2- Cottonwood
        1. "If the porcupine is living and eating this tree, we should probably know what it is. Let's look at the leaves and see if we can figure it out. The leaves aren't on the tree right now because it's winter, so let's find one on the ground. (get leaf). Okay, here it is - it has a heart-shaped (or triangular shaped) leaf with a flat stem that's also called a petiole. And if I look around, I see them everywhere in the Bosque. I can even see them on the other side of the river! (Span the Bosque then point camera to other side of river.)"
        2. "What do you think it is? Vote with your card or write the name on a paper and hold it up."
        3. "You're right! It's a cottonwood. And not just any cottonwood, but a Rio Grande cottonwood. These trees are a very important species in the Bosque. They provide food for many animals, like the porcupine, beaver, deer, rabbits, and insects. Birds eat the insects that feed on the cottonwood. PLUS, many animals use them for their homes! Porcupines sleep in them, and so do great horned owls. Birds make their nest in them. Squirrels live in them. They are a

very important part of a healthy Bosque ecosystem. And the way you identify them is by looking for their heart shaped leaves."

iv. Animal #2- Porcupine
1. Look up in the cottonwood tree: do you see anything there?
a. Option 1: I see a porcupine! It is just a small bundle of quills that is resting in the nook between two branches!
b. Option 2: I see a bunch of branches without bark on them. Who did that? It was a porcupine!
2. Porcupines live in the canopies of cottonwood trees because that is where their food is! Porcupines eat the same thing as beavers, which is the cambium, or inner layer, of the tree behind the bark. Beavers are chunky and unable to climb, so they cut down trees to get to their food, whereas porcupines are able to climb trees.
3. Can we find any evidence of porcupines on the ground?
a. Option 1: I found a track! This track has a bunch of texture on its paw pad. Do you have socks that have texture on the bottom? That helps you stick to the floor and not slide. I bet the texture on its paw pad will help it climb!
b. Option 2: I found some scat! How do I know that it came from the porcupine? It's located in the middle of the trail, which is right under a big branch of the cottonwood tree. We can also distinguish scat by its shape, size, and color!

c. Conclusion
i. Even though the river might not be as wild as it used to be in Rio Bravo, we still have an interconnected system of animals and plants that still live here today! Let's investigate how humans have altered this system in our next section, Rio Manso.

IV. Rio Manso
a. Discussion: Students will have been taken through the Rio Bravo exercise. RX presenter will ask:
i. Do you remember what Rio Manso means?
ii. How did humans alter this ecosystem?
1. Yes! They used jetty jacks, added homes, dams, acequias, and invasive species.
iii. What happened to the river?
1. Yes! The river was channelized and no longer was the braided, meandering river that we once knew.
b. Activity: What evidence can we find of the Rio Manso in the Bosque today?
i. Plant #3- Ravennae grass. Ravennae grass is an invasive species that was brought to New Mexico from Africa as an ornamental and also for soil stabilization. Ravennae is drought tolerant, deer tolerant, and frost tolerant so it thrives in New Mexico. Although it doesn't allow other plants to thrive alongside it. It does such a good job, it outcompetes our native grasses.
1. Can you name some ways in which invasive species can travel?

a. Underneath boats/aircraft, hikers' shoes, bringing them on purpose (ornamental, biological control, soil stabilization)
b. So many more invasive species have made their way to the Middle Rio Grande, but most came on purpose. We just didn't know at the time how problematic they would be.

ii. What happened in the Rio Manso activity that allowed for the invasive species to move in? Yes, they took away vegetation like the cottonwood trees and native shrubs to make room for the expanded population and their homes! Let's take a closer look at the cottonwood trees here.
   1. Cottonwood trees are a keystone species, which means this ecosystem largely depends on their existence and their removal would be catastrophic.
   2. To understand better how our cottonwood trees are doing I want to measure their height. Height in a cottonwood tree doesn't necessarily determine its age, but rather how many resources are available to it.
      a. Explain to students how we use a tangent gauge in order to measure a tree's height. All staff to measure distance to a tree, have students guess the presenter's heights, and then have the students add the measurements to get a calculation.
      b. Trees that are between 60-70 feet are full grown cottonwoods, but with limited resources. Those old cottonwoods that were close to the water will reach up to 90 feet tall! We can't determine if the whole forest has insufficient resources by just one tree. Let's measure the height of another!
         i. Proceed with the same process with another nearby tree.
      c. See how those two trees have a very similar height? Look around at the canopy, what do you notice about the height of all of these trees? Yes, they are mostly the same! We have a very uniform canopy in the Rio Grande Bosque. What resource do you think the trees are not getting enough of? Yes, water! Let's take a look at why these cottonwoods are not getting enough water.

iii. Do you remember what the impact of jetty jacks, levees, and dams did to the Rio Grande in the Rio Manso activity? Yes! They channelized the river or made it straight.
   1. One reason that these cottonwood trees are not getting enough water anymore is because the river does not flood as it would have naturally done before construction.
   2. I need your help to run a little science experiment! I want to see whether a meandering river or a channelized river goes faster.
      a. I want you to form a hypothesis, can you share what you predict will be the answer?
      b. Now, I am going to run two different tests. One in which I will walk in a curved line and one in which I walk in a straight line, both the same length. When I say go, begin counting with [presenter #2]

c. Was your hypothesis correct? The meandering river does run slower! When our river is allowed to meander in cycles slowly and then quickly throughout any given year, the outside to those curves it allows for sand to be deposited and then for cottonwood seedlings to grow. But without those sandbars and moist soil in the floodplain, what happens to our cottonwoods? The seeds cannot grow!

c. Conclusion
   i. Humans have fundamentally altered the Middle Rio Grande, but all it not lost! Humans have also begun to take measures to support a new relationship between our lives and the river. This next section, we have not discussed yet and it is called Rio Nuevo or new river.

V. Rio Nuevo
   a. In the last two models, we were describing what had happened in the past. Rio Nuevo is happening right now and you will ultimately be the ones that get to decide what our river looks like in the future. I want you to be the engineer for me. What would you do to restore the river and make it look more like Rio Bravo?
      i. As the students submit their answers, we will go one by one and explain how that would alter the model. The model will have been already set up as Rio Manso prior to the field trip starting.
      ii. Overbank flooding: during years with high winter snowpack there will be lots of water melting and flowing down into the watershed. Engineers could decide to allow for overbank flooding, which would give the Rio Grande cottonwood seedlings a chance to grow! It would also allow for a better cycling of nutrients so that native species have a better chance of competing with the invasive ones.
      iii. Pole plantings: one way to counteract the decreasing number of cottonwoods is by cutting a long, young branch of an existing cottonwood tree and planting it directly into the ground so that it touches the water table. This branch will then grow roots and form its own, independent tree without the need to grow the trees from seeds.
      iv. Wetland construction: land managers can create new ponds and wetlands that support the variety of wildlife that used to have a home in the Bosque. Some of these are created by allotting space, constructing the ditch with big machines, and providing water as has been done at the Open Space Visitor Center.
      v. Fuel-wood reduction: in earlier years, the overbank flooding that would occur would saturate the branches and leaves that had fallen on the ground and allow them to decompose. It would also act as fire suppression. We now need to manually need to stop these fires because the Bosque is dry and has a lot of fuel. One way to stop these fires is by cleaning the area of downed trees and branches, reducing the fuel.
      vi. Creation of secondary channel: the river used to have many channels as it flowed down the valley. In areas in which a bank may be too high, land managers can remove the excess bank and create a side channel that has enough flow to allow cottonwoods

to germinate and establish themselves. Sediment from these banks can be replaced in the river to provide for sandbars, which is habitat for certain species (silvery minnow).

vii. Removal of exotic species: Many different groups have taken to removing a number of invasive species such as saltcedar, Russian olive, Siberian elm, and others. The Open Space Division hosts spring cleanups every Saturday from April through mid-may in which families are welcomed to come out and help remove invasive species. This is something you can learn how to do!

viii. Water conservation: the amount of water that people use along the river has a large impact on the health of the Bosque and river life. Pumping more water than is being replenished each year has caused the water table to drop and has made it more difficult for native species to survive. Planting low-water use landscaping, installing rain barrels, low-flow toilets, turning off the water while brushing teeth, and taking shorter showers are things that we can do personally. We can also ask businesses and other entities to self-impose water-use limits so that we are all working together.

ix. Jetty Jack Removal: Today, the riverbanks and levees are quite stable. The jetty jacks are seen as a danger to emergency vehicles moving through fires, eye sores, and ultimately the channelization of the river does not benefit the Bosque. Land managers can try to remove the jetty jacks, although it is difficult to do given their size, weight, and difficult access.

x. Monitoring: an important part of managing the Bosque is to understand what is happening to the plants, animals, water table, and other ecological functions. Monitoring is the process of collecting, compiling, and analyzing that information. There are many organizations that will do monitoring throughout Albuquerque in order to ensure that what we do going forward will only benefit the Bosque. So many of our previous actions had unintended consequences and monitoring is one way of making sure that we do not repeat mistakes.

VI. Conclusion

RiverXchange Virtual Field Trip Synopsis 2021-2022

I. Introduction (Ellie: 10 minutes)

II. "I notice, I wonder, It reminds me of" (Erin: 10 minutes)

III. Rio Bravo
   a. Discussion: (Ellie)
   b. Activity
      i. Plant #1 - Coyote Willow (Ellie: 5-7 minutes)
      ii. Animal #1- Beaver (Ellie: 5-7 minutes)
      iii. Plant #2- Cottonwood (Erin: 5-7 minutes)
      iv. Animal #2- Porcupine (Erin: 5-7 minutes)
   c. Conclusion (Erin)

IV. Rio Manso
   a. Discussion (Ellie)
   b. Activity:
      i. Plant #3- Ravennae grass. (Ellie: 5-7 minutes)
      ii. Plant #4- Cottonwood tree / Tangent gauge (Erin: 7-10 minutes)
      iii. Model of river shape- (Erin: 5-7 minutes)
   c. Conclusion (Ellie)

V. Rio Nuevo (Ellie- 30 minutes)

VI. Conclusion (Erin)

Southern Sandoval County Arroyo Flood Control Authority

ADD
SSCAFCA_FY22 Arroyo Classroom End of Year Report (1).pdf
HERE

(21 pages)

Arroyo Classroom

2021-2022 final report

submitted by
Erin Blaz, CSWCD
June 2022

SUMMARY

The Arroyo Classroom program utilizes our natural arroyos as outdoor classrooms and brings local animals into the classroom to motivate 3rd graders to respect the arroyos as important wildlife habitat. Orilla Consulting, LLC developed the program in 2012 and initially implemented the program for 7 classes at Maggie Cordova Elementary in Rio Rancho. In 2013, the program grew to serve 20 classes. On July 1st, 2015, Orilla Consulting, LLC transferred the program to Ciudad Soil and Water Conservation District as part of the larger education and outreach efforts we are involved in throughout Bernalillo and Sandoval Counties. In the 2021-2022 school year, we served 31 classes within Rio Rancho Public Schools, reaching approximately 32 teachers and 638 students. Funding was provided for 35 classes, however one school did not follow through on the registration process. Communication was made until December of 2021, but it was clear there were significant obstacles to getting the school onboard. Beyond that, Arroyo Classroom had a successful year and continued to bring important watershed education to local schools.

Participating Schools

SCHOOL * Title 1 school	**Number of classes**	**Number of Students**
Enchanted Hills Elem.	5	122
Martin Luther King Elem.*	5	114
Sandia Vista Elem.	6	134
Maggie Cordova Elem.*	5	106
Puesta del Sol Elem.*	5	89
Colinas del Norte*	5	73
TOTALS	**31**	**638**

Sponsor

- Southern Sandoval County Arroyo and Flood Control Authority (SSCAFCA)

Sponsor provided a total of $19,300.63 in cash.

Deliverables:

All presentations were offered virtually or in-person and completed.

- Watershed Presentations: 31:31
- Arroyo Walk: 30:31
- Bird Presentation: 31:31
- Reptile Presentations: 31:31

Program Description

Essential Questions: What is a watershed and how does water move across it? What important functions do arroyos provide for humans and other creatures? In what ways can we enjoy arroyos safely and learn new things?

- Students characterize arroyos as ecosystems as well as drains
- Students identify arroyo features that support wildlife
- Students describe the plants, animals, birds and insects that depend on the arroyo ecosystem
- Students explain the ways in which arroyos receive water and the dangers of arroyos
- Students recite the rules for arroyo safety

The program consists of a four-part series of lessons, based on grade-level science standards and addressing areas of interest to SSCAFCA, such as bats, burrowing owls, ATV use, pet waste, and arroyo safety. Erin Blaz delivered two of the lessons – an introductory lesson about watersheds, and either an in person arroyo walk or a virtual arroyo walk that tours an arroyo via Google Earth. Hawks Aloft, Inc. provided the virtual bird presentations as they were prepared to and experienced in delivering virtual presentations with live birds. All lessons were adapted for the virtual setting.

This year the virtual watershed lesson expounded on the water cycle and aimed for students to recognize how water moves across hard (impermeable) or soft (permeable) surfaces. Students made predictions about how water sprayed on a sponge and a stone tile (both at an angle) would move differently to represent the function of a watershed. Then we added more to the stone tile to elaborate on the built environment, including buildings, cars and dogs. Finally, we added "pollution" using similar materials to the enviroscape to create oil, dog poop, pesticide and construction waste. In summary, this lesson introduced the concept of a watershed to students, demonstrated how surface water becomes polluted through various human impacts, and discussed the importance of keeping our arroyos clean.

The virtual arroyo walk this year began with a google earth tour of an arroyo to observe its pathway through Rio Rancho, any visible human impacts and demonstrate the draining power of arroyos into the Rio Grande. We also observed tire tracks in the arroyos and talked about not using motorized vehicles in arroyos, as they are not permitted or allowed in the arroyos, and discussed the impacts of illegal use of arroyos. We observed where the mouth of the arroyo meets the Rio Grande and observed that there was not any kind of infrastructure to clean the water as it enters the river on this particular arroyo. All classrooms received a link to SSCAFCA's Arroyo Safety video as a follow-up to the final presentation.

The in-person Arroyo Walk was approved and completed with 17 total classes. This lesson is about the unique adaptations of arroyo animals and plants, incorporates a walk out to a nearby arroyo from the school and extensive discussion about arroyo safety. The walk starts with a safety discussion about the difference between concrete-lined channels and sandy-bottomed arroyos, and emphasizes that it is never safe to go into concrete-lined channels, while sandy-bottomed arroyos can be visited when there are no clouds in the sky. Students searched for evidence of animals living in the arroyo banks, learned about how lizards and other cold-blooded animals are adapted to the desert environment by moving about to regulate their temperature. They also looked for certain adaptations of desert plants to minimize water loss in the desert. This year, students were extremely excited to go on the walking field trip, as many schools only approved the field trips in spring. A few classes even had a gray fox sighting in a stand of Elms in a drainage area used for the walking field trip.





Top left- Gray fox in Elm spotted by students at Puesta del Sol. Middle top and bottom: Students from Puesta read thermometers to learn about reptile adaptations. Right top and bottom: Students from Colinas look for wildlife evidence on Arroyo.

Evaluation

Teacher feedback for 2021-2022 was collected from 18 participating teachers. Teachers overwhelmingly say they choose to participate in Arroyo Classroom to teach about local ecology and conservation issues, incorporate more science in the classroom, to offer experiential learning opportunities and to offer learning opportunities that connect to the community. They find the presentations to be uniquely engaging and meaningful for their students, however, across the board, teachers requested for the return to in-person learning. Teacher's find that Arroyo Classroom is complementary to other 3rd grade units of study such as life cycles and animal and plant adaptations. Teachers cite that the program is particularly helpful in achieving or developing the following skills: critical thinking and program solving, communication, assessing and analyzing information, and curiosity/imagination.

Highlights from teacher feedback:

What are the greatest learning outcomes for your class as participants in Arroyo Classroom?

- "That students can take what they learned and apply it to their daily lives."
- "Students truly enjoy learning about their environment, animals and how to actively educate others."
- "My class really seemed to learn the most about how the water system within Albuquerque worked."
- "My class has become more aware of how humans can impact wildlife. They remember the animals we have learned about and are determined to keep the environment clean for them."
- "They learned a lot about their local area from habitats for rivers to arroyos."
- "Most of my students could share that the arroyos were important animal and plant habitats and that they had a responsibility to keep them clean, free of pollution and that it wasn't an area for off roading."
- "My students are more aware of their environment and are more knowledgeable."
- "They learn about arroyo safety and also about the local animals. They grow their understanding in conservation as well."
- "That they learn about the environment around them and are more aware of how to take care of it."
- "Students understand their place in protecting our arroyos."
- "Learning about the environment in which my students live. Being able to take what they learn and see it around their houses and school."

Survey Summary

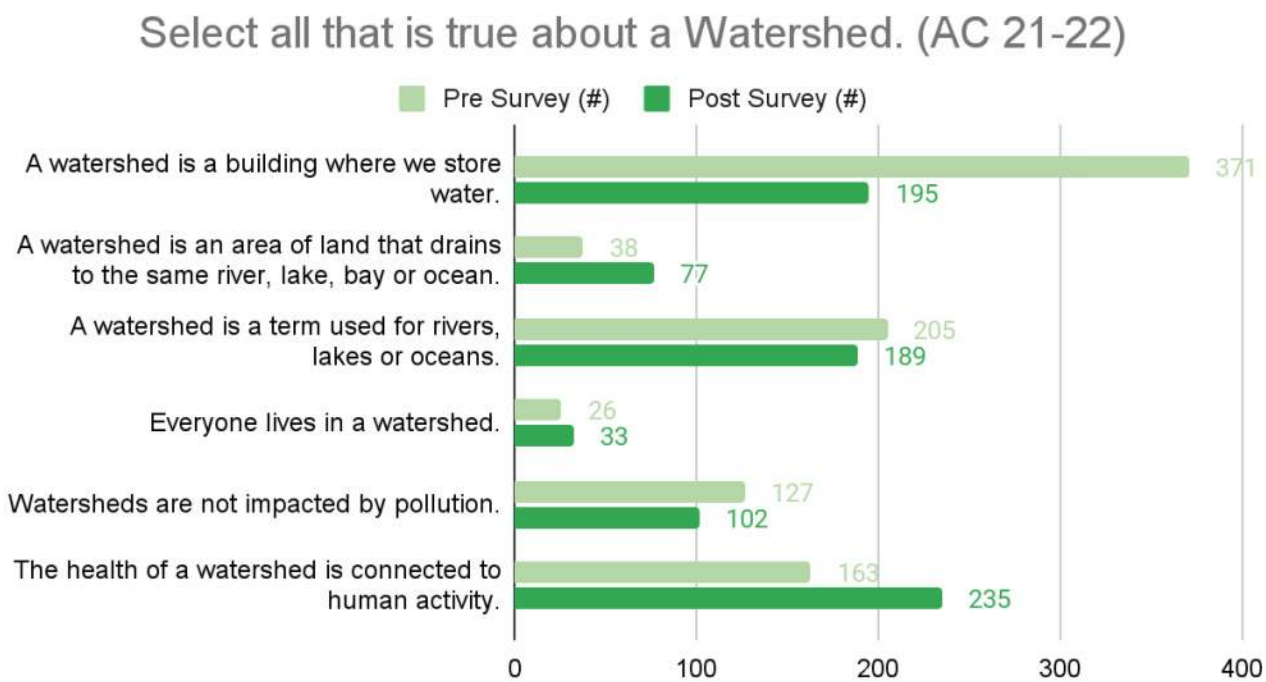
This is the third year that we've administered the pre and post surveys for Arroyo Classroom. Due to some changes in the program content for this year's virtual program, such as the availability of certain species and specimens offered by our presenters for their virtual presentations, we made some adjustments to the pre and post survey to reflect the content of the program. The survey questions were slightly more generalized and used a "check all the apply" format to address different learning

objectives.

This year we had 605 pre-survey responses and 492 post-survey responses. This we formatted the survey responses by total number of responses, rather than percentages.

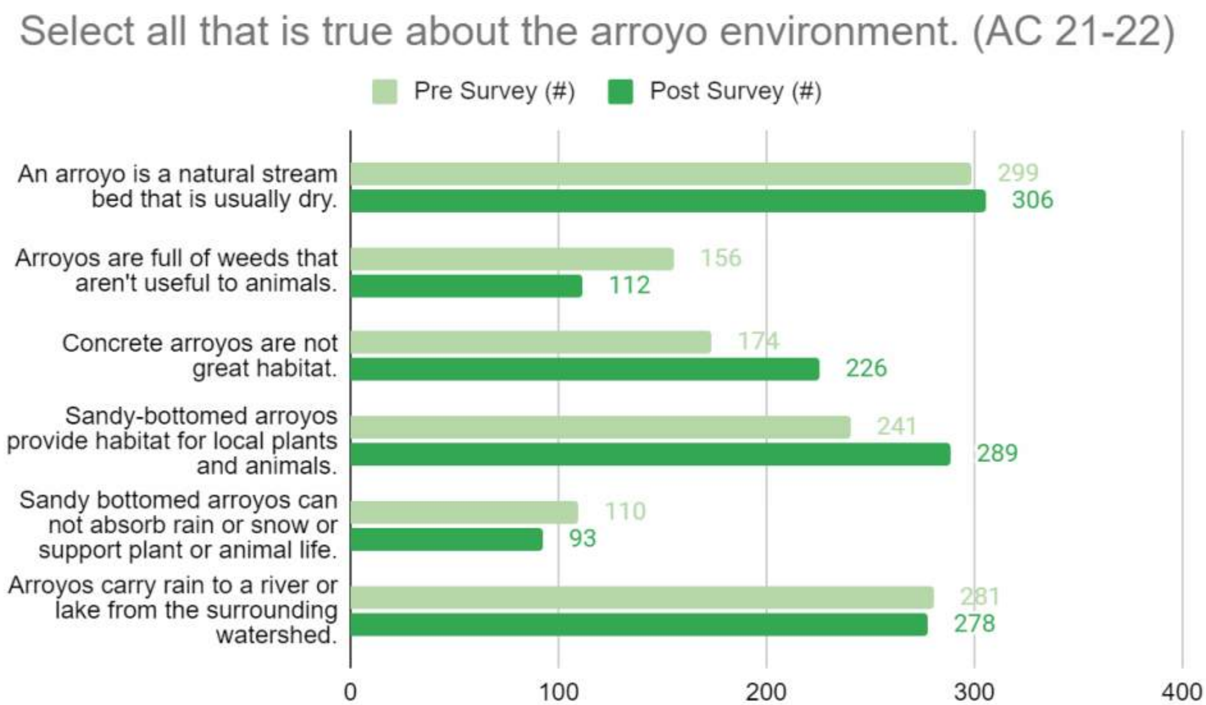
Survey Metrics:

Item 1 Watersheds



Comments
This year we do see an increase in correctly defining a watershed (an area of land that drains to the same waterbody) and a decrease in the wrong answer (a building that stores water) but not a lot of students choose the correct definition of a watershed. More students seem to understand that watershed health is connected to human activity, with almost 50% of students choosing this response. This is an important success as ultimately we want them to see themselves as a part of the watershed and that their actions matter.

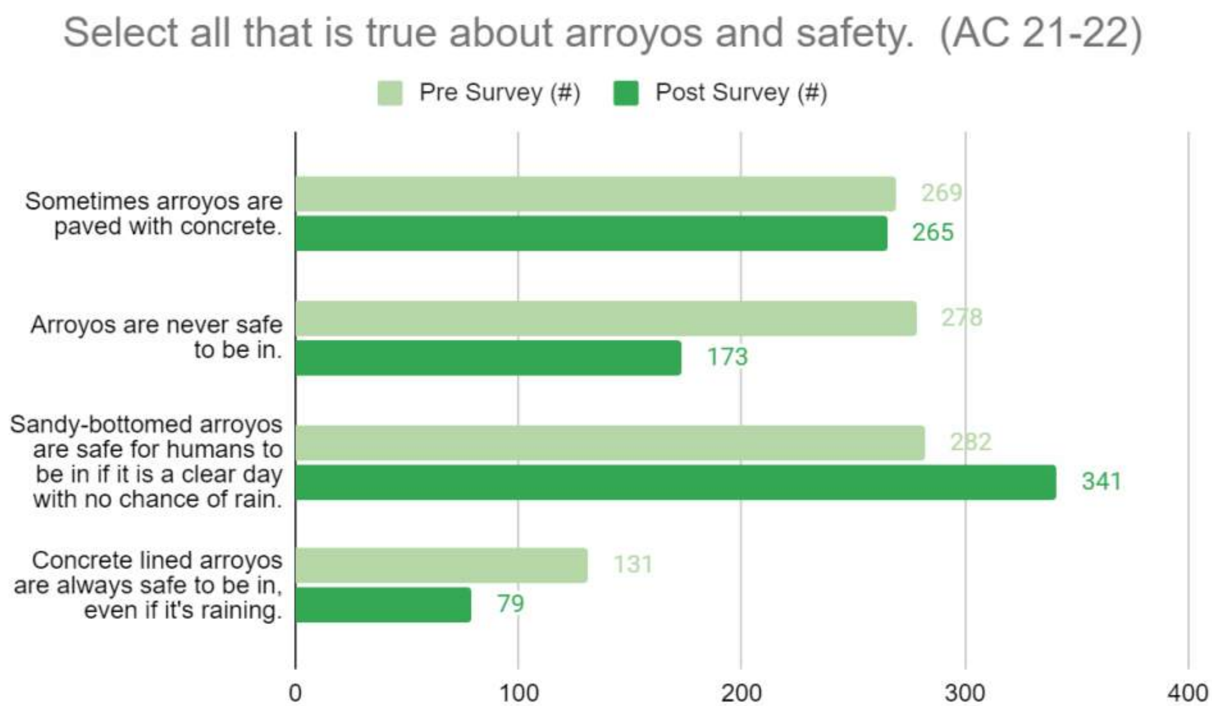
Item 2 Arroyo Function and Environment



Comments

Based on pre and post answers, it looks like the students already know what arroyos are or can easily assume based on "natural stream bed" and "carry rain" responses. There wasn't much movement from pre to post test. However, with an increase in responses about habitat and concrete arroyos not being beneficial to animals, along with a decrease in the question about weeds, students did demonstrate more knowledge about arroyos post program.

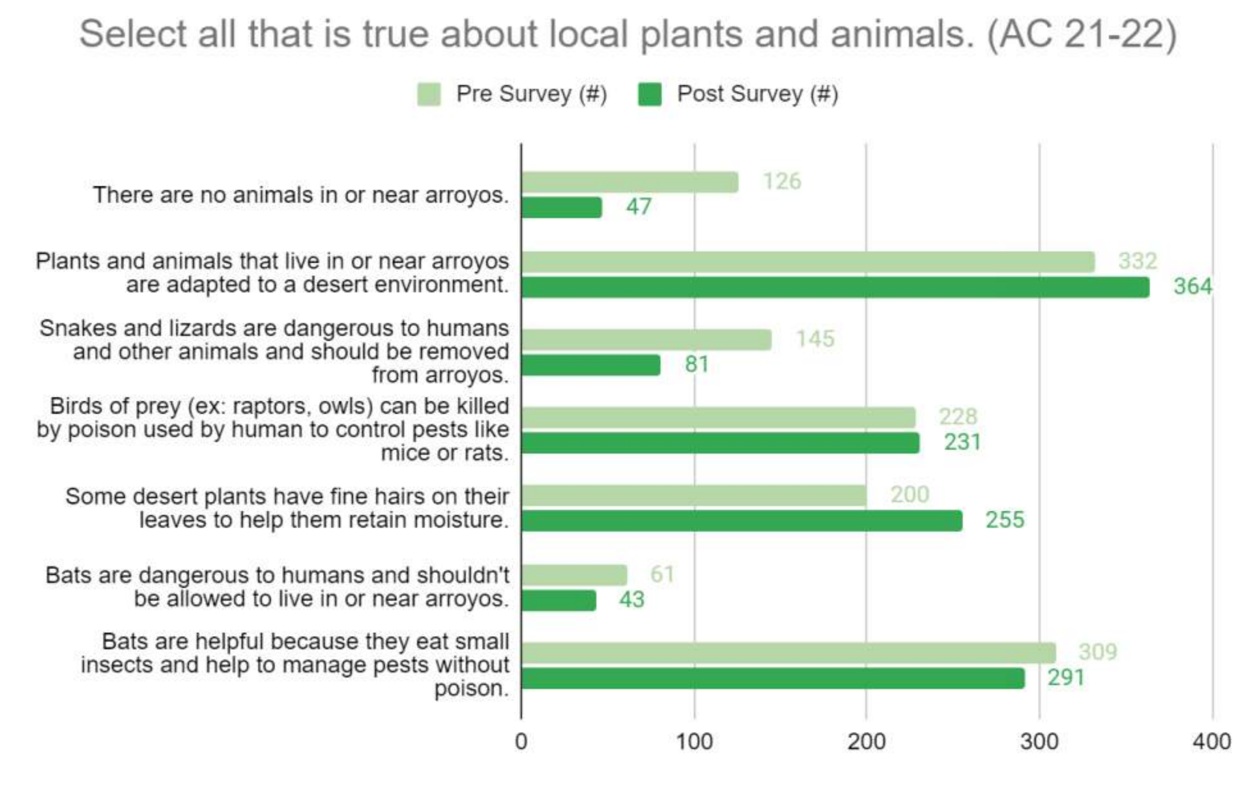
Item 3 Arroyo Safety



Comments

Positive outcomes of this graph are that more students understand the specifics of arroyo safety, demonstrated by a decrease in answers “arroyos are never safe” and an increase in “arroyos can be safe when there is no chance of rain.” However, cultural beliefs and folklore may continue the narrative that arroyos or ditches are never safe to be in, as La Llorona might come for you!

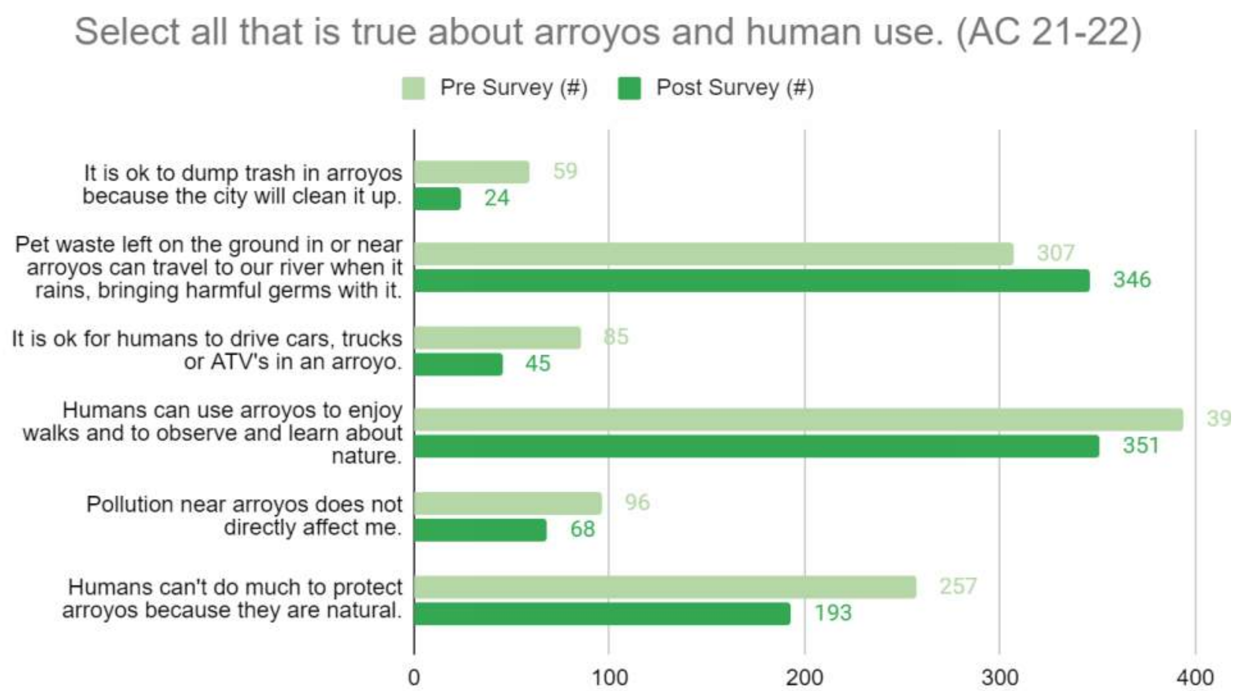
Item 4



Comments

Generally positive outcomes are displayed from these results. Possibly since the 3rd grade curriculum covers adaptations and habitats students are already primed to answer correctly on the pre-survey.

Item 5 Arroyos and Human Use



Comments

Positive outcomes for this question sequence are that there was an increase in students answering more correctly about pet waste as a river contaminant.

Appendix A

Lesson Plans (Ciudad SWCD delivered lessons)

Activity Guide for 3rd Grade – Building a Watershed

1. What are we trying to teach students in this activity?
A watershed is an area of land where all the water flows (or sheds) into a common body of water. We live in the Middle Rio Grande watershed. A natural watershed has many permeable surfaces that help to clean water. Human's build a lot of hard-scapes. As water moves downhill, it carries sediments and other materials to the river. Water is a precious resource and we can help improve the quality of the river by picking up after our pets and not littering or throwing trash on the ground.

2. How can we tie this activity to our teaching goals:

Learning Objectives	Methods
We all live in a watershed. A healthy watershed keeps water clean.	Using models to demonstrate: ● elements of a "watershed" and how natural watersheds help to clean water and move water around. ● Humans have impacts on the watershed (i.e. Hardscapes, Pollution)
The amount of permeable and impermeable surfaces in an area impact the watershed.	We observe and make claims about: ● What happens as water moves across "Hard" vs "Soft" surfaces ● The proportion of hard and soft surfaces around us. ● How this may impact our watershed.
Pollution increases in human environments. What we can do about it.	Using models we aim to demonstrate: ● Water can be polluted in human areas and is harder to clean with impermeable surfaces. All this polluted water flows to the river. Through discussion we: ● Talk about the importance of being responsible and how caring for the watershed in this way not only protects the water, but also helps the people and plants and animals that depend on the water as well. ● Picking up after our pets and minimizing our trash, and the trash on the ground helps keep our river clean

3. How can we tie this activity to standards?

Performance Expectation	
5-ESS2 Earth's Systems	**Disciplinary Core Ideas**

3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the world.	**ESS2.C:** The roles of water in Earth's surface processes **ESS2.D:** Weather and climate
5-ESS3 Earth and Human Activity	
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	**ESS3.A**: Natural resources **ESS3.B**: Natural hazards **ESS3.C**: Human impact on Earth systems

What we do (Science and Engineering Practices)	**How we think (Crosscutting Concepts)**
Developing and Using Models Analysing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Systems and Systems Models Stability and Change

4. How should this activity be organized?

Supplies:

- Large Sponge
- Baking tray
- Filter model (2 liter bottle, upside down with cotton ball, sand, rocks, leaf litter)
- Spray bottle with colored water
- hard surface (flat piece of tile, stone, concrete)
- Slideshow

I. Introduction *(5 minutes)*: **Hi everyone, I'm ------- and I'm here from a program called Arroyo Classroom - a program where you get to learn about your local environment. We are going to learn about your local environment and what you can do to protect and conserve it (Define conservation). You can ask what kids do to help the environment as an ice-breaker.**

Open Presentation

1. **Ask if they know what an Arroyo is. Picture on 1st slide.**
   An **Arroyo** is a dry stream bed. We don't get a lot of rain here, but water can flow here when it rains. Arroyos flow to the Rio Grande. Arroyo's are a part of the watershed, but we will define that shortly.
2. First, let's get a discussion going:
   - How many of you used water before you came to school? How did you use it? Where do you think all this water comes from?
   - Where do you get your water? How is it cleaned? (Rio Rancho = Aquifer)
   - Can we all agree it is important to have clean water for all (including plants and animals)?

II. What is a Watershed? What role does it play in the water cycle? (20 min)

Part A: *(5 minutes)* We are going to learn about how the land around us helps to clean water.

1. **Review the Water Cycle - precipitation, evaporation, condensation (water cycle dance video)**
   - **Important to remember water can't be created or destroyed. We are drinking the same water dinosaurs used. We have to keep what we have clean.**

   Part B: *(5 minutes)*
2. **Introduce the Watershed**
   - **What is Watershed video**
   - Anywhere water falls on land is a watershed. What isn't absorbed will continue to run or shed downhill until it collects in a body of water. A watershed is an area of land that drains to the same body of water.
   - Watershed has different names based on the body of water water ends up in. We live in the **Middle Rio Grande Watershed.** Write down the name of our watershed.

STOP PRESENTATION

Part C: *(10 minutes)*

3. **Natural Watershed Helps to Clean Water. Ask students, before each demo what they think will happen and why? What evidence or prior experiences inform them?**
   - Absorbs- permeable surfaces (spray water on sponge)

        - Moves and Collects Water- (saturation of sponge) Arroyos, Wetlands, Rivers
            - Wetlands attract water loving plants that help filter and clean the water
        - What happens to water that soaks in the ground- Filter demonstration - connect it to the aquifer.

Learning Objective: Permeable surfaces are important for filtering and cleaning water, and slowing it down.

- **Human impacts** - less natural features in watersheds, more impermeable surfaces, density of pollution
    - Demonstrate water sprayed on hard surface
    - Water doesn't absorb and it moves faster.

4. Compare water in a concrete arroyo and sand-bottomed arroyo, which moves faster?

Learning Objective: Concrete Arroyos are never safe. Sandy bottomed arroyos are ok to go in if no chance of rain.

III. Activity: What is the proportion of permeable to impermeable surfaces outside our home or school? *(10 minutes)*

1. **Observe outside -** look at the ground. How much is covered by surfaces that can absorb water like soil, sand, dirt, grass, small rocks, etc. How much is covered by hard surfaces- pavement (driveways, streets, etc). Talk about compacted soils.
2. **Guess the percentage of hard vs soft based on observations.** Students create their own pie chart- labeled Hard and Soft.
3. **What claims can we make about our watershed? What evidence supports our claims**

IV. What's In the Water?
(10 minutes)

1. **Discuss pollutants. Discuss what happens to polluted water.**
   Experiment with how "pollutants" might travel through their watersheds.
    - What is pollution?
    - What forms of pollution exist in our city? Discuss each pollutant:
        - Plastic
        - Factories
        - Motor Oil (suggest a tray under or cat litter to clean it up)
        - Fertilizers (use recommended amount) - eutrophication
        - Herbicides or Pesticides (use recommended amount)
        - Dog Waste
        - Construction Erosion/Sediment

Learning Objective: With more hard surfaces - water moves faster, picks up pollutants and heads to Rio Grande without being cleaned.

V. Conclusion (10min)

- <u>What do you think this means for our watershed - the Middle Rio Grande?</u>

The water we drink comes from our watershed. Animals and plants also depend on this water. That's why it's important that we try not to pollute either the water or the land. Anything that pollutes the land will eventually wind up in the water.

- <u>What might be ways we could reduce pollution in our watershed?</u>

By picking up trash and picking up dog poop if we have dogs.

Activity Guide for 3rd Grade – Virtual Arroyo Walk

1. What are we trying to teach students in this activity?
Arroyos function as an important flood control measure and are essential landforms in the upland desert of Rio Rancho. Arroyos are also habitat to plants that have specific adaptations for living in a desert environment that experiences infrequent flooding. We can protect arroyos as habitat and take care of them so they help with flood control.

2. How can we tie this activity to our teaching goals:

Learning Objectives (Students will be able to:)	**Methods**
Describe arroyos function as flood control.	Using visual models (google earth and drone fly-overs) to demonstrate: ● Arroyos are caused by water flows from precipitation. ● Arroyos are dry when there is no precipitation. ● Arroyos lead to a larger water source- the Rio Grande
Describe who arroyos are habitat for.	Using their experience from previous Arroyo Classroom presentations: ● Student recall animals that live in or near arroyos Using models of different climates: ● Students can state plant needs in an arid climate
Desert plants have adaptations that allow them to survive in a climate with a great temperature range, high solar impact and little precipitation. Name a local plant species	Using models we aim to demonstrate: ● Various plant adaptations such as deep vs wide roots, small leaves, fine hairs and spines. Through discussion we: ● Explore how plants can survive in the desert climate, unique traits of cactus, name a specific native plant- Four Wing Saltbush and some ways to identify and find it.

3. How can we tie this activity to standards?

Performance Expectation	
5-ESS2 Earth's Systems	**Disciplinary Core Ideas**
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. **3-ESS2-2** Obtain and combine information to describe climates in different regions of the	**ESS2.C:** The roles of water in Earth's surface processes **ESS2.D:** Weather and climate

world.	
5-ESS3 Earth and Human Activity	
3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	**ESS3.A**: Natural resources **ESS3.B**: Natural hazards **ESS3.C**: Human impact on Earth systems

What we do (Science and Engineering Practices)	**How we think (Crosscutting Concepts)**
Developing and Using Models Analysing and Interpreting Data Using Mathematics and Computational Thinking Constructing Explanations Engaging in Argument from Evidence	Patterns Cause and Effect Scale, Proportion and Quantity Structure and Function Systems and Systems Models Stability and Change

4. How should this activity be organized?

Materials:

- **Google Earth maps slideshow of arroyo in Rio Rancho**
- **Native Plant and Desert Adaptation slideshow**

I. **Introduction**: This is our final presentation for Arroyo Classroom. Today we are going to learn more about the geography of arroyos and native plants that live in arroyos. Icebreaker: What have you learned so far?

II. **Google Earth Arroyo Tour**
   A. Introduce map and landmarks (Albuquerque, Rio Rancho, Sandia Mountains, Have students recall the name of our river)
   B. Review Watershed: discuss where the water flows to from different points in the land, begin to draw attention to arroyos on the map.
   C. Upper Watershed: Discuss how the arroyos are converging from smaller arroyos, note the area around the arroyo has roads but isn't developed yet. Remind students how

important our voices can be to help share what we've learned in Arroyo Classroom so everyone who lives here and might eventually live here can do their part in caring for our environment.

D. Middle Watershed: Point out that there is more housing, development and hard (impermeable) surfaces at this point in the watershed. Bring their attention to the tire tracks in the arroyo.
    - What are these tracks from?
    - What might the impact be from driving motorized vehicles in the arroyos?
    - Share that it is illegal and why. Discuss other options for those kinds of activities where it is legal.

E. Lower Watershed: Show the mouth of the arroyo meeting the Rio Grande
    - Ask: Do you see anything in place that would remove garbage?
    - Poll students: 1. Who has seen trash in an arroyo? 2. Who has seen trash larger than a television or microwave? 3. Who has seen trash larger than a couch?
    - What can we do to help keep our arroyos clean and safe for all?

III. Adaptations of native and drought-tolerant plants

A. Introduce desert plants, share some fun facts about Yucca - state flower, edible roots - yucca fries.

B. Compare climates - show side-by-side of a tropical climate (dense vegetation, cloudy, waterfall) vs. arid climate (sparse vegetation, sunny, no water). Talk about how plant's needs are different in these climates.

C. Plant Adaptations
    i. Dormancy
    ii. Root systems (tap root or surface)
    iii. Small leaves
    iv. Fine hairs on plants

D. Cactus
    i. True or False Game
    ii. Why do Cacti have spines video
    iii. Photosynthesis and stomata

E. Four Wing Saltbush
    i. Adaptations and traditional uses of fourwing saltbush.

Arroyo Classroom Scavenger Hunt 

Draw or describe each finding, such as size, color, shapes, texture, smells, location and more. You can even write questions you have about what you found! Please respect the wildlife and take an adult. Good luck!

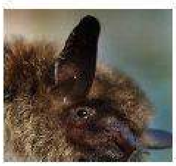
- ❏ Wild animals tracks
- ❏ A plant without leaves
- ❏ A rock that feels warm or cold
- ❏ Cactus
- ❏ A plant with a color other than brown or green. What color?
- ❏ A wild animal on the ground
- ❏ A narrow leaf on a plant
- ❏ A hole in the ground made by an animal
- ❏ A bird in the sky

Appendix B
Supplemental Materials

-SSCAFCA Activity Book and Educational Videos:

KNOW YOUR ARROYOS
ENJOY • RESPECT • PROTECT

-SSCAFCA handouts:



Did you know?

SSCAFCA protects our community from flooding and erosion caused by big rain storms, and works to keep stormwater clean. Stormwater flows down arroyos into the Rio Grande.

Bugs like to live in stagnant water that collects in ponds and low places in the arroyos. Insects like mosquitoes can carry diseases that make us sick.

Almost all U.S. bats feed exclusively on bugs, and 1 bat can eat between 600 and 1,000 mosquitoes and other insect pests in just one hour. One bat can eat its own weight in insects in a single night!

SSCAFCA provides bat houses to encourage bats to make their homes near our arroyos, and especially near detention ponds where stormwater runoff is captured and allowed to slowly drain.

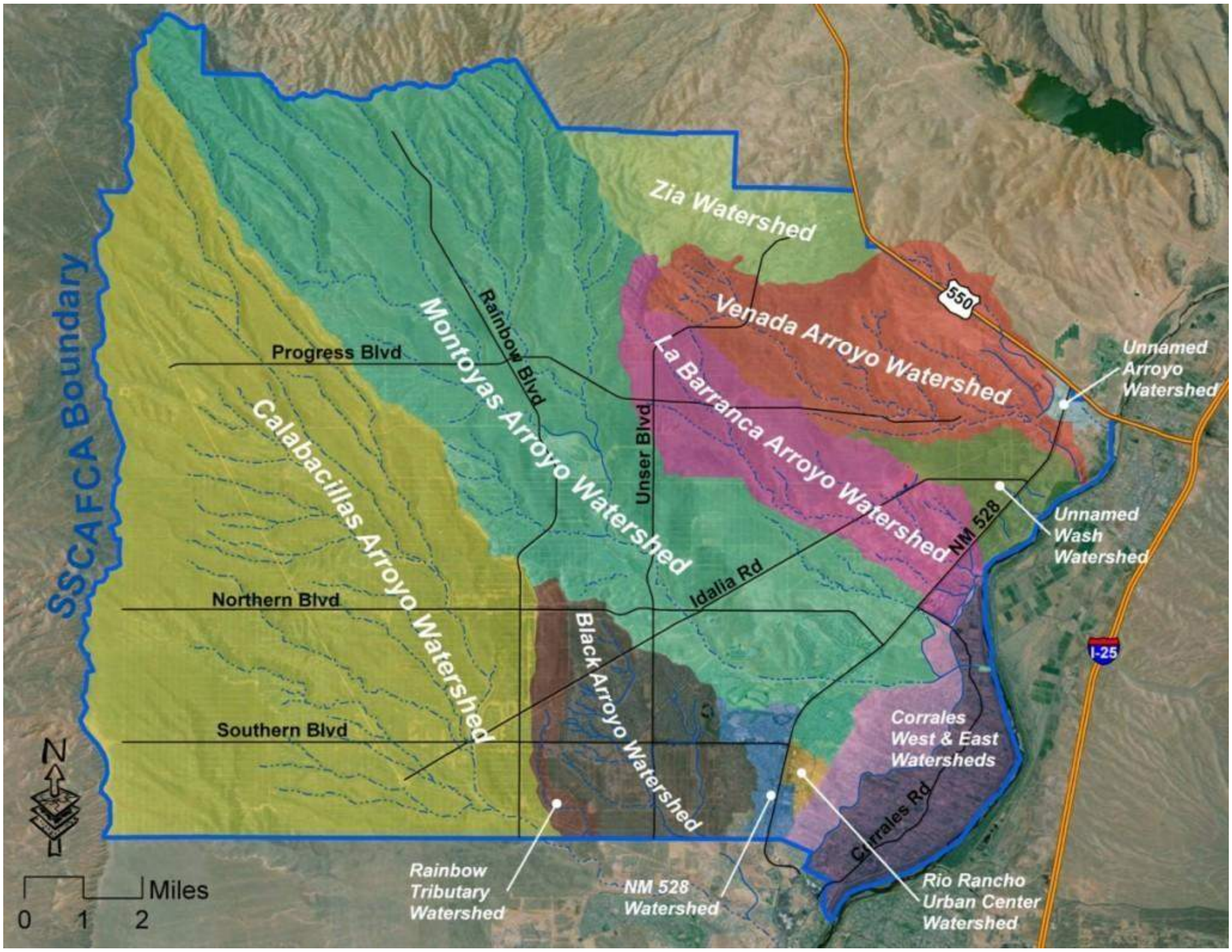
The more we help bats, the more pests they eat, so we don't have to spray pesticide that could wash down to the Rio Grande and pollute it.

Brought to you by:

SSCAFCA

SOUTHERN SANDOVAL COUNTY ARROYO FLOOD CONTROL AUTHORITY

SSCAFCA watershed map:



Arroyo Safety Video:
Arroyo Safety

Albuquerque Bernalillo County
Water Utility Authority

Water Authority distributed educational bill stuffers, ran radio ads and television advertising.

See the Water Authority television advertising at https://youtu.be/AJojsyJfnK4.

WAITING FOR COPY

Town of Bernalillo
"The City of Coronado"

Stormwater tips are printed and distributed in the town's water bills throughout the year.
This includes 3,500 copies each month.

Town of
BERNALILLO
SEPTEMBER 2022
"The City of Coronado"

Mayor
Jack Torres

Councilmembers
Dale Prairie
Sharon Torres Quintana
Phillip Valverde
Vincent Montoya

Town of Bernalillo Recreation Department Presents:

BERNALILLO YOUTH BASKETBALL PROGRAM 2022-2023

Registration begins Monday, September 12, 2022
Last Day to Register: Friday, September 30, 2022
PROGRAM OPEN TO BOYS & GIRLS AGES 5-13 YEARS OLD
Participants must be 5 years old by October 1, 2022.
Participants turning 14 before January 1, 2023 will not be eligible.
PREVIOUS BASKETBALL EXPERIENCE IS NOT REQUIRED.
No late registration applicants will be accepted.

PROGRAM FEES:
$60.00 per participant (*Due at Registration*)

SEASON DURATION:
10 game regular season

DIVISIONS:
Peewee Division - Ages 5 & 6
Junior Division - Ages 7 & 8
Minor Division - Ages 9 & 10
Senior Division - Ages 11-13

Register at:
The Town of Bernalillo Recreation Center
370 Rotary Park Road
Call for more information:
(505) 771-2078 or
(505) 771-1262

Town of Bernalillo's Annual

SCHOOL SUPPLY DRIVE

Accepting school supply donations for the young students of Bernalillo. Supplies are given to students at La Escuelita, Carroll Elementary, and Bernalillo Elementary.
Drop off supplies at Town Hall.
ALL BRAND NEW SUPPLIES SUCH AS: BACKPACKS, COLORED PENCILS, CRAYONS, MARKERS, PAPER, GLUE STICKS, AND SO MUCH MORE IS NEEDED! CALL 867-3311 FOR MORE INFO

BERNALILLO KIDS COAT DRIVE

We are collecting new coats for the youth of Bernalillo.
Please drop off donations at Town Hall now through November 18th
All child sizes are needed!
If your child needs a coat, please contact 867-3311 or stop by Town Hall at 829 Camino del Pueblo, Monday-Friday, 8am-5pm.
SHARE THE WARMTH!

-NOTICE - ROAD RUNNER WASTE - TRASH SERVICE FEE INCREASE

There will be a service fee increase of for trash services for each resident in the Town.

This is due to fee increase in several areas:
- Cost of fuel per gallon
- Disposal at landfill
- Disposal for recyclables

The new price for residential cart fee is $18.42.
THIS WILL GO INTO EFFECT ON SEPTEMBER 1, 2022 & WILL BE REFLECTED IN THE BILL PROVIDED IN OCTOBER 2022.

YOU MIGHT SEE A CREDIT ON YOUR WATER BILL!

The Town's Utility Billing Department has been hard at work auditing our history files and making sure our customers are being charged correctly on their billing statements. This audit process has indicated that ***some*** customers will be receiving a credit to their account. **If you are one of the customers who will receive a water credit, you will see that reflected beginning in the statement for this month!** The Utility Billing Department *will not* be issuing checks or cash for these credits, we will be applying them directly to the account – which is why your bill may be a little lower than you expected. **Any further inquiries about this can be made in writing to joshua.lujan@tobnm.gov, you must include your utility billing account number, name, contact information, and inquiry request.** *Disclaimer: not every utility billing customer will be receiving this credit.*

KEEP IT CLEAN BERNALILLO

Did you know that fats, oils and grease are draining our drains and sewers? Avoid pouring FOG (Fats, Oil, Grease) down the drain!

Fats, Oils, and Grease are bad for the community. When FOG is washed down pipes, it sticks and hardens. Water in the sewer slows down and starts to produce a foul odor. The FOG can block up the entire pipe, causing sewer backups which are dangerous and cost you a lot of money. Follow these simple steps:
- Pour all greasy/oily waste from pots/pans/fryers into a grease waste container (like a recycled coffee tin can).
- Scrape all food wastes into the trash
- Clean spills with towels and absorbent materials, then throw into trash
- Get on a schedule for regular grease cleaning.

Fats, Oils, and Grease (FOG) can:
- Congeal in underground pipes, cause blockages, and possibly damages pipes and cause sewage to contaminate the area.

For more info contact Public Works Department at 505-771-4832

THE UNIVERSITY OF NEW MEXICO

BEMP
Bosque Ecosystem Monitoring Program

BOSQUE SCHOOL
Challenging Education

Middle Rio Grande Stormwater Quality Team Final Report prepared by the Bosque Ecosystem Monitoring Program

JULY 30, 2022

1.1 COMPREHENSIVE OVERVIEW

Historically, culturally, ecologically - the Rio Grande is the heart of our region and the primary resource by which New Mexico's young people familiarize themselves with water. Utilizing its ecosystem as "classroom", BEMP's stormwater science outreach education program aims to teach young people how the health of the Rio Grande is directly related to the health of the surrounding watershed and how they can be stewards in helping to keep the Rio "Grand".

To this end, **7,840 students** throughout Bernalillo and Sandoval counties connected with their local watershed through participation in BEMP activities throughout the 2021-2022 school year. 845 contacts of this total were engaged through purely stormwater science specific lessons.

Due to ongoing pandemic restrictions in the 2021-22 school year, our curriculum shifted to virtual and physical formats to make our activities more equitable and accessible, including adaptations to our stormwater science curriculum to best fit the ongoing COVID-19 scenario. However, as in-person programming became more possible in the 2021-22 school year, in-person visitation to school campuses and the bosque once again became a successful venue for stormwater science education.

In consideration of the implications of COVID-19 on our communities, BEMP's stormwater science program featured synchronous and asynchronous learning resources, as well as in-person programming opportunities. Synchronous resources are remote, live, lessons that include stormwater science concepts and/or projects. Asynchronous curricular components are self-led, virtual lessons that represent a version of the regular stormwater science class and 1-page summer activities; BEMP currently offers five different, 30-minute asynchronous lessons.

Throughout the pandemic, BEMP has continued to support students with accessible, equitable education, including community disseminated educational materials that are actively featured on BEMP's website and social media platforms (See sections 2.2 and 3.0 of this document for more

detailed information). Successful adaptation of BEMP annual events into virtual formats was again necessary to ensure the safety of its participants (Luquillo-Sevilleta Virtual Symposium and Crawford Symposium; see section 2.3). All activities and materials, virtual and printable, are available in English and Spanish to better support inclusion and accessibility to STEM resources for New Mexico's diverse communities.

1.1.1 *Delivery of BEMP Annual Report*

The Bosque Ecosystem Monitoring Program (BEMP) mailed out the BEMP 2021 Annual Report on June 11, 2022. This provides a comprehensive overview of the work done during the performance period up through December 31, 2021. The key sections of that report for MRGSQT include:

Pg. 60 Total outreach numbers and list of schools served

Pg. 61 Community Events and Student Presentation Outreach

2

2.1 STORMWATER SCIENCE EDUCATION AND CURRICULUM

2.1.1 *In-person and synchronous learning.*

3,117 students served
In response to the COVID-19 pandemic, BEMP education continues to pivot to better support the diverse needs of New Mexico's students, teachers and families by offering a multi-level educational pathway to engage with BEMP programming.

For students able to access the field, classes returned to monthly monitoring whereby lessons were taught in data collection procedures, phenological changes, and stewardship initiatives. Additionally, lessons focused on the geographical origins of the Rio Grande and our local drinking water, watershed

dynamics, and the stability of the Rio Grande's water composition throughout the year. Water input fluctuation was discussed in relation to pollution impacts and other bioindicators of watershed health.

For students who were restricted in ability to leave campus, listening to the needs of its audiences, BEMP education re-invisioned in-person classroom sessions to in-person, outdoor lessons on students' campuses. This was done in conjunction with remote lessons that leverage learning and connection within a student's own place-based residence. For example, for students unable to attend monthly data collections onsite in the bosque, a modified version was established to engage students in precipitation, litterfall and arthropod data collections on their own school campuses. Via exposure to data collection in their own neighborhoods, students gain first hand scientific experience while broadening their awareness of the ecosystem all around them rather than as something distant. Other curriculum development examples include a modified stormwater science activity for elementary ages to invent an arthropod while highlighting the connectivity of macroinvertebrate communities to water health, and an asynchronous series analyzing multiple years of groundwater monitoring data in the Rio Grande Valley to discuss the relationship of resource depletion and potential pollution influences.

Additionally, through this multi-level pathway, stormwater science curriculum was offered during the 2021-22 school year paired as an in-person school visit alongside a remote classroom lesson series. Students engaging in these lessons investigate how storms impact river health by looking at a watershed model, varying community sizes, and the pollutants each one produces. Students then utilize data analysis and data visualization components to learn about permeable and impermeable surfaces to better understand how storms impact the overall water quality of the Rio Grande. Through a cumulative in-person activity, students test water quality samples and macroinvertebrate populations hands-on while learning about environmental justice and water health in downstream communities.

Previous in-person lessons that were re-envisioned to become remote, multi-part, synchronous lessons (Exploring the Outdoors and Bosque Data Jam) remained a success. Both lessons focus on water quality and storm impacts, phenological observation, ecosystem monitoring, climate change, scientific processes, graphing and data analysis, encouraging a deeper understanding of nature in students' backyards while developing career-based skills in the sciences, public-speaking and presentation delivery. As in previous years, at the end of their educational process, students come up with a creative piece to represent the results of their scientific projects that are then presented at one or both of our annual events, BEMP Crawford Symposium (April-May) and/or the Luquillo-Sevilleta Virtual Symposium (April-May - presentations in Spanish). This year, College Career High School focused their research

projects on water quality/storm impact topics where students collected and analyzed their own data as a way to better understand first hand the impacts of storms in their own neighborhoods. Through their projects, students broadened community awareness about this topic with the hope of empowering future generations to make a more positive impact.

Throughout the 2021-2022 school year, BEMP served 3,117 students in 32 different schools and community organizations within Bernalillo and Sandoval counties through these lessons.

Funds that would have covered partial costs for some BEMP educational outreach events (Student Congress or Otter Day) were reallocated for the development and execution of new educational resources, printing and other materials, additional translation efforts to support accessible and equitable education, and staff time in order to continue to support the stormwater science program.

2.1.2 *Asynchronous learning.*

4,209 students served, 88,973 indirect interactions
Asynchronous curricular components continue to be designed to meet the diverse needs of students and teachers that otherwise cannot interact with BEMP directly due to timing, scheduling, or pandemic restrictions. As self-led, virtual or printable lessons, BEMP's asynchronous lessons cover a broader array of water quality concepts through various means.

Throughout the 2021-2022 school year, BEMP served 4,209 students within Bernalillo and Sandoval counties through these lessons.

> *Virtual Lessons* **233 students** This year, BEMP educators have been expanding on previous remote stormwater science lessons to include groundwater datasets, including what it is, how it is measured and why it is important. Through use of an aquifer model, students look at several years of data to discuss the relationship between groundwater and river health. Additional lesson concepts include watershed model before and after storm events, environmental justice in downstream communities and stewardship components. These lessons are remote, multi-part, asynchronous lessons offered through Edpuzzle, an interactive video lesson platform.

Self-directed Printable Activities **3,976 downloads** BEMP has been creating and distributing self-led, printable activities to help students and their families become engaged outside and explore their yards, neighborhoods and public lands while also collecting their own data. Subject examples include stormwater pollution sources and watershed heath via the observation of trash accumulation. All activities created have been translated in both English and Spanish and have been uploaded to our website for increased accessibility. Educational resources can be found here.

Social media **88,403 interactions** In maintaining initiatives to make educational materials more accessible to members of our community, BEMP has increased its presence on social media channels and continues to grow. Every day of the week, BEMP staff highlight ecological findings, time in the field, educational activities, and resources from partners. Stormwater science related concepts are consistently presented in Water Wednesday posts including topics such as educational resources from RiverXchange, evidence of water pollution and its effect on wildlife, aquatic invertebrate populations and water health, and stewardship opportunities to reduce impacts on water quality and consumption habits. All materials are provided in English and Spanish.

YouTube channel activity videos **570 views** BEMP's YouTube channel contains videos of our events as well as instructional videos that supplement activities to help guide students through their lessons. Those videos can be found on our YouTube channel, BEMP (Bosque Ecosystem Monitoring Program).

2.1.3 *Events*

281 students served

Providing the community with an opportunity to learn how important student-collected data are for informing the management of our urban riparian system, BEMP's annual community events were successfully adapted for another year to include both virtual and in-person components. Featuring a culmination of student presentations that relied heavily on student collected data and employed their professional development and presentation skills, both the Luquillo-Sevilleta Virtual Symposium and Crawford Symposium were a success in emphasizing the importance of water quality and Stormwater Science concepts.

Additionally, BEMP participated in several other community events and educational festivals to spread community awareness of watershed health, monitoring efforts, and inspire stewardship therein. Some examples include participation in Environmental Justice Week with Valle De Oro, tabling events at Jefferson Middle School, and Valencia Soil and Water Conservation District's Earth Day Science Fiesta.

2.1.4 *Watershed Education Collaboration Group*

Ongoing collaboration with the Ciudad Soil and Water Conservation District and the Valencia Soil and Water Conservation District as part of the Watershed Education Collaborative Group continues. Mutual collaboration rests on the goal of increasing student awareness about water, watersheds and other related components (historical, present and future) related to stormwater in New Mexico.

Of particular note, two separate activities were developed to support student learning throughout Outdoor Learning Week 2021, Environmental Justice Day with Valle De Oro, and Valencia Soil and Water Conservation District's Earth Day Science Fiesta. These lessons encouraged students' awareness of the water cycle, emphasizing the journey of raindrops and the various point and nonpoint pollution sources encountered on their way to the river. Students also participated in a scavenger hunt to become familiar with stormwater control structures, evidence of erosion, and potential sources of water waste.

Moving forward, we would like to continue building a K-12+ water curriculum that scaffolds student learning about stormwater and water related concepts by age group. In utilizing our partnership, we will collectively discern where each of our organizations educational programming best fit within student's experience and build from those strengths while attending to any gaps in student learning we discover. Our collective aim is to offer continuous exposure to stormwater and water quality subjects throughout each grade level while improving New Mexican youth's accessibility to these subjects.

2.1.5 *Assessment tool - IRB update*

This addresses section 2.1.10 in previous reports: Assessment tool of overall effectiveness. BEMP continues to pursue IRB certification so as to officially assess our educational programming and its effectiveness amongst student populations. It is currently being edited to more narrowly refine

questions asked of participants and will again be submitted for review by the IRB governing board; we anticipate its successful acceptance.

3

3.1 OUTREACH NUMBERS

3.1.1 Table(s) of Educational and Indirect outreach numbers for FY 21-22

Education and Curriculum

	Synchronous	Asynchronous		Events	Total
		Virtual Lessons	1-page Activities		
Students	3,117	233	3,976	281	**7,607**
Adults**	859	N/A	N/A	83	**942****
Total (Including Adult Contacts)	3,976	233	3,976	364	**8,549****

** Adult contacts not included in total contacts reported

Social Media

	Reaches	Engagements	Views	Total
Instagram	43,697	7,574	N/A	51,271
Facebook	33,925	3,207	N/A	37,132
Youtube	N/A	N/A	570	570
Total	77,622	10,781	570	**88,973**

Albuquerque Metropolitan Arroyo Flood Control Authority

Middle Rio Grande Watershed-Based MS4 Permit

General Permit Requirements

Special Conditions

- Compliance with water quality standards (Download PDF)
- Discharges to impaired waters with and without TMDLs (Download PDF)
- Additional PCB assessment and study requirement for COA, AMAFCA, and Bernalillo County (Links to PDF)
- ESA requirements for addressing dissolved oxygen and sediment pollutant loads (Links to PDF)

Stormwater Management Program (SWMP)

- Minimum Control Measures (MCMs) (Links to PDF)

Monitoring and Assessment

SWMP Minimum Control Measures

- Construction site stormwater runoff control (Download PDF)
- Post-construction stormwater management in new development and redevelopment (Download PDF)
- Pollution prevention/good housekeeping (Links to PDF)
- Illicit discharges and improper disposal (Download PDF)
- Control of floatables discharges (Download PDF)
- Public education and outreach (Download PDF)
- Public involvement and participation (Download PDF)

Watershed Stewards

2021-2022 Final Report

Submitted by
Erin Blaz, Ciudad SWCD
June 2022

SUMMARY

The overall intent of this program is to educate the public on the all-encompassing importance of watershed health, SSCAFCA's role in local watershed management, and to encourage personal commitment to watershed stewardship. This year's program focused on delivering watershed stewards in partnership with activity coordinators at the Meadowlark Senior Center in Rio Rancho and Del Webb Alegria Community in Bernalillo. The program consisted of lecture-style presentations and field trips to local open spaces and other sites of interest, and also included an outreach activity for Pollinator Day at Meadowlark Senior Center in the spring.

The program required funding in the amount of $10,249.05 generated $599.00 in-kind match, and reached 135 senior citizens, significantly more than our original target of 25 seniors. A few of the participants returned for multiple events. There were 17 presentations/field trips that lasted from 1-2 hours for participants, reaching beyond our target of offering 25 hours of program this year.

2021-2022 Themes and Locations

The theme of this year's fall program centered on Green Stormwater Infrastructure (GSI) and included educational presentations and field trips that were specific and relevant to the concepts of GSI and the role of GSI in watershed health. The theme of spring's program was "Walks and Talks" which focused on local wildlife, native and medicinal plants, and brought participants to Arroyo and Riparian areas located within Rio Rancho Open Spaces. All presentations were able to integrate and connect watershed stewards learning objectives to the content, such as stormwater pollution prevention and local habitat protection.

We also offered two events at the Rio Rancho WaterWise Garden, which is an excellent demonstration space for a range of topics. In the fall, the Master Gardeners gave a tour of the garden with a focus on water conservation, plant selection for drought tolerance with a preference on native species and green stormwater infrastructure. In addition to the tour, Sandoval County presented the Rolling River, and discussed the importance of residential and municipal GSI in watershed health. In the spring, Dara Saville of the Yerba Mansa Project completed a very well received talk and tour at the Waterwise garden about native and medicinal plants.

In addition to our normal programming, we also celebrated pollinators at the Meadowlark with a talk about honey bees and a presentation by ABQ Backyard Refuge. During this time we also made bee hotels with participants and passerby's out front of Meadowlark.

Building Partnerships
This year we increased partner support from Sandoval County Master Gardeners and Cooperative Extension office, Dyane Sonier of City of Rio Rancho Parks, Recreation and Community Services and Dave Gatternman of SSCAFCA, which generated some in-kind match to support the program. Discussions with Dyane Sonier focused on taking a reciprocal approach to engaging the local community in areas where our different programs align. There was hope to invite watershed stewards to help plant the new pollinator garden at the WaterWise Garden, but timing did not allow for this event to include Watershed Steward participants this fiscal year.

Stewardship Opportunities
One of the goals of the Watershed Stewards Program is to encourage personal commitment to watershed stewardship, and while the presentations and field trips offered build knowledge around stewardship strategies, program staff continue to seek out ways to engage our participants in hands-on projects that support watershed health.

This year one participant was interested in applying some GSI techniques to an erosion problem behind his house. Dave Gatterman and Erin Blaz met with this participant and Mr. Gatterman was even able to get City of Rio Rancho approval to apply some mitigation and restoration strategies. This was an exciting opportunity to engage participants in a project, however during the process of planning the city applied an erosion treatment to the hillside and it was determined best to wait and see the results of that effort.

During the pollinator day, we also hosted ABQ Backyard Refuge at Del Webb Alegria. This was a very interesting and fruitful conversation. 11 community members participated from Alegria and discussed the need for support in some of their open spaces within the Del Webb development. There was high interest in creating wildlife refuges in these spaces, but they cited challenges within their own HOA and community perceptions - like a desire for lawns and manicured spaces.

Evaluation
Considering we were able to bring in-person programming back safely to this community after a year of virtual programming due to the pandemic, this year's program reached a larger than expected audience and offered more hours of program than anticipated. However, there are certainly ways to improve. Watershed Stewards will benefit from continued support or partnership with other local entities in Rio Rancho and Town of Bernalillo so that we can collectively reach more people with a wider range of content. Watershed Stewards would also benefit from tracking participant contacts across all programs by Ciudad to be able to maintain correspondence, build community around action and stewardship, and survey folks to increase our understanding of our audience and impacts. In response to this FY22 funding was used to purchase a tablet that can be used in the field to track participant signs-in and survey participants. Additionally, finding ways that are of interest and well-suited to the senior community to engage with hands-on projects will need to continue through relationship and rapport building within the community and local partners.

Program Pictures

Prior page: WWG program with tour and rolling river. Top this page: Mikal Deese with a local bird. 2rd row: Justin shows bats & scat comparisons.
3rd row: Justin does Bosque and Arroyo Habitat walks. Bottom row: Dara Saville at WWG and Bee Hive for Pollinator Day.

Results

Facebook Page reach

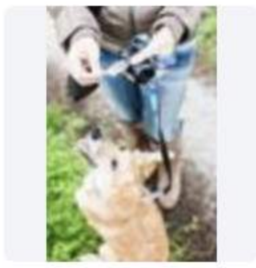
1,322 ↓ 25.3%

See results report

Content

Sort by: Reach

Wed Jun 29, 7:30am
Want to help remind ...
Post
Reach 443



Oct 1, 2021
Disposing pet waste i...
Post
Reach 361

Jul 19, 2021
Taking your furry frie...
Post
Reach 341

Nov 14, 2021
FACT: Hot tap water ...
Post
Reach 326

Nov 20, 2021
Never Pour oil onto th...
Post
Reach 280

Nov 17, 2021
Have you visited the ...
Post
Reach 277

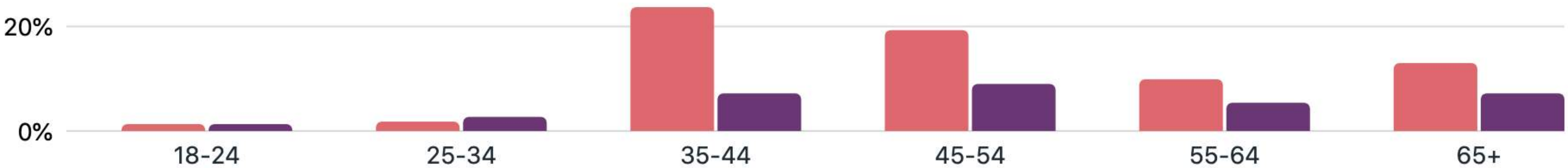
See content report

Audience

Facebook Page likes

225

Age & gender



Women 68.1%
Men 31.9%

Middle Rio Grande Stormwater Quality Team Final Report prepared by the Bosque Ecosystem Monitoring Program

JULY 30, 2022

1.1 COMPREHENSIVE OVERVIEW

Historically, culturally, ecologically - the Rio Grande is the heart of our region and the primary resource by which New Mexico's young people familiarize themselves with water. Utilizing its ecosystem as "classroom", BEMP's stormwater science outreach education program aims to teach young people how the health of the Rio Grande is directly related to the health of the surrounding watershed and how they can be stewards in helping to keep the Rio "Grand".

To this end, **7,840 students** throughout Bernalillo and Sandoval counties connected with their local watershed through participation in BEMP activities throughout the 2021-2022 school year. 845 contacts of this total were engaged through purely stormwater science specific lessons.

Due to ongoing pandemic restrictions in the 2021-22 school year, our curriculum shifted to virtual and physical formats to make our activities more equitable and accessible, including adaptations to our stormwater science curriculum to best fit the ongoing COVID-19 scenario. However, as in-person programming became more possible in the 2021-22 school year, in-person visitation to school campuses and the bosque once again became a successful venue for stormwater science education.

In consideration of the implications of COVID-19 on our communities, BEMP's stormwater science program featured synchronous and asynchronous learning resources, as well as in-person programming opportunities. Synchronous resources are remote, live, lessons that include stormwater science concepts and/or projects. Asynchronous curricular components are self-led, virtual lessons that represent a version of the regular stormwater science class and 1-page summer activities; BEMP currently offers five different, 30-minute asynchronous lessons.

Throughout the pandemic, BEMP has continued to support students with accessible, equitable education, including community disseminated educational materials that are actively featured on BEMP's website and social media platforms (See sections 2.2 and 3.0 of this document for more

detailed information). Successful adaptation of BEMP annual events into virtual formats was again necessary to ensure the safety of its participants (Luquillo-Sevilleta Virtual Symposium and Crawford Symposium; see section 2.3). All activities and materials, virtual and printable, are available in English and Spanish to better support inclusion and accessibility to STEM resources for New Mexico's diverse communities.

1.1.1 *Delivery of BEMP Annual Report*

The Bosque Ecosystem Monitoring Program (BEMP) mailed out the BEMP 2021 Annual Report on June 11, 2022. This provides a comprehensive overview of the work done during the performance period up through December 31, 2021. The key sections of that report for MRGSQT include:

Pg. 60 Total outreach numbers and list of schools served

Pg. 61 Community Events and Student Presentation Outreach

2

2.1 STORMWATER SCIENCE EDUCATION AND CURRICULUM

2.1.1 *In-person and synchronous learning.*

3,117 students served
In response to the COVID-19 pandemic, BEMP education continues to pivot to better support the diverse needs of New Mexico's students, teachers and families by offering a multi-level educational pathway to engage with BEMP programming.

For students able to access the field, classes returned to monthly monitoring whereby lessons were taught in data collection procedures, phenological changes, and stewardship initiatives. Additionally, lessons focused on the geographical origins of the Rio Grande and our local drinking water, watershed

dynamics, and the stability of the Rio Grande's water composition throughout the year. Water input fluctuation was discussed in relation to pollution impacts and other bioindicators of watershed health.

For students who were restricted in ability to leave campus, listening to the needs of its audiences, BEMP education re-invisioned in-person classroom sessions to in-person, outdoor lessons on students' campuses. This was done in conjunction with remote lessons that leverage learning and connection within a student's own place-based residence. For example, for students unable to attend monthly data collections onsite in the bosque, a modified version was established to engage students in precipitation, litterfall and arthropod data collections on their own school campuses. Via exposure to data collection in their own neighborhoods, students gain first hand scientific experience while broadening their awareness of the ecosystem all around them rather than as something distant. Other curriculum development examples include a modified stormwater science activity for elementary ages to invent an arthropod while highlighting the connectivity of macroinvertebrate communities to water health, and an asynchronous series analyzing multiple years of groundwater monitoring data in the Rio Grande Valley to discuss the relationship of resource depletion and potential pollution influences.

Additionally, through this multi-level pathway, stormwater science curriculum was offered during the 2021-22 school year paired as an in-person school visit alongside a remote classroom lesson series. Students engaging in these lessons investigate how storms impact river health by looking at a watershed model, varying community sizes, and the pollutants each one produces. Students then utilize data analysis and data visualization components to learn about permeable and impermeable surfaces to better understand how storms impact the overall water quality of the Rio Grande. Through a cumulative in-person activity, students test water quality samples and macroinvertebrate populations hands-on while learning about environmental justice and water health in downstream communities.

Previous in-person lessons that were re-envisioned to become remote, multi-part, synchronous lessons (Exploring the Outdoors and Bosque Data Jam) remained a success. Both lessons focus on water quality and storm impacts, phenological observation, ecosystem monitoring, climate change, scientific processes, graphing and data analysis, encouraging a deeper understanding of nature in students' backyards while developing career-based skills in the sciences, public-speaking and presentation delivery. As in previous years, at the end of their educational process, students come up with a creative piece to represent the results of their scientific projects that are then presented at one or both of our annual events, BEMP Crawford Symposium (April-May) and/or the Luquillo-Sevilleta Virtual Symposium (April-May - presentations in Spanish). This year, College Career High School focused their research

projects on water quality/storm impact topics where students collected and analyzed their own data as a way to better understand first hand the impacts of storms in their own neighborhoods. Through their projects, students broadened community awareness about this topic with the hope of empowering future generations to make a more positive impact.

Throughout the 2021-2022 school year, BEMP served 3,117 students in 32 different schools and community organizations within Bernalillo and Sandoval counties through these lessons.

Funds that would have covered partial costs for some BEMP educational outreach events (Student Congress or Otter Day) were reallocated for the development and execution of new educational resources, printing and other materials, additional translation efforts to support accessible and equitable education, and staff time in order to continue to support the stormwater science program.

2.1.2 *Asynchronous learning.*

4,209 students served, 88,973 indirect interactions
Asynchronous curricular components continue to be designed to meet the diverse needs of students and teachers that otherwise cannot interact with BEMP directly due to timing, scheduling, or pandemic restrictions. As self-led, virtual or printable lessons, BEMP's asynchronous lessons cover a broader array of water quality concepts through various means.

Throughout the 2021-2022 school year, BEMP served 4,209 students within Bernalillo and Sandoval counties through these lessons.

> *Virtual Lessons* **233 students** This year, BEMP educators have been expanding on previous remote stormwater science lessons to include groundwater datasets, including what it is, how it is measured and why it is important. Through use of an aquifer model, students look at several years of data to discuss the relationship between groundwater and river health. Additional lesson concepts include watershed model before and after storm events, environmental justice in downstream communities and stewardship components. These lessons are remote, multi-part, asynchronous lessons offered through Edpuzzle, an interactive video lesson platform.

Self-directed Printable Activities **3,976 downloads** BEMP has been creating and distributing self-led, printable activities to help students and their families become engaged outside and explore their yards, neighborhoods and public lands while also collecting their own data. Subject examples include stormwater pollution sources and watershed heath via the observation of trash accumulation. All activities created have been translated in both English and Spanish and have been uploaded to our website for increased accessibility. Educational resources can be found here.

Social media **88,403 interactions** In maintaining initiatives to make educational materials more accessible to members of our community, BEMP has increased its presence on social media channels and continues to grow. Every day of the week, BEMP staff highlight ecological findings, time in the field, educational activities, and resources from partners. Stormwater science related concepts are consistently presented in Water Wednesday posts including topics such as educational resources from RiverXchange, evidence of water pollution and its effect on wildlife, aquatic invertebrate populations and water health, and stewardship opportunities to reduce impacts on water quality and consumption habits. All materials are provided in English and Spanish.

YouTube channel activity videos **570 views** BEMP's YouTube channel contains videos of our events as well as instructional videos that supplement activities to help guide students through their lessons. Those videos can be found on our YouTube channel, BEMP (Bosque Ecosystem Monitoring Program).

2.1.3 *Events*

281 students served

Providing the community with an opportunity to learn how important student-collected data are for informing the management of our urban riparian system, BEMP's annual community events were successfully adapted for another year to include both virtual and in-person components. Featuring a culmination of student presentations that relied heavily on student collected data and employed their professional development and presentation skills, both the Luquillo-Sevilleta Virtual Symposium and Crawford Symposium were a success in emphasizing the importance of water quality and Stormwater Science concepts.

Additionally, BEMP participated in several other community events and educational festivals to spread community awareness of watershed health, monitoring efforts, and inspire stewardship therein. Some examples include participation in Environmental Justice Week with Valle De Oro, tabling events at Jefferson Middle School, and Valencia Soil and Water Conservation District's Earth Day Science Fiesta.

2.1.4 *Watershed Education Collaboration Group*

Ongoing collaboration with the Ciudad Soil and Water Conservation District and the Valencia Soil and Water Conservation District as part of the Watershed Education Collaborative Group continues. Mutual collaboration rests on the goal of increasing student awareness about water, watersheds and other related components (historical, present and future) related to stormwater in New Mexico.

Of particular note, two separate activities were developed to support student learning throughout Outdoor Learning Week 2021, Environmental Justice Day with Valle De Oro, and Valencia Soil and Water Conservation District's Earth Day Science Fiesta. These lessons encouraged students' awareness of the water cycle, emphasizing the journey of raindrops and the various point and nonpoint pollution sources encountered on their way to the river. Students also participated in a scavenger hunt to become familiar with stormwater control structures, evidence of erosion, and potential sources of water waste.

Moving forward, we would like to continue building a K-12+ water curriculum that scaffolds student learning about stormwater and water related concepts by age group. In utilizing our partnership, we will collectively discern where each of our organizations educational programming best fit within student's experience and build from those strengths while attending to any gaps in student learning we discover. Our collective aim is to offer continuous exposure to stormwater and water quality subjects throughout each grade level while improving New Mexican youth's accessibility to these subjects.

2.1.5 *Assessment tool - IRB update*

This addresses section 2.1.10 in previous reports: Assessment tool of overall effectiveness. BEMP continues to pursue IRB certification so as to officially assess our educational programming and its effectiveness amongst student populations. It is currently being edited to more narrowly refine

questions asked of participants and will again be submitted for review by the IRB governing board; we anticipate its successful acceptance.

3

3.1 OUTREACH NUMBERS

3.1.1 Table(s) of Educational and Indirect outreach numbers for FY 21-22

Education and Curriculum

	Synchronous	**Asynchronous**		**Events**	**Total**
		Virtual Lessons	**1-page Activities**		
Students	3,117	233	3,976	281	**7,607**
Adults**	859	N/A	N/A	83	**942****
Total (Including Adult Contacts)	3,976	233	3,976	364	**8,549****

** Adult contacts not included in total contacts reported

Social Media

	Reaches	**Engagements**	**Views**	**Total**
Instagram	43,697	7,574	N/A	51,271
Facebook	33,925	3,207	N/A	37,132
Youtube	N/A	N/A	570	570
Total	77,622	10,781	570	**88,973**

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority
2600 Prospect N.E., Albuquerque, NM 87107
Phone: (505) 884-2215 Fax: (505) 884-0214
Website: www.amafca.org

October 15, 2019

Mr. Robert Houston
Chief, Special Projects Section
U.S. Environmental Protection Agency, Region 6
1201 Elm Street, Suite 500
Dallas, Texas 75270

RE: NPDES Permit No. NMR04A000 Administrative Continuance – Duty to Re-Apply

Dear Mr. Houston:

This correspondence serves as a written notification that the members copied below of the Middle Rio Grande Technical Advisory Group (TAG) will continue to operate and discharge into the Rio Grande under the coverage and the conditions set forth in NPDES Permit No. NMR04A000 (Permit), after December 19, 2019, based on Permit language in Part IV:V and required notification in Part IV:C.

On June 27, 2019 the Middle Rio Grande TAG MS4 permittees met with and were informed by EPA Region 6 staff Brent Larson & Maria Martinez that the Permit, which expires on December 19, 2019, would likely go into administrative continuance. As EPA staff explained during the meeting, EPA is not required to issue a public notice related to the administrative continuance and the current permittees do not need to complete any actions or submit renewal applications to have continued coverage under the current Permit.

This guidance from EPA was confirmed in the Permit, in Part IV:V. CONTINUATION OF THE EXPIRED GENERAL PERMIT. *If this Permit is not reissued or replaced prior to the expiration date, it will be administratively continued in accordance with the Administrative Procedures Act and remain in force and effect. Any permittee who was granted permit coverage prior to the expiration date will automatically remain covered by the continued Permit until the earlier of:*

1. *Reissuance or replacement of this Permit, at which time the permittee must comply with the Notice of Intent conditions of the new permit to maintain authorization to discharge; or*
2. *Issuance of an individual permit for your discharges; or*
3. *A formal permit decision by the permitting authority not to reissue this general Permit, at which time the permittee must seek coverage under an alternative general permit or an individual permit.*

Closer review of the Permit noted the language in Part IV:C: DUTY TO REAPPLY. *If the permittee wishes to continue an activity regulated by this Permit after the Permit expiration date, the permittee must apply for and obtain a new permit. The application shall be submitted at least 180 days prior to expiration of this permit. The EPA may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date. Continuation of expiring permits shall be governed by regulations promulgated at 40 CFR § 122.6 and any subsequent amendments.* It is unclear from the Permit language in Part IV: C, if this section applies to permits that are administratively continued.

This letter is to inform EPA that, based on the provided guidance from EPA and the MS4 Permit language in Part IV:V, members of the Middle Rio Grande TAG will continue to operate with coverage under the current MS4 Permit when the Permit is administratively continued on December 19, 2019. If these assumptions are incorrect or if an application is required for continued coverage under MS4 Permit NMR04A000, please let us know as soon as possible.

We appreciate your attention to this matter. Please contact me if you have any questions.

Sincerely,
Middle Rio Grande TAG

Patrick J. Chavez

Patrick Chavez, PE
AMAFCA Storm Water Quality Engineer and TAG Member

TAG Members Included and Copied:

Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA)
City of Rio Rancho
Sandia National Labs (operated by NTESS for US DOE)
Bernalillo County
Kirtland Air Force Base
Village of Los Ranchos
Eastern Sandoval County Arroyo Flood Control Authority (ESCACA)
Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)
City of Albuquerque
Village of Corrales
Sandoval County
Town of Bernalillo
New Mexico Department of Transportation (NMDOT)
University of New Mexico

Bohannan Huston

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M E M O R A N D U M

DATE: August 10, 2022

TO: Patrick Chavez, PE, AMAFCA

FROM: Sarah Ganley, PE, ENV-SP
Savannah Maynard
Emma Adams, EI

SUBJECT: **CMC Dry Season, Wet Weather Stormwater Monitoring
Data Verification, Analysis Results Database, and Reporting
FY 2022 Dry Season (November 1, 2021 to June 30, 2022)**

Notification of In-Stream Water Quality Exceedances

For downstream notification purposes, the following parameters for in-stream samples taken in the Rio Grande for the FY 2022 dry season had results that exceeded applicable E. coli water quality standards (WQSs) for samples obtained on June 22, 2022. Based on the Compliance Monitoring Cooperative (CMC) review of the storm, it was determined that this was not a qualifying storm event, hence further sampling and testing were not conducted. Table 1 summarizes the samples with E. coli exceedances.

**Table 1: E. coli Detected Above Applicable Water Quality Standards
CMC FY 2022 Dry Season Monitoring**

Sampling Date Location	**Parameters, Applicable Water Quality Standard (WQS), and Results Exceeding Applicable WQS**
	E. coli
	WQS: 88 MPN (CFU/100 mL) Pueblo of Isleta Primary Contact Ceremonial & Recreational
6/22/2022 Rio Grande North Angostura Diversion Dam	686.7 MPN (CFU/100ml)
6/22/2022 Rio Grande at Alameda Bridge E. coli Only	>2,419.6 MPN (CFU/100ml)

Overview of Stormwater Monitoring Activity

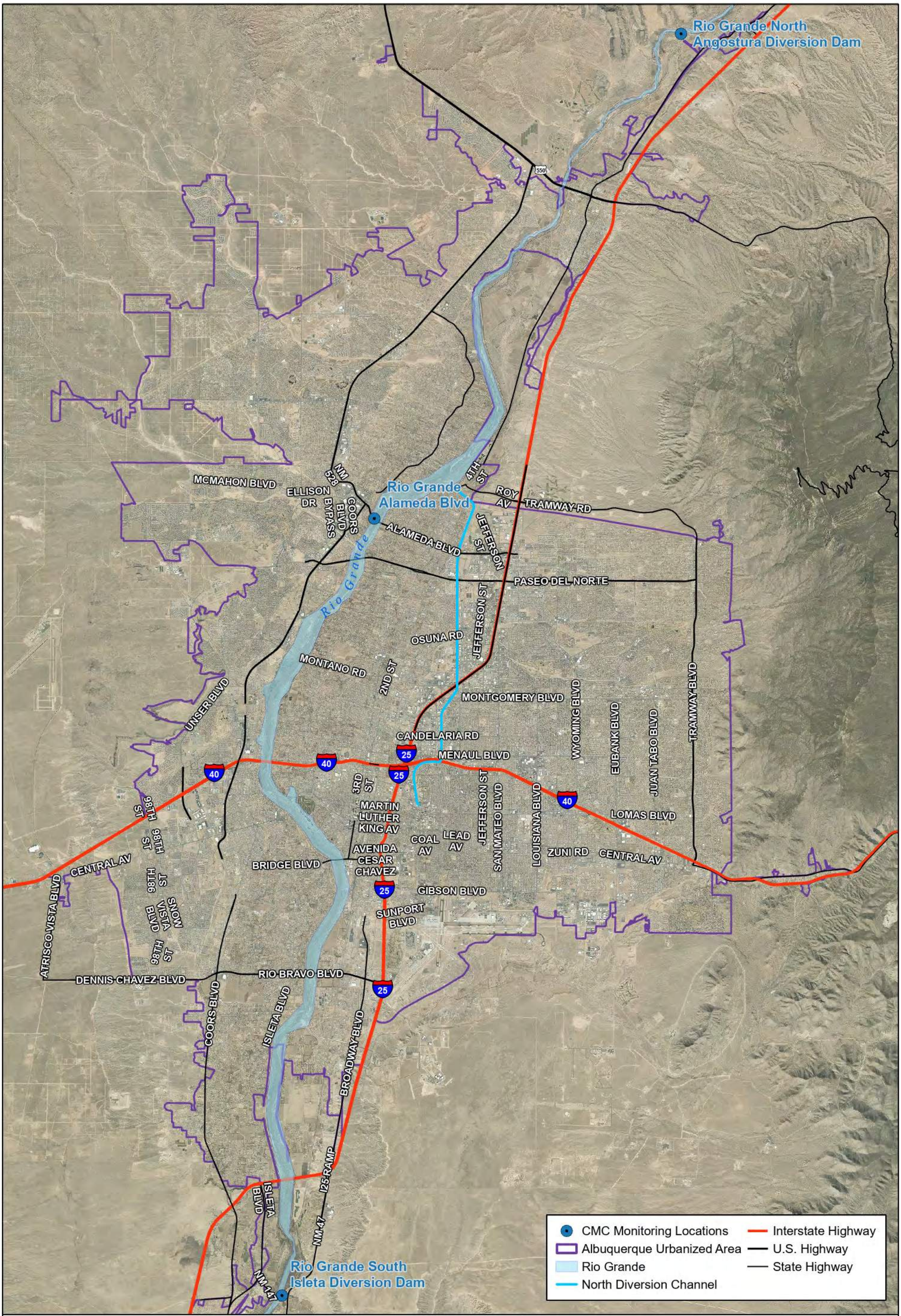
Bohannan Huston, Inc. (BHI) has been tasked to perform water quality services for the CMC Stormwater Data Verification, Database, and Reporting for the Wet Weather Stormwater Quality Monitoring Program for Fiscal Year (FY) 2022 (July 1, 2021 to June 30, 2022). The scope of work for this task includes data verification of the stormwater laboratory analysis results, compiling the analysis results into a database, and calculating the E. coli loading to compare with the Waste Load Allocation (WLA) for the qualifying storm events. The stormwater compliance monitoring is being conducted separately by Daniel B. Stephens & Associates, Inc. (DBS&A) and is not a part of this on-call task. This task is being conducted to assist the CMC members with their comprehensive monitoring and assessment program for compliance under the 2014 Middle Rio Grande (MRG) Watershed Based Municipal Separate Storm Sewer System (MS4) Permit, NPDES Permit No. NMR04A000 ("WSB MS4 Permit").

The WSB MS4 Permit entered Administrative Continuance in December 2019 when U.S. Environmental Protection Agency (EPA) Region 6 did not issue a new MS4 Permit before the current MS4 Permit's expiration date. The MRG Technical Advisory Group (TAG) sent EPA a letter dated October 15, 2019, acknowledging Administrative Continuance after the expiration date of the 5-year Permit term. Until a new MS4 Permit is issued, there are no compliance monitoring requirements for the CMC in the Rio Grande. As identified in the CMC Monitoring Plan, the WSB MS4 Permit required a minimum of seven (7) storm events be sampled at both the Rio Grande North and Rio Grande South locations (refer to Figure 1, page 3). All Permit required samples have been obtained by the CMC, as well as two (2) samples obtained in FY 2021 and the one (1) sample obtained in FY 2022 wet season during Administrative Continuance; all CMC samples are summarized in Table 2 below.

Table 2: CMC Sample Summary
Compared to WSB MS4 Permit Requirements

No. of Storm Events Required to Sample	CMC-WSB MS4 Permit Required Samples per Season	FY (Date) Samples Obtained for CMC
1	#1 Wet Season	FY 2017 (8/10/2016)
2	#2 Wet Season	FY 2017 (9/12/2016)
3	#3 Wet Season	FY 2017 (9/21/2016)
4	#1 Dry Season	FY 2017 (11/21/2016)
5	#2 Dry Season	FY 2019 (3/13/2019)
6	Any Season	FY 2018 (Wet Season - 7/27/2017)
7	Any Season	FY 2018 (Wet Season - 9/27/2017)
Not Required	Wet Season	FY 2021 (10/28/2020)
Not Required	Dry Season	FY 2021 (4/28/2021)
Not Required	Wet Season	FY 2022 (9/1/2021)

During the WSB MS4 Permit Administrative Continuance, the CMC members chose to continue sampling within the Rio Grande to support their MS4 program needs and gather additional data in support of the future MS4 Permit compliance. This memo reports on the wet weather stormwater monitoring activity for the FY 2022 dry season (November 1, 2022 to June 30, 2022).



AMAFCA

Bohannan Huston
www.bhinc.com 800.877.5332

N

0 6,000 12,000 24,000 Feet
1 inch = 12,205 feet

CMC Monitoring

Figure 1
Monitoring Locations

P:\20230125\WR\Reports\Preliminary & Draft\Figures\APRXs\Figure1.aprx
Author: mcrooks

August 2022

Monitoring Activity Summary

The list below provides a summary of the CMC comprehensive monitoring program activities completed for the FY 2022 dry season from November 2021 through June 2022. One (1) non-qualifying storm event was sampled and analyzed during the FY 2022 dry season.

- **June 22, 2022 – Only E. Coli for Rio Grande North and at Alameda Bridge.** A sample was collected at the Rio Grande North location at 2:00 p.m. and at Alameda Bridge at 3:30 p.m. on June 22, 2022, and samples were taken to the laboratory for E. coli only tests. Based on the CMC review of the storm, it was determined this was not a qualifying storm event, hence further sampling or testing was conducted.

Stormwater Quality Database for CMC

As stated previously, there were no qualifying storm events sampled for the CMC during the FY 2022 dry season, wet weather monitoring. However, the June 22, 2022, E. coli samples were added to the CMC Excel database. The Hall Environmental Analysis Laboratory (HEAL) analysis reports for this monitoring season have been received, added to the database, and are provided with this memo (Attachment 1). The lab data entered is marked in the spreadsheet as “V” (verified), and data V&V has been completed (refer to Attachment 2). The updated database is also included with this memo.

Conclusions and Planning

During the FY 2022 dry season (November 1, 2021 to June 30, 2022), one (1) non-qualifying storm event was sampled by the CMC. E. coli samples were collected at the Rio Grande North monitoring location and at Alameda Bridge. The lab reports for these samples have been received, and this data has been entered into the CMC Excel database.

To summarize:

- The WSB MS4 Permit entered Administrative Continuance in December 2019 when U.S. Environmental Protection Agency (EPA) Region 6 did not issue a new MS4 Permit before the current MS4 Permit’s expiration date. Until a new MS4 Permit is issued, there are no compliance monitoring requirements for the CMC in the Rio Grande. All MS4 Permit required samples have been obtained by the CMC, as well several samples collected during Administrative Continuance.
- There was not a qualifying storm event sampled by the CMC during the FY 2022 dry season (November 1, 2021 to June 30, 2022).

SG/ab

Attachments:

Attachment 1 – DBS&A Field Data & Hall Environmental Analysis Laboratory Reports with BHI Notes for FY 2022 Dry Season

Attachment 2 – FY 2022 Dry Season Completed Data Verification and Validation (V&V) Forms

Spreadsheet Included Separately:

Excel CMC Spreadsheet updated with water quality criterion details

ATTACHMENT 1

DBS&A FIELD DATA & HALL ENVIRONMENTAL ANALYSIS LABORATORY REPORTS WITH BHI NOTES FOR FY 2022 DRY SEASON

CMC Water Quality Results Database
FY 2017 -FY 2021
Date: August 10, 2022
Summary of Lab Results for CMC samples

		Rio Grande - North - At Angostura Dam												Rio Grande - Alameda Bridge (E. coli Only Samples)															
Parameter	Permit Required Units	Provisional or Verified	2022 CMC SAMPLE - EXTRA NORTH Collection Date 8/16/2021 Wet Season Sample Non Qualifying Storm Event	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA NORTH Collection Date 9/01/2021 Wet Season Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA NORTH Collection Date 6/22/2022 Dry Season Sample Non Qualifying Storm Event	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA SOUTH Collection Date 9/02/2021 Wet Season Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA ALAMEDA Collection Date 9/1/2021 Wet Season Pre-Storm Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA ALAMEDA Collection Date 9/2/2021 Wet Season Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA ALAMEDA Collection Date 6/22/2022 Dry Season Sample Non Qualifying Storm Event	Qualifier	Check compared to Water Quality Criterion
Total Suspended Solids (TSS)	mg/L					V	130		--					V	790	D	--												
Total Dissolved Solids (TDS)	mg/L					V	230	D	OK					V	330	D	OK												
Chemical Oxygen Demand (COD)	mg/L					V	22.2		--					V	54.2		--												
Biochemical Oxygen Demand (BOD_5)	mg/L					V	2.7	RE	--					V	4.9		--												
Dissolved Oxygen (DO)	mg/L	V	6.13		OK	V	6.98		OK	V	7.66		OK	V	6.92		OK	V	7.06		OK	V	6.92		OK	V	7.02		OK
Oil and Grease (N-Hexane Extractable Material)	mg/L					V	ND		OK					V	ND		OK												
E. coli	MPN (CFU/100 mL)	V	6,867		>WQ Standard	V	183		>WQ Standard	V	686.7		>WQ Standard	V	4,884		>WQ Standard	V	20.0		OK	V	554.0		>WQ Standard	V	>2,419.6		>WQ Standard
pH	S.U.	V	7.92		OK	V	8.63		OK	V	8.27		OK	V	8.11		OK	V	8.37		OK	V	7.72		OK	V	7.67		OK
Total Kjedahl Nitrogen (TKN)	mg/L					V	4.1		--					V	2	JD	--												
Nitrate plus Nitrite	mg/L					V	ND		OK					V	1.8		OK												
Dissolved Phosphorous	mg/L					V	0.15	D	--					V	1.4	D	--												
Ammonia (mg/L as N)	mg/L					V	0.42	J	OK					V	ND		OK												
Total Nitrogen	mg/L					V	4.52	J	OK					V	3.80		OK												
Total Phosphorous	mg/L					V	0.29	D	--					V	1.3	D	--												
PCBS - 0.000064 (Method 1668A - sum of all congeners)	µg/L					V	0.00027	J	>WQ Standard					V	0.00172	J	>WQ Standard												
Gross Alpha, Adjusted	pCi/L					v	4.94	Note - Gross Alpha was reported, not adjusted gross alpha. Calculation completed to determine adjusted gross alpha.	OK					V	31.56	Note - Gross Alpha was reported, not adjusted gross alpha. Calculation completed to determine adjusted gross alpha.	>WQ Standard												
Tetrahydrofuran	µg/L					V	ND		--					V	ND		--												
Benzo(a)pyrene	µg/L					V	ND		OK					V	ND		OK												
Benzo[b]fluoranthene (other name: 3,4-Benzofluoranthene)	µg/L					V	ND		OK					V	ND		OK												
Benzo(k)fluoranthene	µg/L					V	ND		OK					V	ND		OK												
Chrysene	µg/L					V	ND		OK					V	ND		OK												
Indeno(1,2,3-cd)Pyrene	µg/L					V	ND		OK					V	ND		OK												
Dieldrin	µg/L					V	ND		OK					V	ND		OK												
Pentachlorophenol	µg/L					V	ND		OK					V	ND		OK												
Benzidine	µg/L					V	ND		OK					V	ND		OK												
Benzo(a)anthracene	µg/L					V	ND		OK					V	ND		OK												
Dibenzofuran	µg/L					V	ND		--					V	ND		--												
Dibenzo(a,h)anthracene	µg/L					V	ND		OK					V	ND		OK												
Chromium VI (Hexavalent)	µg/L					V	ND		OK					V	ND		OK												
Dissolved Copper	µg/L					V	0.84	J	OK					V	1.5		OK												
Dissolved Lead	µg/L					V	0.065	J	OK					V	0.32	J	OK												
Bis (2-ethyhexyl) Phthalate (other names: Di(2-ethylhexly)phthalate, DEHP) - 2.2	µg/L					V	ND		OK					V	ND		OK												
Conductivity	umhos/cm	V	591		--	V	315		--	V	293		--	V	484		--	V	375		--	V	383		--	V	287		--
Temperature	°C	V	21.24		OK	V	21.71		OK	V	18.8		OK	V	21.21		OK	V	23.19		OK	V	22.14		OK	V	22.1		OK
Hardness (as $CaCO_3$)	mg/L					V	160		--					V	290		--												
Mercury	µg/l																												

Data Verification/Validation and Qualifier Notes:
(R) The sample results are unusable because certain criteria were not met. The analyte may or may not be present in the sample.
(H) Sample holding time exceeded.
(J) The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
(D) Sample was diluted by Lab due to matrix
(U) Analyte was analyzed for, but not detected above the specified detection limit.

Notes:
1. Wet Season monitoring period - July 1 to October 31 and Dry Season monitoring period - November 1 to June 30 according to the Watershed Based MS4 Permit NMR04A000.
2. Water Quality Criterion from 20.6.4 NMAC; Rio Grande Basin - section 20.6.4.105; For a mean monthly flow of 100 cfs, monthly average
3. Aquatic life criteria for metals are expressed as a function of total
4. According to NMAC 20.6.4, E. coli bacteria for Primary Contact - monthly
5. Water quality criterion for metals is based on dissolved metals, NMAC 20.6.4.900.I and individual sample results compared to acute toxicity
6. HEAL lab method: SM 9223B Fecal Indicator. Note - lab method for units of MPN/100 ml, lab report uses units CFU/100 ml, for this analysis

ND - analyte not detected above the laboratory method detection limit
NA - not analyzed
Hatching also indicates that parameter was not analyzed

National recommended WQ criteria Human Health
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

June 28, 2022

Patrick Chavez
AMAFCA
2600 Prospect Ave NE
Albuquerque, NM 87107
TEL: (505) 884-2215
FAX:

RE: CMC OrderNo.: 2206C11

Dear Patrick Chavez:

Hall Environmental Analysis Laboratory received 2 sample(s) on 6/22/2022 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Field Parameters
Rio Grande North-
Temp = 18.80 ºC
pH = 8.27
Conductivity (uS/cm=umho/cm) = 293
Dissolved Oxygen (mg/L) = 7.66
Rio Grande Alameda-
Temp = 22.10 ºC
pH = 7.67
Conductivity (uS/cm=umho/cm) = 287
Dissolved Oxygen (mg/L) = 7.02

Analytical Report
Lab Order **2206C11**
Date Reported: **6/28/2022**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA
Project: CMC
Lab ID: 2206C11-001 **Matrix:** AQUEOUS

Client Sample ID: RG - North - 20220622
Collection Date: 6/22/2022 2:00:00 PM
Received Date: 6/22/2022 4:05:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM 9223B FECAL INDICATOR: E. COLI MPN						Analyst: **dms**
E. Coli	686.7	1.000		MPN/100	1	6/23/2022 5:28:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA
Project: CMC
Lab ID: 2206C11-002
Matrix: AQUEOUS

Client Sample ID: RG - Alameda - 20220622
Collection Date: 6/22/2022 3:30:00 PM
Received Date: 6/22/2022 4:05:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM 9223B FECAL INDICATOR: E. COLI MPN						Analyst: **dms**
E. Coli	>2419.6	1.000		MPN/100	1	6/23/2022 5:28:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Estimated value
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix interference		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: AMAFCA   Work Order Number: 2206C11   RcptNo: 1

Received By: **Andy Freeman** 6/22/2022 4:05:00 PM

Completed By: **Isaiah Ortiz** 6/22/2022 4:20:02 PM   I-Ox

Reviewed By: 6-22-22 @ 16:39

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
5. Sample(s) in proper container(s)? Yes ☑ No ☐
6. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
8. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA? Yes ☐ No ☐ NA ☑
10. Were any sample containers received broken? Yes ☐ No ☑
11. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
13. Is it clear what analyses were requested? Yes ☑ No ☐
14. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

# of preserved bottles checked for pH: ____ (<2 or >12 unless noted)
Adjusted? ____
Checked by: KPG 6-22-22

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	16.8	Good	Not Present			

Chain-of-Custody Record

Client: AMAFCA

Mailing Address:

Phone #:

email or Fax#: pchavez @ AMAFCA.org

QA/QC Package:

☐ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance

☐ NELAC ☐ Other

☐ EDD (Type)

Turn-Around Time:

☒ Standard ☐ Rush

Project Name: CMC

Project #:

Project Manager: Patrick Chavez

Sampler:

On Ice: ☒ Yes ☐ No

# of Coolers: 1

Cooler Temp (including CF): 16.7+0.1=16.8 (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2206C11	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	Ecoli enumerated
6-22-22	1400	AQ	RG-North-20220622			001											X
6-22-22	1530	AQ	RG-Alameda-20220622			002											X

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
6-22-22	1605	[signature]	[signature]		6/22/22	1605
Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time

Remarks:

Samplers CMJ, JK

CMC Sampling Data Sheet

Site Identification: RG-North

Notes: onsite ~12:50

Full Suite Sample Date and Time:	6/22/22 1400
Full Sample Identification:	RG-North-20220622
QC Samples: Duplicate / None	QC Sample ID:
QC samples require a DIFFERENT sample time than the environmental sample. QC Sample time:	

Full Suite Collection Point : MRGCD Dam structure

Full Suite Sample Volume: 6 gal Collection Time Start: 1315 End: 1400

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (μS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
1	1315	19.27	8.30	295	7.54	81.6
2	1330	19.04	8.20	292	7.97	85.8
3	1345	18.97	8.27	290	8.27	84.8
4	1400	18.91	8.26	288	7.90	83.9
Composite	1402	18.80	8.27	293	7.66	82.1

☒Turbid Water ☒Color BROWN ☒Solids ☐Oil/Sheen ☐Foam ☐Odor________

Analytical - see 2021 COC table

☒Site Photo ☒Sample Photo

Chain-of-Custody Record

Client: AMAFCA

Mailing Address:

Phone #:

email or Fax#: pchavez@AMAFCA.org

QA/QC Package:
☐ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other
☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: CMC

Project #:

Project Manager: Patick Chavez

Sampler:

On Ice: ☐ Yes ☐ No

# of Coolers:

Cooler Temp(including CF): (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No.	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	Ecoli enumerated					
6-22-22	1400	AQ	RG-North-20220622														X					
6-22-22	1530	AQ	RG-Alameda-20220622														X					

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
6-22-22	1605	[signature]	[signature]		6/22/22	1605

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Samplers IJ JK

CMC Sampling Data Sheet

Site Identification: RG - Alameda

Notes:

Full Suite Sample Date and Time:	~~RG-Alameda~~ 6/22/22 1530
Full Sample Identification:	RG-Alameda-20220622
QC Samples: Duplicate / None	QC Sample ID:
QC samples require a DIFFERENT sample time than the environmental sample. QC Sample time:	

Full Suite Collection Point : Bridge

Full Suite Sample Volume: 2 Liters Collection Time Start: End:

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
1						
2						
3						
4						
Composite	1530	22.10	7.67	287	7.02	79.6

☒*Turbid Water* ☒*Color* Brown ☒*Solids* ☐*Oil/Sheen* ☐*Foam* ☐*Odor*______

Analytical - see 2021 COC table

☒Site Photo ☒Sample Photo

YSI SONDE CALIBRATION WORKSHEET Last Revision 01/03/2007

Sonde ID: 06K1697 Date/Time: 6/22/22 1300 Technician: CMJ

Reason for Calibration: CMC Sampling

Battery Voltage: — (6920 & 600 XLM only)

Specific Conductance:

Standard Used (mS)	Initial	Post Cal.	Cell Constant:*	
1413	1351	1413		(Range: 5 +/-0.5)

pH

		Initial	Post Cal.	mV	
7 Buffer:	(first)	7.04	7.00	-1.0	(Range: 0 mV +/- 50)
4 Buffer:	(second)	4.03	4.00	165.6	(Range: +177 from pH 7)
10 Buffer:	(third)	10.14	10.00	-173.6	(Range: -177 from pH 7)

Note: Span between pH 7 and pH 4, and pH 7 and pH 10 should be aproximately 165 to 180 mV.

DO % Sat. Membrane Changed? Y/N ______ If yes, run probe at least 15 mins before calibration. Optimally, wait 6 to 8 hrs before calibration / use.

DO Charge ______ (Range: 50 +/- 25)

mm Hg	Initial	Post Cal.	DO Gain*	
639.3	76.1	84.1		(Range: 1 (0.7 to 1.5))

Turbidity Wiper Changed? Y/N ______ Wiper parks ~180 degrees from optic port? Y/N ______

Standards Values (NTUs)		Initial	Post Cal.
Zero	(Always First)		

Note: Use longer probe guard with black turb probe; shorter guard with grey probe.

Post Calibration DO Sensor Output Test

Turn off handset (650MDS). Wait 1 minute, turn handset on and enter "Run". DO % Sat. **must** start reading with a high value and descend to the calibration value in 1 to 2 minutes. **If it does not, reject.**
Note: Disregard the first two readings as they may be affected by the warm-up process.

Accept? ______ Reject? ______ See note in comments

Calibration Comments

* Found in: Main Menu --> Sonde Menu --> Advanced --> Calibration Constants

ATTACHMENT 2

FY 2022 DRY SEASON COMPLETED DATA VERIFICATION AND VALIDATION (V&V) FORMS

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (June 2022 – Dry Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Rio Grande North – 6/22/22 – E. coli Only Sample – Was Not Qualifying Storm Event
Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
______	______
______	______

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_________
_____	_____	_________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?
☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: **0**

☒ **Step 1 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 2: Verify Data Deliverables

A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: **0**

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?
______	______	______	______	______

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 3: Verify Flow Data
*Note – Not Applicable – no flow data provided with CMC sample collection
A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	_________
______	______	__________	_________

Total number of occurrences: 0

Not Applicable
☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☐ Yes ☒ No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken

Total number of occurrences: 0

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results
Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database? *
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: 0

☒ **Step 5 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 6: Validate Holding Times Violations
Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 6 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?
☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 7 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

****

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

Sarah Gramy 8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or "flags" the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes.
The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as "less than the detection limit."	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (June 2022 – Dry Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Alameda – 6/22/22 – E. coli Only Sample – Was Not Qualifying Storm Event

Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data
A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
______	______
______	______

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_________
_____	_____	_________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?
☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: **0**

☒ **Step 1 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 2: Verify Data Deliverables
A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: **0**

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?
______	______	______	______	______

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 3: Verify Flow Data

*Note – Not Applicable – no flow data provided with CMC sample collection

A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	_________
______	______	__________	_________

Total number of occurrences: 0

Not Applicable

☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☐ Yes ☒ No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken

Total number of occurrences: 0

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results
Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database? *
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: 0

☒ **Step 5 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 6: Validate Holding Times Violations
Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 6 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?
☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 7 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

****

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

Sarah Conway 8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that “V V in STORET” be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes.
The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Bohannan Huston

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MEMORANDUM

DATE: August 10, 2022

TO: Patrick Chavez, PE, AMAFCA

FROM: Sarah Ganley, PE, ENV-SP
Savannah Maynard
Emma Adams, EI

SUBJECT: **CMC Wet Season, Wet Weather Stormwater Monitoring Data Verification, Analysis Results Database, and Reporting Memo FY 2022 Wet Season (July 1, 2021 to October 31, 2021)**

Notification of In-Stream Water Quality Exceedances

For downstream notification purposes, the following parameters for in-stream samples taken in the Rio Grande for the FY 2022 wet season had results that exceeded applicable water quality standards (WQSs) for one or more samples: E. coli, polychlorinated biphenyls (PCBs), and gross alpha, adjusted. Table 1 summarizes the samples with exceedances and the applicable WQS that was exceeded. Additional details on the sampling results are provided in this memo.

Table 1: Parameters Detected Above Applicable Water Quality Standards
CMC FY 2022 Wet Season Monitoring

Sampling Date Location	Parameters, Applicable Water Quality Standard (WQS), and Results Exceeding Applicable WQS		
	E. coli	**PCBs**	**Gross Alpha, Adjusted**
	WQS: 88 MPN (CFU/100 mL) Pueblo of Isleta Primary Contact Ceremonial & Recreational	**WQS: 0.00017 ug/L** Pueblo of Isleta Human Health Criteria (based on fish consumption only)	**WQS: 0.00017 ug/L** Pueblo of Isleta Human Health Criteria (based on fish consumption only)
8/16/2021 Rio Grande North Angostura Diversion Dam Pre-Storm Sample – E. coli Only	6,867 MPN (CFU/100mL)	Not Tested	Not Tested

Table 1 (continued).

Sampling Date Location	**Parameters, Applicable Water Quality Standard (WQS), and Results Exceeding Applicable WQS**		
	E. coli	**PCBs**	**Gross Alpha, Adjusted**
	WQS: 88 MPN (CFU/100 mL) Pueblo of Isleta Primary Contact Ceremonial & Recreational	**WQS: 0.00017 ug/L** Pueblo of Isleta Human Health Criteria (based on fish consumption only)	**WQS: 0.00017 ug/L** Pueblo of Isleta Human Health Criteria (based on fish consumption only)
9/1/2021 Rio Grande North Angostura Diversion Dam Pre-Storm Sample	183 MPN (CFU/100mL)	0.00027 ug/L	No Exceedance
9/2/2021 Rio Grande at Alameda Bridge E. coli Only	554 MPN (CFU/100mL)	Not Tested	Not Tested
9/2/2021 Rio Grande South Isleta Diversion Dam	4,884 MPN (CFU/100mL)	0.00172 ug/L	31.56 pCi/L

Overview of Stormwater Monitoring Activity

Bohannan Huston, Inc. (BHI) has been tasked to perform water quality services for the Compliance Monitoring Cooperative (CMC) Stormwater Data Verification, Database, and Reporting for the Wet Weather Stormwater Quality Monitoring Program for Fiscal Year (FY) 2022 (July 1, 2021 to June 30, 2022). The scope of work for this task includes data verification of the stormwater laboratory analysis results, compiling the analysis results into a database, and calculating the E. coli loading to compare with the Waste Load Allocation (WLA) for the qualifying storm events. The stormwater compliance monitoring is conducted separately by Daniel B. Stephens & Associates, Inc. (DBS&A) and is not a part of this task. This task is being conducted to assist the CMC members with their comprehensive monitoring and assessment program for compliance under the 2014 Middle Rio Grande (MRG) Watershed Based Municipal Separate Storm Sewer System (MS4) Permit, NPDES Permit No. NMR04A000 ("WSB MS4 Permit").

The WSB MS4 Permit entered Administrative Continuance in December 2019 when U.S. Environmental Protection Agency (EPA) Region 6 did not issue a new MS4 Permit before the current MS4 Permit's expiration date. The MRG Technical Advisory Group (TAG) sent EPA a letter dated October 15, 2019, acknowledging Administrative Continuance after the expiration date of the 5-year Permit term. Until a new MS4 Permit is issued, there are no compliance monitoring requirements for the CMC in the Rio Grande. As identified in the CMC Monitoring

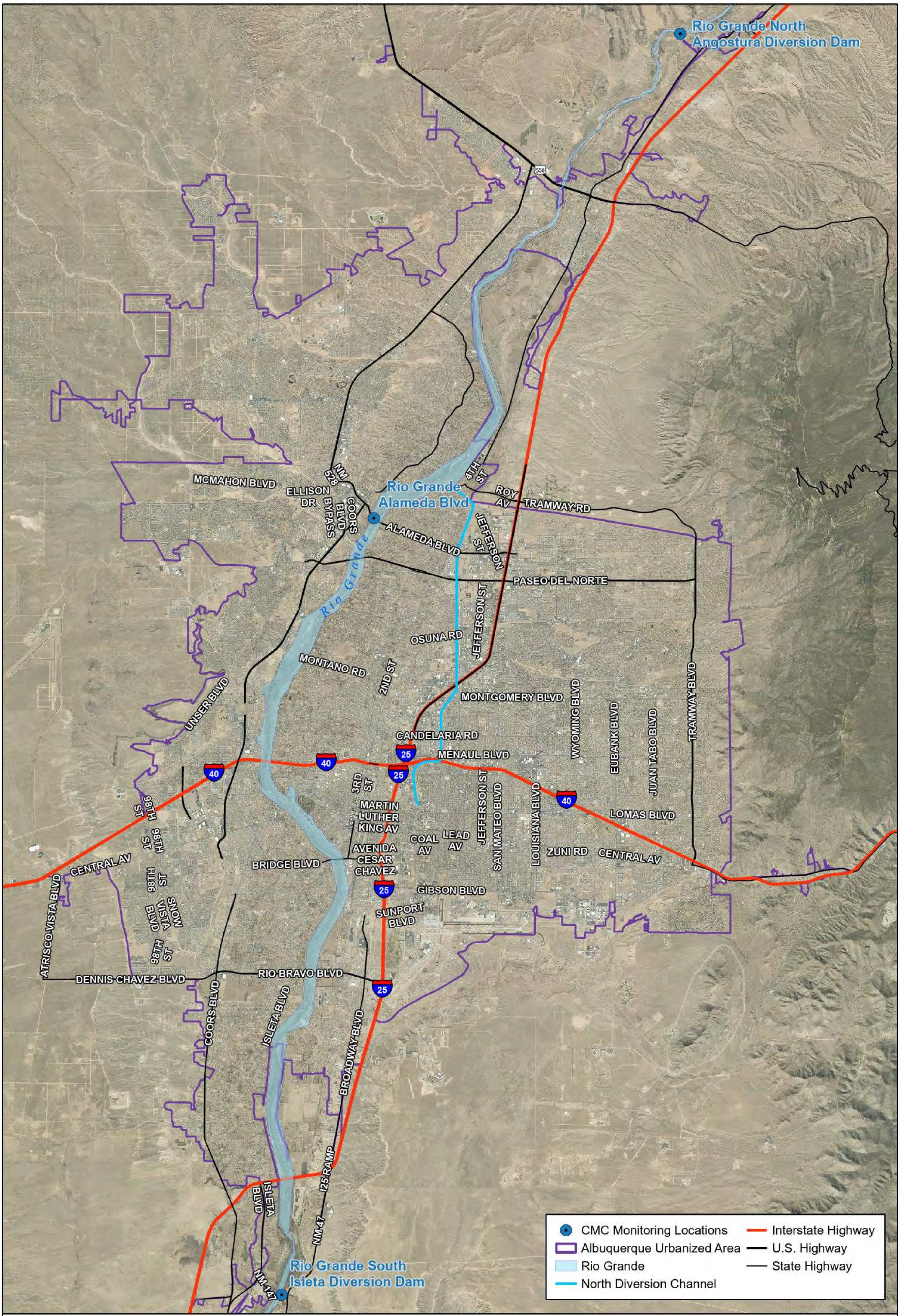
Plan, the WSB MS4 Permit required a minimum of seven (7) storm events be sampled at both the Rio Grande North and Rio Grande South locations (refer to Figure 1, page 4). All Permit required samples have been obtained by the CMC, as well as two (2) samples obtained in FY 2021 and the one (1) sample obtained in FY 2022 wet season during Administrative Continuance; all CMC samples are summarized in Table 2 below.

Table 2: CMC Sample Summary
Compared to WSB MS4 Permit Requirements

No. of Storm Events Required to Sample	CMC-WSB MS4 Permit Required Samples per Season	FY (Date) Samples Obtained for CMC
1	#1 Wet Season	FY 2017 (8/10/2016)
2	#2 Wet Season	FY 2017 (9/12/2016)
3	#3 Wet Season	FY 2017 (9/21/2016)
4	#1 Dry Season	FY 2017 (11/21/2016)
5	#2 Dry Season	FY 2019 (3/13/2019)
6	Any Season	FY 2018 (Wet Season - 7/27/2017)
7	Any Season	FY 2018 (Wet Season - 9/27/2017)
Not Required	Wet Season	FY 2021 (10/28/2020)
Not Required	Dry Season	FY 2021 (4/28/2021)
Not Required	Wet Season	FY 2022 (9/1/2021)

During the WSB MS4 Permit Administrative Continuance, the CMC members chose to continue sampling within the Rio Grande to support their MS4 program needs and gather additional data in support of the future MS4 Permit compliance. This memo reports on the wet weather stormwater monitoring activity for the FY 2022 wet season (July 1, 2021 to October 31, 2021).

The CMC Excel database was updated with the FY 2022 wet season, wet weather monitoring data as results were received. The database contains sample location, sample date, analyses conducted, methods used, applicable surface WQSs, WSB MS4 Permit required Minimum Qualification Levels (MQL) and results. Any unusable data will be identified.



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CMC Monitoring

Figure 1
Monitoring Locations

P:\20230125\WR\Reports\Preliminary & Draft\Figures\APRXs\Figure1.aprx
Author: mcrooks

August 2022

Summary of the CMC Sampling Plan

Sampling Parameters:

Samples from both the Rio Grande North and Rio Grande South monitoring locations were analyzed for the parameters defined in the EPA approved WSB MS4 CMC Monitoring Plan, May 5, 2016. The parameter list for both locations, which is intended to characterize stormwater discharges into the river, is as follows:

Total Suspended Solids (TSS)
Total Dissolved Solids (TDS)
Chemical Oxygen Demand (COD)
Biological Oxygen Demand – 5-day (BOD_5)
Dissolved Oxygen (DO)
Oil & grease (N-Hexane Extractable Material)
E. coli
pH
Total Kjeldahl Nitrogen (TKN)
Nitrate plus Nitrite
Dissolved Phosphorus
Ammonia plus Organic Nitrogen (Nitrogen, Ammonia and Nitrogen, Total)
Phosphorous (Total Phosphorous)
Polychlorinated Biphenyls (PCBs - Method 1668A)
Gross Alpha, adjusted
Tetrahydrofuran
Benzo(a)pyrene
Benzo(b)fluoranthene (3, 4 Benzofluoranthene)
Benzo(k)fluoranthene
Chrysene
Indeno (1 ,2,3-cd) Pyrene
Dieldrin
Pentachlorophenol
Benzidine
Benzo(a)anthracene
Dibenzofuran
Dibenzo(a, h)anthracene
Chromium VI (Hexavalent)
Copper – Dissolved
Lead – Dissolved
Bis (2-ethylhexyl) phthalate
Conductivity
Temperature

Hardness (as CaCO3) was added to the parameter list to allow dissolved metal results to be compared to the applicable WQSs. DO, pH, conductivity, and temperature are required by the WSB MS4 Permit to be analyzed in the field during sample collection, which was conducted by DBS&A, within 15 minutes of sample collection. All E. coli samples were submitted to the laboratory within eight (8) hours of collection in order to meet the specified hold time.

Sampling Locations:

The sampling locations are shown in Figure 1, page 4.

Rio Grande North – In-stream sampling within the Rio Grande was performed upstream of the Angostura Diversion Dam at the north end of the watershed. The location is upstream of all inputs from the Urban Area (UA) to the river and provides the background water conditions.

Rio Grande South – In-stream sampling within the Rio Grande was performed at the Isleta Bridge at the south end of the watershed. The location is downstream of all inputs from the UA to the river and provides the downstream water conditions. These locations have been accepted by EPA and the New Mexico Environment Department (NMED) to meet the WSB MS4 Permit requirements in Part III.A.

During this FY 2022 wet season, E. coli samples were collected within the Rio Grande at Alameda Blvd. This is the location of the NMED defined stream segment divide (refer to Figure 6). This sample point was added after discussion with NMED in February 2017 regarding potential refinements to E. coli loading calculations.

Sample Collection:

As mentioned previously, sample collection for the CMC is being conducted by DBS&A (through a separate on-call contract). Since BHI was not involved in the sample collection, this task and memo do not address the details of the methodologies regarding sampling, determining if an event was a qualifying storm event, or determining the timing of the hydrograph at the Rio Grande Alameda and Rio Grande South locations.

DBS&A provided BHI their field notes and field sample data (temperature, DO, specific conductivity, and pH) for the FY 2022 wet season sampling. AMAFCA provided BHI the completed laboratory analysis reports from Hall Environmental Analysis Laboratory (HEAL) for this monitoring season.

Quality Assurance Project Plan (QAPP):

AMAFCA provided BHI with the Draft Quality Assurance Project Plan (QAPP) for the CMC dated June 14, 2016. DBS&A followed this QAPP during sample collection. BHI used this QAPP and the included standard operating procedures (SOPs) for the data verification and validation.

Monitoring Activity & Lab Analysis Summary

The list below provides a summary of the CMC comprehensive monitoring program activities completed for the FY 2022 wet season from July 2021 through October 2021. One (1) qualifying storm event was sampled and analyzed during the FY 2022 wet season.

- **August 16, 2021 – Only E. Coli for Rio Grande North.** A sample was collected at the Rio Grande North location at 10:00 a.m. on August 16, 2021, and was sent to the laboratory for an E. coli only test. Based on the CMC review of the storm, it was determined this was not a qualifying storm event, hence further parameter testing was not conducted for the sample collected at the Rio Grande North location.

- **September 1-2, 2021 – Qualifying Storm Event – Full Analysis of Samples.** A sample was collected at the Rio Grande North location beginning at 9:15 a.m. on September 1 and sent to the laboratory for an E. coli and BOD test. A pre-storm sample was collected at the Rio Grande at Alameda Blvd. location at 11:25 a.m. on September 1 and tested for E. Coli only. The CMC determined that the storm event beginning September 1 was a qualifying storm event. A sample in the Rio Grande at Alameda Blvd. was obtained at 10:30 a.m. on September 2 and sent to the laboratory for E. Coli testing only. A Rio Grande South sample was collected beginning at 8:35 a.m. on September 2. The samples from the North (from September 1) and South (from September 2) locations were taken to HEAL for full parameter testing.

Stormwater Quality Database for CMC

As stated previously, there was one (1) qualifying storm event during the FY 2022 wet season, wet weather monitoring sampled by the CMC, which occurred September 1-2, 2021. DBS&A's field notes containing DO, pH, conductivity, and temperature measurements, as well as sampling comments have been received, and field results have been added to the database. Additionally, the HEAL reports for the corresponding time period have been received, added to the database, and are provided with this memo (Attachment 1). The laboratory reports attached to this memo have BHI added comments including the field parameter measurements and other relevant notes related to the laboratory report.

Database Data Entry:

The CMC Excel database was updated with the FY 2022 wet season, wet weather monitoring data. The database contains sample locations, sample date, analyses conducted, methods used, applicable surface water quality standards (WQS), WSB MS4 Permit required Minimum Quantification Levels (MQL), and analysis results. The database was updated under this Task to include the Rio Grande at Alameda sample location. Applicable surface WQSs found in New Mexico Administrative Code (NMAC) 20.6.4, as well as the Pueblo of Isleta WQSs, are entered in the Excel database for comparison purposes with testing results. There is an indicator in the database to show if the monitoring results exceed the applicable surface WQS. An exceedance is not a violation of the WSB MS4 Permit, as the Permit does not have numeric discharge limitations. These ">WQ Standard" flags simply and quickly show the CMC members where the results of the lab data exceed the applicable WQS.

Water quality data was entered into the database upon receipt of the lab reports. All data entered into the database is initially denoted with a "P" to indicate that it is provisional and has not been through the verification and validation process yet. Full parameter analyses of qualifying storm events for both Rio Grande North and Rio Grande South locations were entered respectively into the database. The E. coli only samples from the Rio Grande Alameda location were also entered into the database.

Data Verification and Validation:

The HEAL analysis reports were provided to BHI by AMAFCA. The lab reports also contain the Chain of Custody for the submitted samples. Field data was requested by and provided to BHI by DBS&A. Data verification and validation (V&V) was conducted by BHI on all field notes, lab reports, and Chain of Custody documents in accordance with the CMC WQS Operating Procedure

(SOP) #2, which is part of the existing CMC QAPP, Draft June 14, 2016. These procedures are based on EPA Guidance for Environmental Data Verification and Validation (EPA, 2008).

As stated in the QAPP, the V&V process was completed by a different person than the one who entered the data into the database. The V&V process included use of the *Data Verification and Validation Worksheet* (provided in the QAPP). For this task, field data was verified first, confirming all field notes were complete. BHI handled field parameter questions directly with DBS&A. Chemical data verification began as soon as the lab reports were received, checking that all parameters were tested and looking for any obvious exceedances of WQS. Other steps listed on the *Data Verification and Validation Worksheet* were completed after all data from the laboratory was received and entered into the database. Sample blank results were reviewed to identify potential contamination during field processing or transport. Replica/duplicate samples were evaluated based on relative percent difference (as described in more detail in the QAPP) to determine the variability of the samples.

All CMC FY 2021 wet season data met the appropriate QA/QC requirements. If there were any data that did not meet the appropriate QA/QC requirements, it would have been assigned an appropriate laboratory qualifier or validation codes. A summary of validation codes is provided in the QAPP.

Once the V&V process was completed, the worksheets were signed. Copies of the V&V worksheets are provided with this memo (Attachment 2). In the database, data that was checked during the V&V process was then changed from being denoted with a “P” for provisional to a “V” for verified, and laboratory qualifiers were added, as needed.

CMC FY 2022 Wet Season Assessment and Evaluation of Monitoring Results

The EPA approved WSB MS4 CMC Monitoring Plan, May 5, 2016, has 33 parameters to monitor at the Rio Grande North and Rio Grande South monitoring locations. Of these 33 parameters, 15 parameters were not detected in the FY 2022 wet season samples at either the Rio Grande North or South locations. Refer to Table 3 for a list of the parameters that were not detected.

Table 3: Parameters Not Detected
CMC FY 2022 Wet Season Monitoring

Parameters Not Detected	
Oil and Grease (N-Hexane Extractable Material)	Pentachlorophenol
Tetrahydrofuran	Benzidine
Benzo(a)pyrene	Benzo(a)anthracene
Benzo(b)fluoranthene (3, 4 Benzofluoranthene)	Dibenzofuran
Benzo(k)fluoranthene	Dibenzo(a,h)anthracene
Chrysene	Chromium VI (Hexavalent)
Indeno (1,2,3-cd) Pyrene	Bis (2-ethyhexyl) Phthalate (other names: Di(2-ethylhexly)phthalate, DEHP)
Dieldrin	

For the remaining 18 parameters on the CMC monitoring parameter list, only three (3) parameters (E. coli, PCBs, and gross alpha, adjusted) had exceedances of the applicable surface WQS found in New Mexico Administrative Code (NMAC) 20.6.4 and the Pueblo of Isleta WQS during the FY 2022 wet season. These exceedances are summarized on Table 1, pages 1-2, and discussed below in further detail.

E. coli:

The E. coli results collected during the FY 2022 wet season are summarized in Table 4.

Table 4: E. coli Results
CMC FY 2022 Wet Season Monitoring

Date – Rio Grande Location	E. coli Results MPN (CFU/100 mL)
August 16, 2021 – North	6,867
September 1, 2021 – North	183
September 1, 2021 – Alameda	20
September 2, 2021 – Alameda	554
September 2, 2021 – South	4,884

At the Rio Grande North location (upstream of the Albuquerque UA, at the Angostura Diversion Dam), two (2) samples were collected and tested for E. coli. Both E. coli results exceeded Pueblo of Isleta and Pueblo of Sandia's primary contact-single sample WQS of 88 CFU/100 mL, and one sample (August 16, 2021) was above and one sample (September 1, 2021) was below NMAC's primary contact-single sample WQS of 410 CFU/100 mL. At the Rio Grande South location (downstream of the MS4 UA), one (1) sample was collected and tested for E. coli. This sample also exceeded the Pueblo of Isleta WQS (88 CFU/100 mL) and the NMAC's WQS (410 CFU/100 mL) for E. coli concentration.

In addition, the CMC collected two (2) E. coli samples in the Rio Grande at Alameda Blvd. during the FY 2022 wet season. The Alameda Blvd. analysis point was based on discussions with NMED in February 2017 on collecting actual E. coli data at the stream segment divide verses using an area percentage (as defined in the TMDL) for E. coli loading calculations. For the FY 2022 wet season storm event, two (2) samples were collected at the Alameda location. One sample was taken before the storm event and one was taken after. The lab results showed that the pre-storm sample had an acceptable E. coli concentration, while the post-storm sample exceeded the primary contact-single sample Pueblo of Isleta WQS (88 CFU/100 mL) and the primary contact-single sample NMAC WQS (410 CFU/100 mL).

As a reminder, in January 2017 the CMC members clarified with NMED that the units MPN/100 mL and CFU/100 mL are considered to be interchangeable for the purposes of this stormwater quality monitoring reporting. The New Mexico and Pueblo WQS for E. coli are currently in units of CFU/100 mL while the lab reports are typically in units of MPN/100mL. The graph presented in this section uses units of CFU/100 mL to be consistent with the WQS units. Refer to Figure 2 for a graphical representation of E. coli results from August and September 2021.

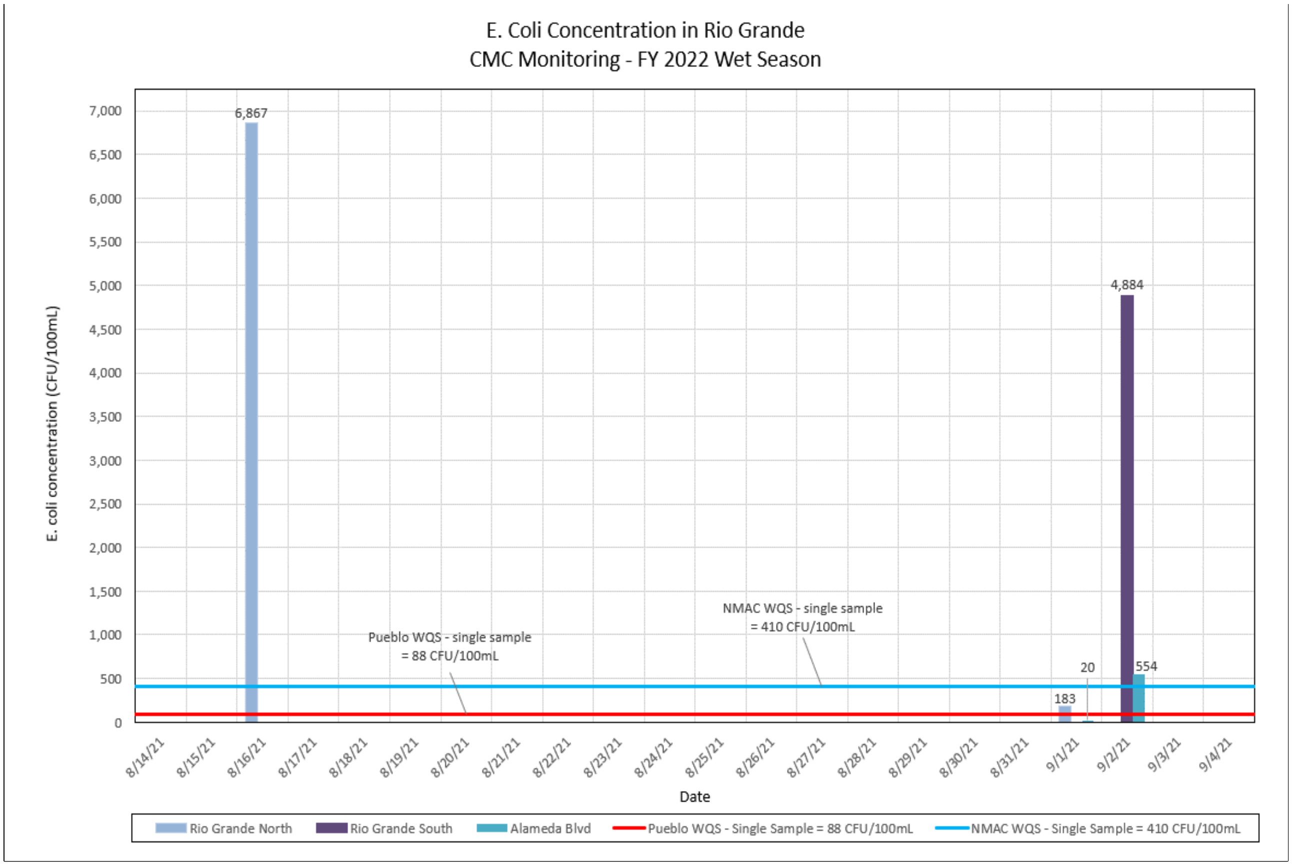


Figure 2: E. coli Results in Rio Grande
CMC Monitoring – FY 2022 Wet Season

PCBs:

There are multiple surface WQS values listed for PCBs in both the Pueblo of Isleta and the State of New Mexico standards for the various designated uses. The PCBs measured in samples collected from the Rio Grande during the FY 2022 wet season stormwater event were all below the minimum quantification level (MQL) established in EPA standards for the MS4 NPDES Permit (Appendix F, 0.2 ug/L for PCBs). The PCB results were also well below the New Mexico Surface WQSs and Pueblo of Isleta Surface WQSs for designated uses including drinking water (0.5 ug/L) and wildlife habitat, acute aquatic life, and chronic aquatic life (0.014 ug/L). However, the CMC sample from the Rio Grande South location was above the Pueblo of Isleta human health criteria (based on fish consumption only) WQS for surface waters. The human health-organism only criterion is based upon human consumption of fish and other aquatic life that bioaccumulate contaminants over time. The PCB results from 2016 through 2021 are shown in Figure 3 relative to several of the WQSs for PCBs.

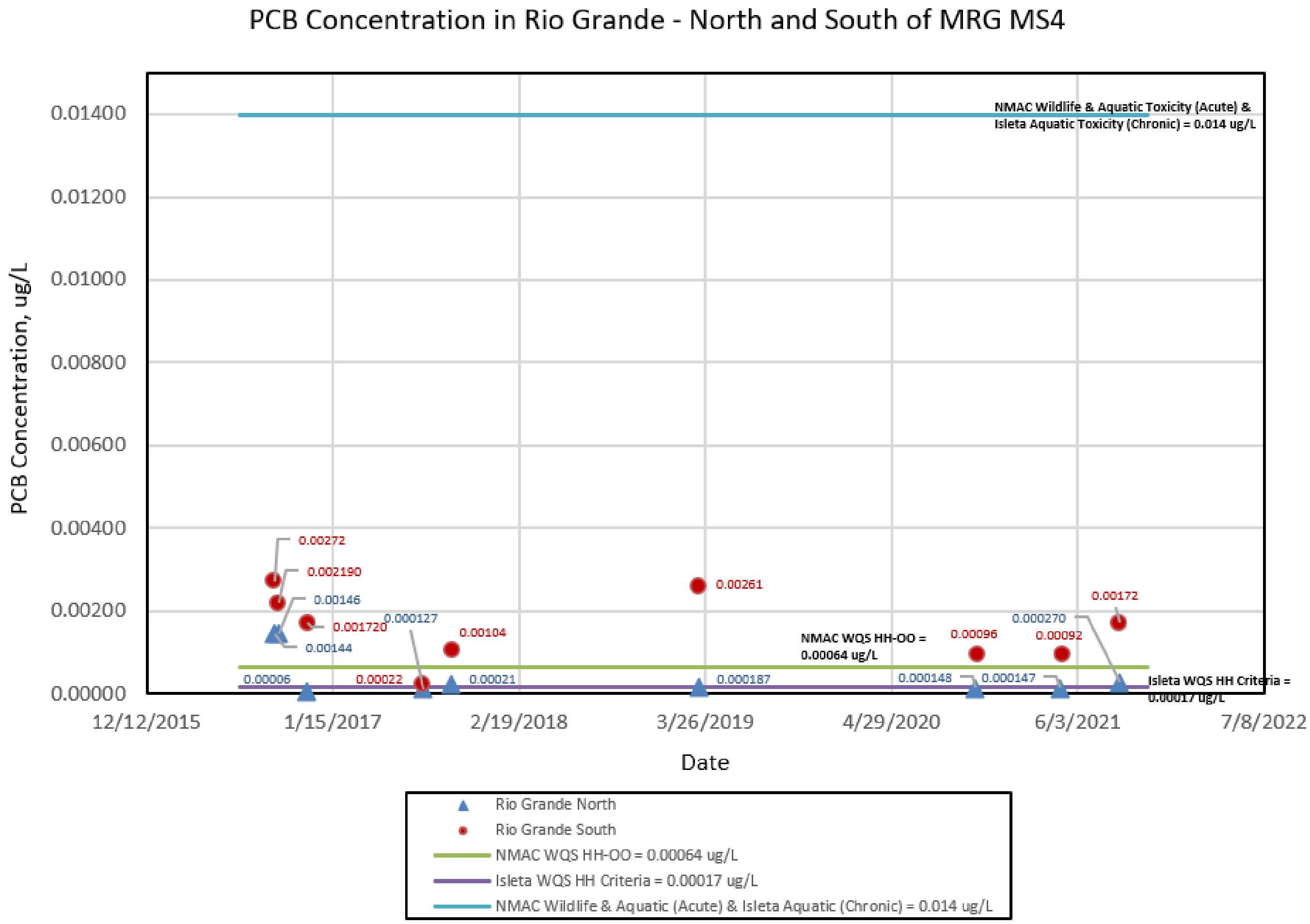


Figure 3: PCB Monitoring Results in Rio Grande
CMC Monitoring – 2016 - 2021

Adjusted Gross Alpha:

The September 2, 2021, Rio Grande South sample results exceeded the New Mexico and Pueblo of Isleta WQS for adjusted gross alpha. The WQS for adjusted gross alpha is the same value for both the NMAC 20.6.4 Water Quality Criterion and Pueblo of Isleta; the WQS of 15 pCi/L ("pCi/L" means picocuries per liter) is a general standard for the Pueblo of Isleta, and for New Mexico it is based on Domestic Water Supply and Livestock Watering designated uses. In surface water, the adjusted gross alpha analyses may be affected by a high content of suspended load, particularly where sediment sources may be derived from granitic terrain; gross alpha results may reflect the radioactivity of the natural elements in the sediment more than the surface water.

The September 2, 2021, Rio Grande South adjusted gross alpha analytical results are detailed below; the units are in pCi/L:

- Rio Grande South CMC sample result for adjusted gross alpha = 31.56 pCi/L
- Adjusted gross alpha WQS at the Rio Grande South location = 15 pCi/L (NMAC 20.6.4 Water Quality Criterion for livestock watering and domestic water supply designated uses and general standard for Pueblo of Isleta)

This is the second time since 2016 that the analytical results from a CMC sample have had an exceedance in adjusted gross alpha. The prior exceedance was reported for the September 28, 2017, Rio Grande South sample. The CMC will continue to closely evaluate this parameter in future samples. If additional exceedances occur, the CMC will discuss the results further and may consult NMED for further guidance.

Dissolved Oxygen and Temperature:

Two (2) of the water quality parameters are specifically worth mentioning in this memo because they are listed in the WSB MS4 Permit, Part I.C.1 – Special Conditions: dissolved oxygen and temperature. These parameters did not have any surface water quality exceedances during the FY 2022 wet season sampling.

Dissolved oxygen is a water quality concern in the Rio Grande if it is below 5 mg/L. None of the samples taken from the Rio Grande during the FY 2022 wet season monitoring had dissolved oxygen values below 5 mg/L. This provides the MS4s with specific monitoring data showing that stormwater did not cause or contribute to exceedances of applicable dissolved oxygen water quality standards in the Rio Grande from any of the CMC samples from 2016 to 2021. Refer to Figure 4 for CMC dissolved oxygen results and comparison to applicable WQSs.

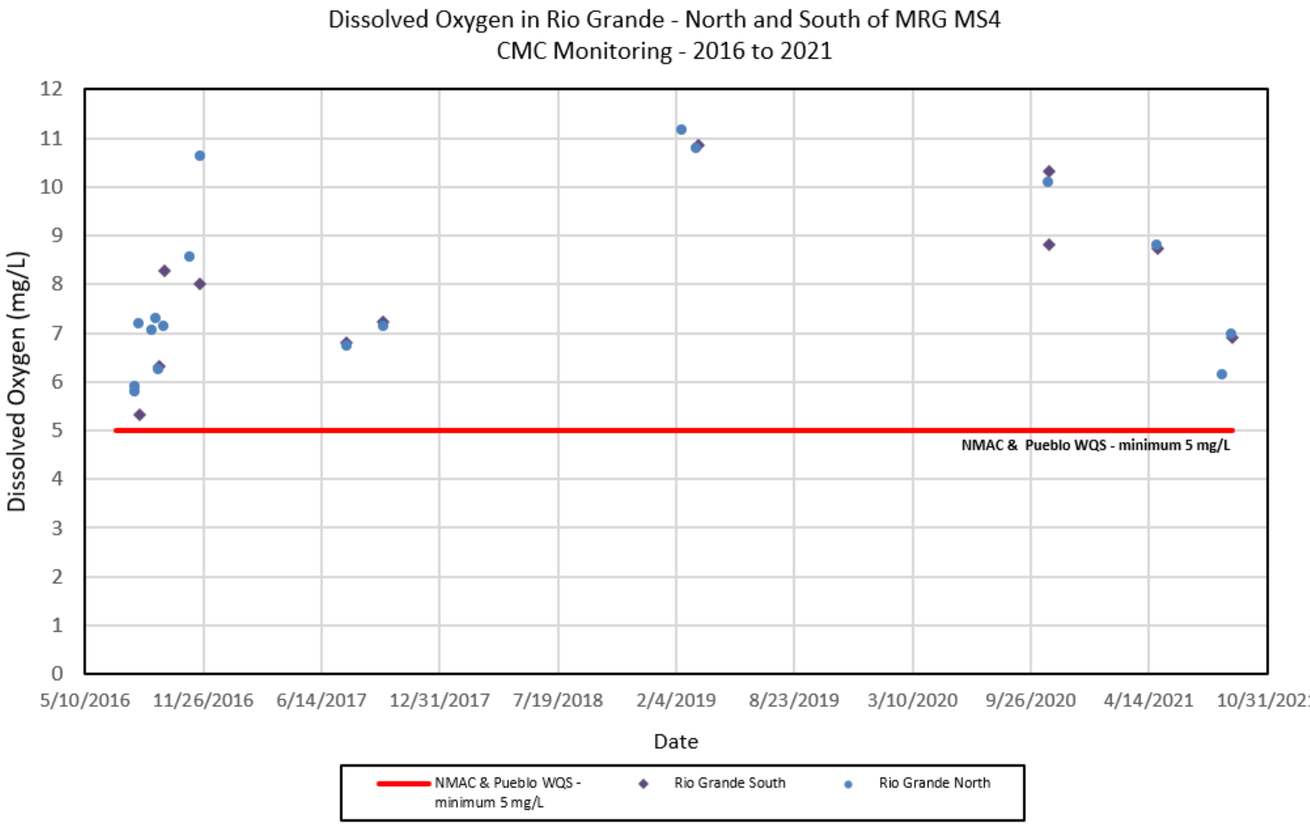


Figure 4: Dissolved Oxygen Results in the Rio Grande CMC Monitoring – 2016 - 2021

Temperature is listed in the WSB MS4 Permit as a special condition (currently only applicable to the City of Albuquerque and AMAFCA). Past data submitted to EPA and NMED by the MS4 permittees have proven that stormwater discharges into the Rio Grande are not raising the Rio Grande temperature above the WQSs. The data collected during this FY 2022 wet season monitoring also supports this conclusion. All the temperature field readings taken in the Rio Grande during the CMC FY 2022 wet season were below 32.2°C (90°F), which is the WQS for the State of New Mexico and for the Isleta and Sandia Pueblos. Refer to Figure 5 for temperature results and comparison to applicable WQSs for all CMC samples taken upstream and downstream of the MRG MS4 area from 2016 to 2021.

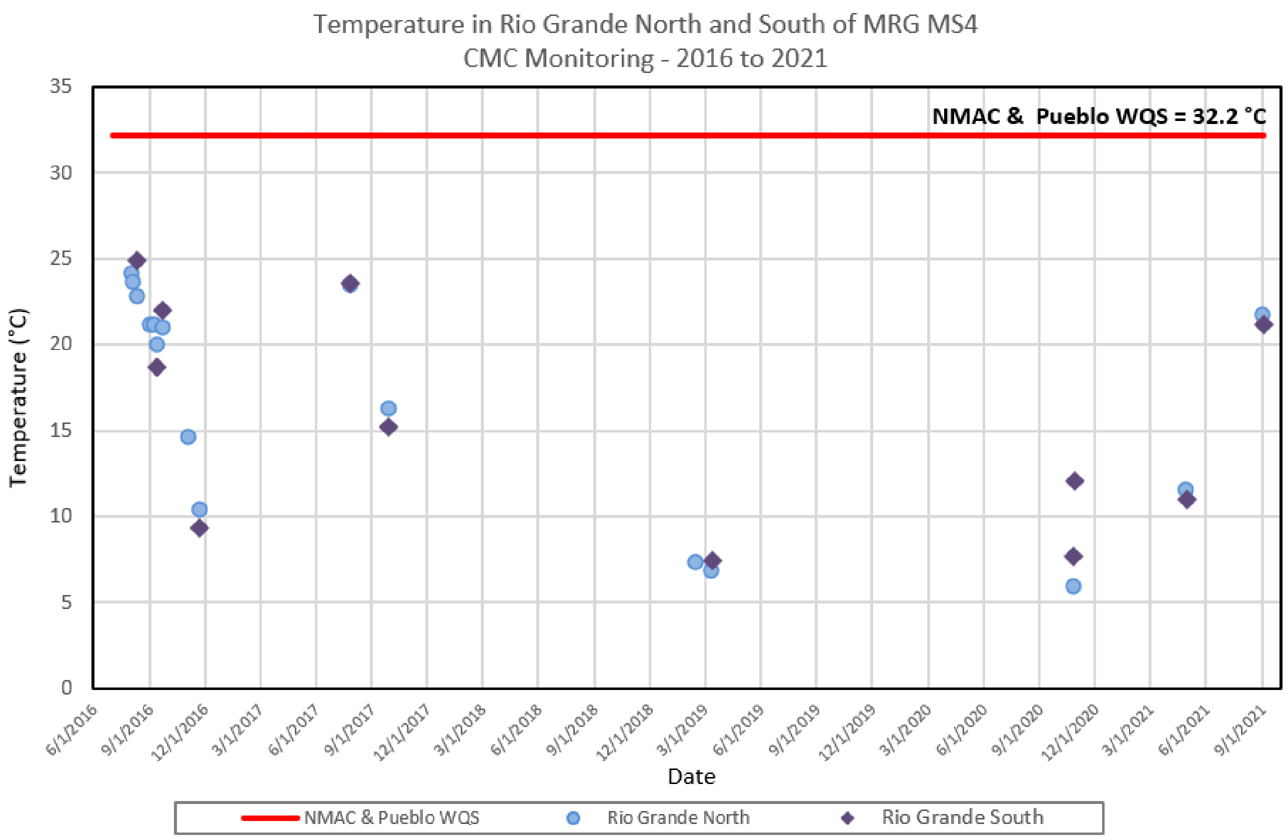


Figure 5: Temperature Monitoring Results in the Rio Grande CMC Monitoring – 2016 - 2021

CMC FY 2022 Wet Season E. coli Loading Calculations and Waste Load Allocation (WLA)

Related to assessing the stormwater results, the E. coli loading was calculated and compared to the aggregate Total Maximum Daily Load (TMDL) Waste Load Allocation (WLA) for the CMC group. A TMDL is the maximum amount of a pollutant (E. coli in this case) that a water body (Rio Grande) can assimilate on a daily basis without violating applicable surface WQSs. The total TMDL for a stream segment consists of the multiple WLA for point sources, non-point sources, and natural sources, plus a margin of safety. The CMC MS4 allotted WLA was determined in the EPA Approved, Total Maximum Daily Load for the Middle Rio Grande Watershed, June 30, 2010, and subsequent communications with NMED. The WLA varies by flow condition in the Rio Grande and by stream segment.

E. coli loading calculations and comparison to the WLA follows the WSB MS4 Permit requirements in "Discharges to Water Quality Impaired Water Bodies with an Approved TMDL", Part I.C.2.b.(i).(c).B, Appendix B-Total Maximum Daily Loads (TMDLs) Tables of the WSB MS4 Permit, and the NMED guidance provided to the CMC. Attached to this memo is the WLA Calculation spreadsheet which steps through the E. coli loading calculations and assumptions comparing the calculated E. coli loading to the CMC aggregate WLA defined by NMED.

There are two (2) stream segments defined in the WSB MS4 Permit (Appendix B): Isleta Pueblo Boundary to Alameda Street Bridge (Stream Segment 2105_50) and Non-Pueblo Alameda Bridge to Angostura Diversion (Stream Segment 2105.1_00). These stream segments differ from NMED's current stream segments defined in the *2020-2022 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report* (NMED, 2020). NMED currently has four (4) stream segments instead of the two (2) WSB MS4 stream segments. These various stream segment designations are shown in Figure 6, page 16.

The *NMED 303(d)/305(b) 2020-2022 Integrated Report* tables show the most recent assessment results, and currently all segments of the Rio Grande (Isleta to Angostura Diversion) are impaired for E. coli and have a TMDL for E. coli.

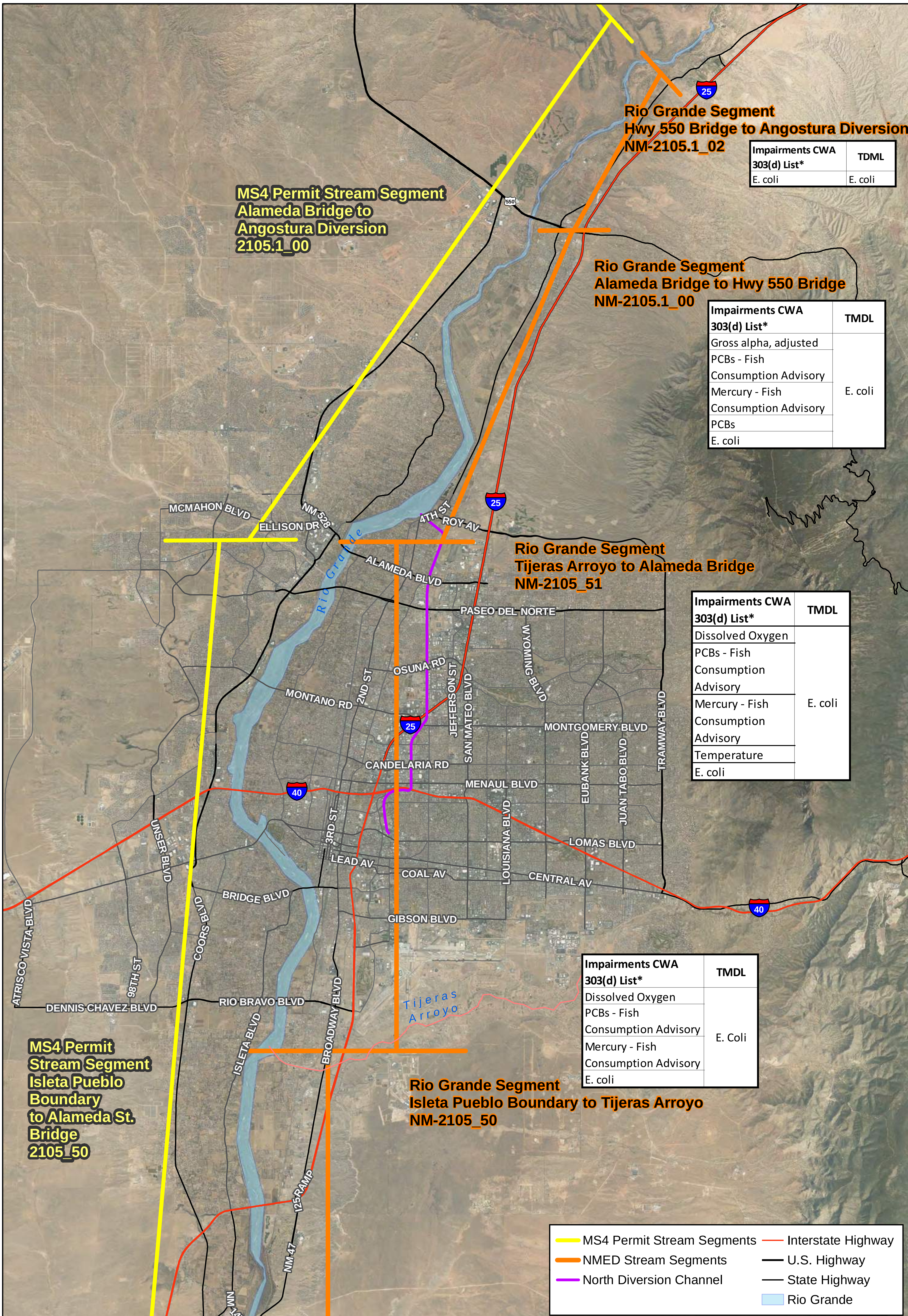
The E. coli daily loading associated with the CMC group and comparison to the NMED WLA was completed for the one (1) qualifying wet season storm event – September 1-2, 2021. For this event, the CMC obtained an E. coli sample in the Rio Grande at Alameda and used this to calculate the E. coli loading for the two (2) river segments. Refer to Table 5 for a summary of the WLA comparison results. A spreadsheet is attached to this memo that provides the detailed WLA calculations.

Table 5: Summary of CMC E. Coli Loading Compared to WLA for the CMC

Date / Stream Segment	Daily Mean Flow (cfs)	Flow Conditions (cfs) *range defined by NMED*	CMC Daily E. coli Loading (CFU/day)	NMED WLA for CMC for Stream Segment and Flow Conditions	Loading Compared to WLA Potential Exceedance or Acceptable
September 1-2, 2021 – Rio Grande North E. coli Concentration 9/1/2021 = 183 MPN (CFU/100 mL) Rio Grande at Alameda pre-storm E. coli Concentration 9/1/2021 = 20 MPN (CFU/100 mL) Rio Grande at Alameda E. coli Concentration 9/2/2021 = 554 MPN (CFU/100 mL) Rio Grande South E. coli Concentration 9/2/2021 = 4,884 MPN (CFU/100 mL)					
Alameda to Angostura	146	Low	1.02E+12	1.68E+10	WLA Potential Exceedance
Isleta to Alameda	165	Low	3.20E+11	3.42E+09	WLA Potential Exceedance

As Table 5 illustrates, the calculated E. coli loading for the September 1-2, 2021 storm event for the northern segment (Alameda to Angostura) and the southern segment (Isleta to Almeda) of the Rio Grande exceeded the WLA for the CMC MS4s. This analysis used the mid-point E. coli sample result obtained in the Rio Grande at Alameda.

The WSB MS4 Permit implies that the WLA is a measurable goal for the MS4s related to E. coli. Based on extensive review of the EPA Approved, Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed, June 30, 2010, this seems to be an unattainable goal for MS4s.



Hwy 550 Bridge to Angostura Diversion (NM-2105.1_02)

Impairments CWA 303(d) List*	TDML
E. coli	E. coli

Alameda Bridge to Hwy 550 Bridge (NM-2105.1_00)

Impairments CWA 303(d) List*	TMDL
Gross alpha, adjusted	E. coli
PCBs - Fish Consumption Advisory	
Mercury - Fish Consumption Advisory	
PCBs	
E. coli	

Tijeras Arroyo to Alameda Bridge (NM-2105_51)

Impairments CWA 303(d) List*	TMDL
Dissolved Oxygen	E. coli
PCBs - Fish Consumption Advisory	
Mercury - Fish Consumption Advisory	
Temperature	
E. coli	

Isleta Pueblo Boundary to Tijeras Arroyo (NM-2105_50)

Impairments CWA 303(d) List*	TMDL
Dissolved Oxygen	E. Coli
PCBs - Fish Consumption Advisory	
Mercury - Fish Consumption Advisory	
E. coli	

AMAFCA

Bohannan Huston
www.bhinc.com 800.877.5332

N

0 12,000 24,000 Feet
1 in = 12,500 ft

CMC Monitoring

Figure 6
Rio Grande Impairments & TMDL Information

* Final 2020-2022 State of NM Clean Water Act, Section 303(d)/Section 305(b) Integrated Report

P:\20230125\WR\Reports\Final\Figures\MXDs\Figure6-MS4_TMDLStreamSegments_2021_0416.mxd
Author: mcrooks

August 2022

Page 40 of the 2010 TMDL Report states, “It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards…Meeting the calculated TMDL may be a difficult objective.” The TMDL/WLA was calculated by NMED to meet the Pueblo (Sandia and Isleta) geometric mean maximum of 47 CFU/100 ml, which was done to be “protective of downstream waters” and “to provide an implicit margin of safety (MOS)”. A single grab sample E. coli result meeting this very low geometric means WQSs will be very difficult for the MS4s to obtain.

The CMC members discussed the difficulty of using the WLA as a measurable goal with NMED on February 1, 2017. NMED explained that exceeding the WLA does not trigger enforcement. However, NMED strongly encouraged the MS4s to document what they are doing once they realize the WLA is potentially exceeded. The meeting on February 1, 2017, and the CMC discussion with NMED on February 16, 2017, demonstrate CMC members are working toward understanding the WLA. In addition, the CMC members began implementing a refinement to the sampling plan discussed with NMED by obtaining an E. coli sample in the Rio Grande at Alameda effective the FY 2018 wet season, as feasible. This demonstrates that the CMC is continuing to investigate the potential exceedances and make improvements to monitor E. coli in the Rio Grande.

Data Entry for Discharge Monitoring Reports

The WSB MS4 Permit entered Administrative Continuance in December 2019 when EPA Region 6 did not issue a new MS4 Permit before the current MS4 Permit’s expiration date. Until a new MS4 Permit is issued, there are no compliance monitoring requirements for the CMC in the Rio Grande. As identified in the CMC Monitoring Plan, the WSB MS4 Permit required a minimum of seven (7) storm events be sampled at both the Rio Grande North and Rio Grande South locations. All MS4 Permit required samples have been obtained by the CMC and verified stormwater quality data from these required events have been submitted to the EPA using electronic Discharge Monitoring Report (DMR) forms. Data from the DMRs are uploaded to a comprehensive nationwide database that contains discharge data for facilities and other point sources that discharge directly to receiving streams. For this Task, BHI has not completed any data entry related to the EPA DMRs for the FY 2022 wet season.

Conclusions and Planning

During the FY 2022 wet season (July 1 to October 31, 2021), one (1) qualifying stormwater sample was obtained by the CMC. Lab results were received, and this data has been entered into the CMC Excel database. The lab data entered is marked in the spreadsheet as “V” (verified), and data V&V has been completed (refer to Attachment 2).

To summarize, monitoring results and E. coli loading calculations for the FY 2022 wet season show that:

- The WSB MS4 Permit entered Administrative Continuance in December 2019 when U.S. Environmental Protection Agency (EPA) Region 6 did not issue a new MS4 Permit before the current MS4 Permit’s expiration date. Until a new MS4 Permit is issued, there are no compliance monitoring requirements for the CMC in the Rio Grande. All MS4 Permit required samples have been obtained by the CMC, as well several samples collected during Administrative Continuance, including the one (1) sample obtained in the FY 2022 wet season, as reported in this memo.

- For the FY 2022 wet season, 15 of the 33 parameters tested were not detected in any of the Rio Grande North or South samples.
- Several key parameters all met the applicable WQSs, as they have for all the CMC samples to date:
    - All dissolved oxygen results were greater than 5 mg/L (minimum WQS).
    - All temperature results were less than 32.2°C (maximum WQS).
- The PCB results were below the New Mexico Surface WQSs and Pueblo of Isleta Surface WQSs for designated uses including drinking water, wildlife habitat, acute aquatic life, and chronic aquatic life. However, the Rio Grande North and South CMC samples from September 1-2, 2021 were above the Pueblo of Isleta human health criteria (based on fish consumption only) WQS for surface waters.
- The September 2, 2021, Rio Grande South sample result exceeded the New Mexico Surface WQSs and Pueblo of Isleta Surface WQSs (15 pCi/L) for adjusted gross alpha. This is the second time since 2016 that the analytical results from a CMC sample have had an exceedance in adjusted gross alpha. The CMC will continue to closely evaluate this parameter in future samples
- The calculated E. coli loading for the September 1-2, 2021 storm event for the northern segment (Alameda to Angostura) and the southern segment (Isleta to Almeda) of the Rio Grande exceeded the WLA for the CMC MS4s. This analysis used the mid-point E. coli sample result obtained in the Rio Grande at Alameda.
    - Sources for the E. coli loading measured in the river are not solely attributable to the CMC MS4 members; the E. coli loading calculations serve to provide a reasonable estimate of the CMC contribution to the measured E. coli loading.
    - This sampling and calculation approach is only an estimate of the CMC contribution to the E. coli loading which is why the term “potential exceedance” is used.
    - The in-stream data does not provide the concentration of E. coli contributed by only the CMC MS4s or any of the other potential sources. By using this percentage calculation approach, if other contributors are in exceedance of the WLA, then the CMC will likely also be in exceedance since this approach relies on a percentage of a total.

For planning purposes for the CMC members, the FY 2022 dry season CMC monitoring will be summarized by BHI for the CMC in a dry season memo.

SG/ab

Attachments:

Attachment 1 – DBS&A Field Data & Hall Environmental Analysis Laboratory Reports with BHI Notes for FY 2022 Wet Season

Attachment 2 – FY 2022 Wet Season Completed Data Verification and Validation (V&V) Forms

Spreadsheets Included Separately:

E. coli Loading and Comparison to Waste Load Allocation (WLA) Excel Spreadsheet

Excel CMC Spreadsheet with FY 2022 Wet Season Stormwater Quality Monitoring Results

ATTACHMENT 1

DBS&A FIELD DATA & HALL ENVIRONMENTAL ANALYSIS LABORATORY REPORTS WITH BHI NOTES FOR FY 2022 WET SEASON

CMC Water Quality Results Database
FY 2017 -FY 2021
Date: August 10, 2022
Summary of Lab Results for CMC samples

		Rio Grande - North - At Angostura Dam												Rio Grande - Alameda Bridge (E. coli Only Samples)							
Parameter	Permit Required Units	Provisional or Verified	2022 CMC SAMPLE - EXTRA NORTH Collection Date 8/16/2021 Wet Season Sample Non Qualifying Storm Event	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA NORTH Collection Date 9/01/2021 Wet Season Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA SOUTH Collection Date 9/02/2021 Wet Season Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA ALAMEDA Collection Date 9/1/2021 Wet Season Pre-Storm Sample	Qualifier	Check compared to Water Quality Criterion	Provisional or Verified	2022 CMC SAMPLE - EXTRA ALAMEDA Collection Date 9/2/2021 Wet Season Sample	Qualifier	Check compared to Water Quality Criterion
Total Suspended Solids (TSS)	mg/L					V	130		--	V	790	D	--								
Total Dissolved Solids (TDS)	mg/L					V	230	D	OK	V	330	D	OK								
Chemical Oxygen Demand (COD)	mg/L					V	22.2		--	V	54.2		--								
Biochemical Oxygen Demand (BOD_5)	mg/L					V	2.7	RE	--	V	4.9		--								
Dissolved Oxygen (DO)	mg/L	V	6.13		OK	V	6.98		OK	V	6.92		OK	V	7.06		OK	V	6.92		OK
Oil and Grease (N-Hexane Extractable Material)	mg/L					V	ND		OK	V	ND		OK								
E. coli	MPN (CFU/100 mL)	V	6,867		>WQ Standard	V	183		>WQ Standard	V	4,884		>WQ Standard	V	20.0		OK	V	554.0		>WQ Standard
pH	S.U.	V	7.92		OK	V	8.63		OK	V	8.11		OK	V	8.37		OK	V	7.72		OK
Total Kjedahl Nitrogen (TKN)	mg/L					V	4.1		--	V	2	JD	--								
Nitrate plus Nitrite	mg/L					V	ND		OK	V	1.8		OK								
Dissolved Phosphorous	mg/L					V	0.15	D	--	V	1.4	D	--								
Ammonia (mg/L as N)	mg/L					V	0.42	J	OK	V	ND		OK								
Total Nitrogen	mg/L					V	4.52	J	OK	V	3.80		OK								
Total Phosphorous	mg/L					V	0.29	D	--	V	1.3	D	--								
PCBS - 0.000064 (Method 1668A - sum of all congeners)	µg/L					V	0.00027	J	>WQ Standard	V	0.00172	J	>WQ Standard								
Gross Alpha, Adjusted	pCi/L					v	4.94	Note - Gross Alpha was reported, not adjusted gross alpha. Calculation completed to determine adjusted gross alpha.	OK	V	31.56	Note - Gross Alpha was reported, not adjusted gross alpha. Calculation completed to determine adjusted gross alpha.	>WQ Standard								
Tetrahydrofuran	µg/L					V	ND		--	V	ND		--								
Benzo(a)pyrene	µg/L					V	ND		OK	V	ND		OK								
Benzo[b]fluoranthene (other name: 3,4-Benzofluoranthene)	µg/L					V	ND		OK	V	ND		OK								
Benzo(k)fluoranthene	µg/L					V	ND		OK	V	ND		OK								
Chrysene	µg/L					V	ND		OK	V	ND		OK								
Indeno(1,2,3-cd)Pyrene	µg/L					V	ND		OK	V	ND		OK								
Dieldrin	µg/L					V	ND		OK	V	ND		OK								
Pentachlorophenol	µg/L					V	ND		OK	V	ND		OK								
Benzidine	µg/L					V	ND		OK	V	ND		OK								
Benzo(a)anthracene	µg/L					V	ND		OK	V	ND		OK								
Dibenzofuran	µg/L					V	ND		--	V	ND		--								
Dibenzo(a,h)anthracene	µg/L					V	ND		OK	V	ND		OK								
Chromium VI (Hexavalent)	µg/L					V	ND		OK	V	ND		OK								
Dissolved Copper	µg/L					V	0.84	J	OK	V	1.5		OK								
Dissolved Lead	µg/L					V	0.065	J	OK	V	0.32	J	OK								
Bis (2-ethyhexyl) Phthalate (other names: Di(2-ethylhexly)phthalate, DEHP) - 2.2	µg/L					V	ND		OK	V	ND		OK								
Conductivity	umhos/cm	V	591		--	V	315		--	V	484		--	V	375		--	V	383		--
Temperature	°C	V	21.24		OK	V	21.71		OK	V	21.21		OK	V	23.19		OK	V	22.14		OK
Hardness (as $CaCO_3$)	mg/L					V	160		--	V	290		--								
Mercury	µg/l																				

Data Verification/Validation and Qualifier Notes:
(R) The sample results are unusable because certain criteria were not met. The analyte may or may not be present in the sample.
(H) Sample holding time exceeded.
(J) The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
(D) Sample was diluted by Lab due to matrix
(U) Analyte was analyzed for, but not detected above the specified detection limit.

Notes:
1. Wet Season monitoring period - July 1 to October 31 and Dry Season monitoring period - November 1 to June 30 according to the Watershed Based MS4 Permit NMR04A000.
2. Water Quality Criterion from 20.6.4 NMAC; Rio Grande Basin - section 20.6.4.105; For a mean monthly flow of 100 cfs, monthly average
3. Aquatic life criteria for metals are expressed as a function of total
4. According to NMAC 20.6.4, E. coli bacteria for Primary Contact - monthly
5. Water quality criterion for metals is based on dissolved metals, NMAC 20.6.4.900.I and individual sample results compared to acute toxicity
6. HEAL lab method: SM 9223B Fecal Indicator. Note - lab method for units of MPN/100 ml, lab report uses units CFU/100 ml, for this analysis assuming

ND - analyte not detected above the laboratory method detection limit
NA - not analyzed
Hatching also indicates that parameter was not analyzed

National recommended WQ criteria Human Health
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

Samplers S. Williams/M. Zbcozek

CMC Sampling Data Sheet

Site Identification: Angostora Dam

Notes:

Full Suite Sample Date and Time: 8/16/21 1049	
Full Sample Identification: RGNorth-20210816	
QC Samples: Duplicate / None	QC Sample ID:
QC samples require a DIFFERENT sample time than the environmental sample. QC Sample time:	

Full Suite Collection Point : Angostora Dam

Full Suite Sample Volume: ~2.5 gal Collection Time Start: 1000 End: 1045

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
1						
2						
3	1030	20.92	7.83	591	5.29	58.4
4	1045	20.69	7.89	581	5.37	59.2
Composite	1049	21.24	7.92	591	6.13	68.4

☒*Turbid Water* ☒*Color* Brn ☐*Solids* ☐*Oil/Sheen* ☐*Foam* ☐*Odor*________

Analytical -see 2020 COC table

☐Site Photo ☐Sample Photo

Samplers Amy Ewing + Mike Zbrozek

CMC Sampling Data Sheet

Site Identification: RGNorth (Angostura Dam)

Notes:

Full Suite Sample Date and Time:	RGNorth-20210901
Full Sample Identification:	9/1/2021 1005
QC Samples: Duplicate (None)	QC Sample ID:
QC samples require a DIFFERENT sample time than the environmental sample. QC Sample time:	

Full Suite Collection Point : NNE off the end of Angostura Dam

Full Suite Sample Volume: 4 gal Collection Time Start: 0917 End: 1002

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	ORP (mV)
1	0917	21.73	8.54	351	6.90	74.8	149.5
2	0932	21.33	8.62	305	7.23	84.1	168.4
3	0947	21.69	8.65	303	6.81	78.6	150.6
4	1002	22.07	8.70	302	6.98	80.7	134.5
Composite	1005	21.71	8.63	315	6.98	79.6	150.7

☑ *Turbid Water* Semi- ☐ *Color* tan/clear ☐ *Solids* ☐ *Oil/Sheen* ☐ *Foam* ☐ *Odor*________

Analytical -see 2020 COC table

☑ Site Photo ☑ Sample Photo

Samplers Amy Ewing + Mike Zbrozek

CMC Sampling Data Sheet

Site Identification: Rio Grande at Alameda

Notes: Sampled per Kali's request

E. coli
~~Full Suite~~ **Sample Date and Time:** 9/01/2021 1125

Full Sample Identification: RGAlameda-20210901

QC Samples: Duplicate / None QC Sample ID:

QC samples require a DIFFERENT sample time than the environmental sample.
QC Sample time:

E. coli
~~Full Suite~~ **Collection Point :** Downstream side of the Alameda foot bridge across from USGS gage

Full Suite Sample Volume: —— Collection Time Start: 1125 End: 1125 (grab)

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (μS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	ORP (mV)
1	1125	23.19	8.37	375	7.06	83.7	97.7
2							
3							
4							
Composite							

☑ *Turbid Water* ☑ *Color* Brown ☐ *Solids* ☐ *Oil/Sheen* ☐ *Foam* ☐ *Odor*________

Analytical - see 2021 COC table

☑ Site Photo ☑ Sample Photo

Samplers Amy Ewing and Mike Zbrozek

CMC Sampling Data Sheet

Site Identification: Rio Grande at Alameda

Notes:

E. coli

~~Full Suite~~ **Sample Date and Time:**	9/2/21 1030
~~Full Sample~~ **Identification:**	RGAlameda-20210902
QC Samples: Duplicate / None	QC Sample ID:
QC samples require a DIFFERENT sample time than the environmental sample. QC Sample time:	

E. coli

~~Full~~ **Suite Collection Point :** off footbridge, downstream side, across from USGS stream gage

~~Full Suite~~ Sample Volume: —— Collection Time Start: —— End: ——

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
1	1030	22.14	7.72	383	6.72	77.4
2						
3						
4						
Composite						

☑ *Turbid Water* ☑ *Color* Brown ☐ *Solids* ☐ *Oil/Sheen* ☐ *Foam* ☐ *Odor*________

Analytical - ~~see 2021 COC table~~
E. coli only

☑ Site Photo ☑ Sample Photo

Samplers Amy Ewing and Mike Zbrozek

CMC Sampling Data Sheet

Site Identification: Rio Grande at Isleta diversion

Notes:

Full Suite Sample Date and Time:	9/2/21 ~~0905~~ 0920
Full Sample Identification:	RG South - 20210902
QC Samples: Duplicate None	QC Sample ID:
QC samples require a DIFFERENT sample time than the environmental sample. QC Sample time:	

Full Suite Collection Point : Off diversion structure, next to bldg.

Full Suite Sample Volume: 5 gallons Collection Time Start: 0835 End: 092

Field Parameters for each 2-gallon grab

Grab	Time	Temp (°C)	pH	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)
1	0835	20.05	7.99	495	5.89	64.1
2	0850	20.37	7.93	484	7.93	83.1
3	0905	20.66	7.97	485	6.06	66.6
4	0920	20.68	7.95	477	6.06	67.2
Composite	0928	21.21	8.11	484	6.92	77.6

☑ *Turbid Water* ☑ *Color* Brown ☑ *Solids* minor bits ☐ *Oil/Sheen* ☐ *Foam* ☐ *Odor*________

Analytical - see 2021 COC table

☑ Site Photo ☑ Sample Photo

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

August 19, 2021

8/16/2021 CMC Sample at Rio Grande North. E. coli results for the pre-storm. Storm did not become a qualifying event.

Patrick Chavez
AMAFCA
2600 Prospect Ave NE
Albuquerque, NM 87107
TEL: (505) 884-2215
FAX:

RE: CMC

OrderNo.: 2108836

Dear Patrick Chavez:

Hall Environmental Analysis Laboratory received 1 sample(s) on 8/16/2021 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Field Parameters
Rio Grande North-
Temp = 21.24 °C
pH = 7.92
Conductivity (uS/cm=umho/cm) = 591
Dissolved Oxygen (mg/L) = 6.13

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **8/19/2021**

CLIENT: AMAFCA
Project: CMC
Lab ID: 2108836-001 **Matrix:** AQUEOUS

Client Sample ID: RG North-20210816
Collection Date: 8/16/2021 10:49:00 AM
Received Date: 8/16/2021 12:49:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM 9223B FECAL INDICATOR: E. COLI MPN						Analyst: **dms**
E. Coli	6867	10.00		MPN/100	10	8/17/2021 5:44:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

Sample Log-In Check List

Client Name: AMAFCA   Work Order Number: 2108836   RcptNo: 1

Received By: Tracy Casarrubias   8/16/2021 12:49:00 PM

Completed By: Sean Livingston   8/16/2021 4:14:27 PM   S. Livingston

Reviewed By: BOD/Enumeration JR 8/16/21 @16:40

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C Yes ☐ No ☑ NA ☐
   Samples were collected the same day and chilled.
5. Sample(s) in proper container(s)? Yes ☑ No ☐
6. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
8. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA? Yes ☐ No ☐ NA ☑
10. Were any sample containers received broken? Yes ☐ No ☑
11. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
13. Is it clear what analyses were requested? Yes ☑ No ☐
14. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

# of preserved bottles checked for pH:
(<2 or >12 unless noted)
Adjusted?
Checked by:

BOD/Enumeration: TMC 8-16-21

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	23.8	Good				

Chain-of-Custody Record

Client: AMAFCA

Mailing Address:

Phone #:

email or Fax#: pchavez@amafca.org

QA/QC Package:

☐ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance

☐ NELAC ☐ Other

☐ EDD (Type)

Turn-Around Time:

☒ Standard ☐ Rush

Project Name: CMC

Project #:

Project Manager: Patrick Chavez

Sampler:

On Ice: ☒ Yes ☐ No

# of Coolers: 1

Cooler Temp(Including CF): 24.0-0.2=23.8 (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2108836	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)						
8.16.21	1049	AQ	RGNorth-20210816	bottles		001		see attached														

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
8/16/21	1241	[signature]	[signature]		8.16.21	12:49
Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time

Remarks: Per Chad - only analyze for e.coli enumeration. [initials] 8/17/21

[signature] 8/16/21

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
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September 07, 2021

9/1/2021 CMC Sample at Rio Grande North and Alameda. E. coli results for the pre-storm. Storm did become a qualifying event.

Patrick Chavez
AMAFCA
2600 Prospect Ave NE
Albuquerque, NM 87107
TEL: (505) 884-2215
FAX:

RE: CMC OrderNo.: 2109083

Dear Patrick Chavez:

Hall Environmental Analysis Laboratory received 2 sample(s) on 9/1/2021 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0901

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Field Parameters
Rio Grande North-
Temp = 21.71 °C
pH = 8.63
Conductivity (uS/cm=umho/cm) = 315
Dissolved Oxygen (mg/L) = 6.98
Alameda-
Temp = 23.19 °C
pH = 8.37
Conductivity (uS/cm=umho/cm) = 375
Dissolved Oxygen (mg/L) = 7.06

Analytical Report
Lab Order **2109083**

Hall Environmental Analysis Laboratory, Inc.

Date Reported: **9/7/2021**

CLIENT: AMAFCA
Project: CMC
Lab ID: 2109083-001 **Matrix:** AQUEOUS

Client Sample ID: RG North- 20210901
Collection Date: 9/1/2021 10:05:00 AM
Received Date: 9/1/2021 4:10:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM 9223B FECAL INDICATOR: E. COLI MPN						Analyst: **dms**
E. Coli	183	10.00		MPN/100	10	9/2/2021 5:05:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA		**Client Sample ID:**	RG Alameda- 20210901
Project: CMC		**Collection Date:**	9/1/2021 11:25:00 AM
Lab ID: 2109083-002	**Matrix:** AQUEOUS	**Received Date:**	9/1/2021 4:10:00 PM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
SM 9223B FECAL INDICATOR: E. COLI MPN						Analyst: **dms**
E. Coli	20	10.00		MPN/100	10	9/2/2021 5:05:00 PM

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
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TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

Sample Log-In Check List

Client Name: AMAFCA   Work Order Number: **2109083**   RcptNo: **1**

Received By: **Sean Livingston**   9/1/2021 4:10:00 PM   S Livingston

Completed By: **Isaiah Ortiz**   9/1/2021 4:18:41 PM   I Ortiz

Reviewed By: JR 9/1/21 @ 16:25

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
5. Sample(s) in proper container(s)? Yes ☑ No ☐
6. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
8. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA? Yes ☐ No ☐ NA ☑
10. Were any sample containers received broken? Yes ☐ No ☑
11. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
13. Is it clear what analyses were requested? Yes ☑ No ☐
14. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

# of preserved bottles checked for pH:
(<2 or >12 unless noted)
Adjusted?
Checked by: SPA 9.1.21

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.9	Good	Not Present			

Chain-of-Custody Record

Client: AMAFCA

Mailing Address:

Phone #:

email or Fax#: pchavez@amafca.org

QA/QC Package:
☑ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other
☑ EDD (Type)

Turn-Around Time:
☑ Standard ☐ **Rush**

Project Name: CMC

Project #:

Project Manager: Patrick Chavez

Sampler: A. Ewing - DBS+A

On Ice: ☑ Yes ☐ No

# of Coolers: 1

Cooler Temp(including CF): 4.2-0.3=3.9 (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2109083	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	E. coli - enumeration					
9/1/21	1005	AQ	RGNorth-20210901	1		001											✓					
9/1/21	1125	AQ	RGAlameda-20210901	1		002											✓					

Amy Ewing 9/1/21

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
9/1/21	1610	Amy Ewing	Sa	CNO	9/1/21	16:10
Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
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TEL: 505-345-3975 FAX: 505-345-4107
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9/2/2021 CMC Sample at Rio Grande North, Alameda (only E. coli), and Rio Grand South.

October 13, 2021

Patrick Chavez
AMAFCA
2600 Prospect Ave NE
Albuquerque, NM 87107
TEL: (505) 884-2215
FAX

RE: CMC OrderNo.: 2109132

Dear Patrick Chavez:

Hall Environmental Analysis Laboratory received 6 sample(s) on 9/2/2021 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results, it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifiers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -

Field Parameters
Rio Grande North-
Temp = 21.71 ºC
pH = 8.63
Conductivity (uS/cm=umho/cm) = 315
Dissolved Oxygen (mg/L) = 6.98
Rio Grande South-
Temp = 21.21 ºC
pH = 8.11
Conductivity (uS/cm=umho/cm) = 484
Dissolved Oxygen (mg/L) = 6.92
Alameda-
Temp = 22.14 ºC
pH = 7.72
Conductivity (uS/cm=umho/cm) = 383
Dissolved Oxygen (mg/L) = 6.72

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

Case Narrative

WO#: **2109132**
Date: **10/13/2021**

CLIENT: AMAFCA
Project: CMC

Analytical Notes Regarding EPA Method 8081:
The method blank and sample RG South-20210902 were not spiked with surrogates. The samples were reextracted, outside of the holding time to confirm the original data. The samples are reported from the original extraction and analysis.

Analytical Notes Regarding BOD:
The method blank(s) had a DO depletion >0.2mg/L.

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA
Project: CMC
Lab ID: 2109132-001
Matrix: AQUEOUS

Client Sample ID: RG North-20210901
Collection Date: 9/1/2021 10:05:00 AM
Received Date: 9/2/2021 12:17:00 PM

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 8081: PESTICIDES							Analyst: **LSB**	
Dieldrin	ND	0.040	0.10		µg/L	1	9/17/2021 1:57:29 PM	62459
Surr: Decachlorobiphenyl	89.1	0	41.7-129		%Rec	1	9/17/2021 1:57:29 PM	62459
Surr: Tetrachloro-m-xylene	58.7	0	31.8-88.5		%Rec	1	9/17/2021 1:57:29 PM	62459
EPA METHOD 300.0: ANIONS							Analyst: **LRN**	
Nitrate+Nitrite as N	ND	0.11	1.0		mg/L	5	9/3/2021 4:14:05 PM	R81067
EPA METHOD 200.7: METALS							Analyst: **ELS**	
Calcium	51	0.11	1.0		mg/L	1	9/14/2021 12:30:15 PM	62544
Magnesium	8.7	0.067	1.0		mg/L	1	9/14/2021 12:30:15 PM	62544
EPA 200.8: DISSOLVED METALS							Analyst: **bcv**	
Copper	0.00084	0.00037	0.0010	J	mg/L	1	9/18/2021 6:25:56 PM	A81374
Lead	0.000065	0.000057	0.00050	J	mg/L	1	9/18/2021 6:25:56 PM	A81374
SM2340B: HARDNESS							Analyst: **ELS**	
Hardness as CaCO3	160	2.5	6.6		mg/L	1	9/14/2021 8:50:00 AM	R81263
EPA METHOD 1664B							Analyst: **dms**	
N-Hexane Extractable Material	ND	4.10	10.2		mg/L	1	9/8/2021 12:03:00 PM	62408
SM5210B: BOD							Analyst: **AG**	
Biochemical Oxygen Demand	2.7	2.0	2.0	RE	mg/L	1	9/8/2021 4:15:00 PM	62380

NOTES:
R- RPD between dilutions >30%. E- Estimated value due to final read time exceeding +/-6 hour read time.

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed	Batch ID
SM 4500 NH3: AMMONIA							Analyst: **CJS**	
Nitrogen, Ammonia	0.42	0.42	1.0	J	mg/L	1	9/16/2021 2:40:00 PM	R81339
SM4500-H+B / 9040C: PH							Analyst: **CAS**	
pH	8.54			H*	pH units	1	9/8/2021 9:52:08 PM	R81133
EPA METHOD 365.1: TOTAL PHOSPHOROUS							Analyst: **CJS**	
Phosphorus, Total (As P)	0.29	0.050	0.050	D	mg/L	1	9/15/2021 1:39:00 PM	62548
SM2540C MOD: TOTAL DISSOLVED SOLIDS							Analyst: **KS**	
Total Dissolved Solids	230	100	100	D	mg/L	1	9/10/2021 10:00:00 AM	62453
SM 4500 NORG C: TKN							Analyst: **EKM**	
Nitrogen, Kjeldahl, Total	4.1	0.50	1.0		mg/L	1	9/17/2021 1:45:00 PM	62630
SM 2540D: TSS							Analyst: **KS**	
Suspended Solids	130	4.0	4.0		mg/L	1	9/9/2021 1:39:00 PM	62455

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Analytical Report
Lab Order **2109132**
Date Reported: **10/13/2021**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA
Project: CMC
Lab ID: 2109132-002 **Matrix:** AQUEOUS

Client Sample ID: RG North-20210901
Collection Date: 9/1/2021 10:05:00 AM
Received Date: 9/2/2021 12:17:00 PM

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 365.1: TOTAL PHOSPHOROUS							Analyst: **CJS**	
Phosphorus, Total (As P)	0.15	0.050	0.050	D	mg/L	1	9/15/2021 1:40:00 PM	62548

dissolved phosphorous

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA | **Client Sample ID:** RG South-20210902
Project: CMC | **Collection Date:** 9/2/2021 9:20:00 AM
Lab ID: 2109132-003 | **Matrix:** AQUEOUS | **Received Date:** 9/2/2021 12:17:00 PM

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 8081: PESTICIDES							Analyst: **LSB**	
Dieldrin	ND	0.040	0.10		µg/L	1	9/17/2021 2:23:56 PM	62459
Surr: Decachlorobiphenyl	0	0	41.7-129	S	%Rec	1	9/17/2021 2:23:56 PM	62459
Surr: Tetrachloro-m-xylene	0	0	31.8-88.5	S	%Rec	1	9/17/2021 2:23:56 PM	62459
EPA METHOD 300.0: ANIONS							Analyst: **LRN**	
Nitrogen, Nitrite (As N)	ND	0.073	0.50		mg/L	5	9/3/2021 3:48:20 PM	R81067
Nitrogen, Nitrate (As N)	1.8	0.10	0.50		mg/L	5	9/3/2021 3:48:20 PM	R81067
EPA METHOD 200.7: METALS							Analyst: **ELS**	
Calcium	86	0.11	1.0		mg/L	1	9/14/2021 12:33:10 PM	62544
Magnesium	19	0.067	1.0		mg/L	1	9/14/2021 12:33:10 PM	62544
EPA 200.8: DISSOLVED METALS							Analyst: **bcv**	
Copper	0.0015	0.00037	0.0010		mg/L	1	9/18/2021 6:30:41 PM	A81374
Lead	0.00032	0.000057	0.00050	J	mg/L	1	9/18/2021 6:30:41 PM	A81374
SM2340B: HARDNESS							Analyst: **ELS**	
Hardness as CaCO3	290	2.5	6.6		mg/L	1	9/14/2021 8:50:00 AM	R81263
EPA METHOD 1664B							Analyst: **dms**	
N-Hexane Extractable Material	ND	3.99	9.89		mg/L	1	9/8/2021 12:03:00 PM	62408
SM5210B: BOD							Analyst: **AG**	
Biochemical Oxygen Demand	4.9	2.0	2.0		mg/L	1	9/8/2021 4:15:00 PM	62380
SM 9223B FECAL INDICATOR: E. COLI MPN							Analyst: **SMS**	
E. Coli	4884	10.00	10.00		MPN/100	10	9/3/2021 5:45:00 PM	62378
SM 4500 NH3: AMMONIA							Analyst: **CJS**	
Nitrogen, Ammonia	ND	0.42	1.0		mg/L	1	9/16/2021 2:40:00 PM	R81339
SM4500-H+B / 9040C: PH							Analyst: **CAS**	
pH	8.18			H	pH units	1	9/8/2021 9:56:07 PM	R81133
EPA METHOD 365.1: TOTAL PHOSPHOROUS							Analyst: **CJS**	
Phosphorus, Total (As P)	1.3	0.050	0.050	D	mg/L	1	9/15/2021 1:42:00 PM	62548
SM2540C MOD: TOTAL DISSOLVED SOLIDS							Analyst: **KS**	
Total Dissolved Solids	330	200	200	D	mg/L	1	9/10/2021 10:00:00 AM	62453
SM 4500 NORG C: TKN							Analyst: **EKM**	
Nitrogen, Kjeldahl, Total	2.0	1.0	2.0	JD	mg/L	1	9/17/2021 1:45:00 PM	62630
SM 2540D: TSS							Analyst: **KS**	
Suspended Solids	790	40	40	D	mg/L	1	9/9/2021 1:39:00 PM	62455

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quantitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA
Project: CMC
Lab ID: 2109132-004 **Matrix:** AQUEOUS

Client Sample ID: RG South-20210902
Collection Date: 9/2/2021 9:20:00 AM
Received Date: 9/2/2021 12:17:00 PM

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed	Batch ID
EPA METHOD 365.1: TOTAL PHOSPHOROUS							Analyst: **CJS**	
Phosphorus, Total (As P)	1.4	0.050	0.050	D	mg/L	1	9/15/2021 1:43:00 PM	62548

dissolved phosphorous

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: AMAFCA
Project: CMC
Lab ID: 2109132-005
Matrix: AQUEOUS
Client Sample ID: RG Alameda-20210902
Collection Date: 9/2/2021 10:30:00 AM
Received Date: 9/2/2021 12:17:00 PM

Analyses	Result	MDL	PQL	Qual	Units	DF	Date Analyzed	Batch ID
SM 9223B FECAL INDICATOR: E. COLI MPN							Analyst: **SMS**	
E. Coli	554	10.00	10.00		MPN/100	10	9/3/2021 5:45:00 PM	62378

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

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Client:	Hall Environmental Analysis Lab	Work Order:	MBI0301
Address:	4901 Hawkins NE Suite D	Project:	MDL Projects
	Albuquerque, NM 87109	Reported:	9/21/2021 11:03
Attn:	Andy Freeman		

Analytical Results Report

Sample Location:	2109132-001A (RG North-20210901)		
Lab/Sample Number:	MBI0301-01	Collect Date:	09/01/21 10:05
Date Received:	09/08/21 12:41	Collected By:	
Matrix:	Water		

Analyte	Result	Units	MDL	PQL	Analyzed	Analyst	Method	Qualifier
Volatiles								
Tetrahydrofuran	ND	ug/L	0.500	2.50	9/10/21 14:05	TEC	EPA 8260D	U
Surrogate: 1,2-Dichlorobenzene-d4	*104%*		*70-130*		*9/10/21 14:05*	*TEC*	*EPA 8260D*	
Surrogate: 4-Bromofluorobenzene	*98.8%*		*70-130*		*9/10/21 14:05*	*TEC*	*EPA 8260D*	
Surrogate: Toluene-d8	*94.9%*		*70-130*		*9/10/21 14:05*	*TEC*	*EPA 8260D*	

Analytical Results Report

(Continued)

Sample Location:	2109132-001K (RG North-20210901)		
Lab/Sample Number:	MBI0301-02	Collect Date:	09/01/21 10:05
Date Received:	09/08/21 12:41	Collected By:	
Matrix:	Water		

Analyte	Result	Units	MDL	PQL	Analyzed	Analyst	Method	Qualifier
Semivolatiles								
Benzidine	ND	ug/L	0.833	1.67	9/13/21 23:44	MAH	EPA 8270D	
Benzo[a]anthracene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Benzo[a]pyrene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Benzo[b]fluoranthene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Benzo[k]fluoranthene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Chrysene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Di (2-ethylhexyl) phthalate	ND	ug/L	0.667	1.67	9/13/21 23:44	MAH	EPA 8270D	
Dibenz(a,h)anthracene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Dibenzofuran	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Indeno(1,2,3-cd)pyrene	ND	ug/L	0.333	1.67	9/13/21 23:44	MAH	EPA 8270D	
Pentachlorophenol	ND	ug/L	0.667	1.67	9/13/21 23:44	MAH	EPA 8270D	
Surrogate: 2,4,6-Tribromophenol	*94.0%*		*48-120*		*9/13/21 23:44*	*MAH*	*EPA 8270D*	
Surrogate: 2-Fluorobiphenyl	*107%*		*57-120*		*9/13/21 23:44*	*MAH*	*EPA 8270D*	
Surrogate: 2-Fluorophenol	*64.6%*		*37-110*		*9/13/21 23:44*	*MAH*	*EPA 8270D*	
Surrogate: Nitrobenzene-d5	*81.0%*		*65-110*		*9/13/21 23:44*	*MAH*	*EPA 8270D*	
Surrogate: Phenol-2,3,4,5,6-d5	*85.3%*		*51-112*		*9/13/21 23:44*	*MAH*	*EPA 8270D*	
Surrogate: Terphenyl-d14	*102%*		*57-133*		*9/13/21 23:44*	*MAH*	*EPA 8270D*	

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Analytical Results Report
(Continued)

Sample Location: 2109132-003A (RG South-20210902)
Lab/Sample Number: MBI0301-03 Collect Date: 09/02/21 09:20
Date Received: 09/08/21 12:41 Collected By:
Matrix: Water

Analyte	Result	Units	MDL	PQL	Analyzed	Analyst	Method	Qualifier
Volatiles								
Tetrahydrofuran	ND	ug/L	0.500	2.50	9/10/21 14:34	TEC	EPA 8260D	U
Surrogate: 1,2-Dichlorobenzene-d4	*104%*		*70-130*		*9/10/21 14:34*	*TEC*	*EPA 8260D*	
Surrogate: 4-Bromofluorobenzene	*99.1%*		*70-130*		*9/10/21 14:34*	*TEC*	*EPA 8260D*	
Surrogate: Toluene-d8	*95.2%*		*70-130*		*9/10/21 14:34*	*TEC*	*EPA 8260D*	

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Analytical Results Report

(Continued)

Sample Location: 2109132-003K (RG South-20210902)

Lab/Sample Number: MBI0301-04 Collect Date: 09/02/21 09:20

Date Received: 09/08/21 12:41 Collected By:

Matrix: Water

Analyte	Result	Units	MDL	PQL	Analyzed	Analyst	Method	Qualifier
Semivolatiles								
Benzidine	ND	ug/L	1.25	2.50	9/14/21 0:12	MAH	EPA 8270D	
Benzo[a]anthracene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Benzo[a]pyrene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Benzo[b]fluoranthene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Benzo[k]fluoranthene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Chrysene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Di (2-ethylhexyl) phthalate	ND	ug/L	1.00	2.50	9/14/21 0:12	MAH	EPA 8270D	
Dibenz(a,h)anthracene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Dibenzofuran	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Indeno(1,2,3-cd)pyrene	ND	ug/L	0.500	2.50	9/14/21 0:12	MAH	EPA 8270D	
Pentachlorophenol	ND	ug/L	1.00	2.50	9/14/21 0:12	MAH	EPA 8270D	
Surrogate: 2,4,6-Tribromophenol	*101%*		*48-120*		*9/14/21 0:12*	*MAH*	*EPA 8270D*	
Surrogate: 2-Fluorobiphenyl	*110%*		*57-120*		*9/14/21 0:12*	*MAH*	*EPA 8270D*	
Surrogate: 2-Fluorophenol	*64.4%*		*37-110*		*9/14/21 0:12*	*MAH*	*EPA 8270D*	
Surrogate: Nitrobenzene-d5	*81.9%*		*65-110*		*9/14/21 0:12*	*MAH*	*EPA 8270D*	
Surrogate: Phenol-2,3,4,5,6-d5	*83.3%*		*51-112*		*9/14/21 0:12*	*MAH*	*EPA 8270D*	
Surrogate: Terphenyl-d14	*96.5%*		*57-133*		*9/14/21 0:12*	*MAH*	*EPA 8270D*	

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Analytical Results Report

(Continued)

Sample Location:	2109132-006A (Trip Blank)		
Lab/Sample Number:	MBI0301-05	Collect Date:	09/02/21 00:00
Date Received:	09/08/21 12:41	Collected By:	
Matrix:	Water		

Analyte	Result	Units	MDL	PQL	Analyzed	Analyst	Method	Qualifier
Volatiles								
Tetrahydrofuran	ND	ug/L	0.100	0.500	9/10/21 12:03	TEC	EPA 8260D	U
Surrogate: 1,2-Dichlorobenzene-d4	*103%*		*70-130*		*9/10/21 12:03*	*TEC*	*EPA 8260D*	
Surrogate: 4-Bromofluorobenzene	*98.9%*		*70-130*		*9/10/21 12:03*	*TEC*	*EPA 8260D*	
Surrogate: Toluene-d8	*95.1%*		*70-130*		*9/10/21 12:03*	*TEC*	*EPA 8260D*	

Authorized Signature,

Todd Taruscio, Laboratory Manager

U	Compound was analyzed for but not detected
PQL	Practical Quantitation Limit
ND	Not Detected
MDL	Method Detection Limit
Dry	Sample results reported on a dry weight basis
*	Not a state-certified analyte
RPD	Relative Percent Difference
%REC	Percent Recovery
Source	Sample that was spiked or duplicated.

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Quality Control Data

Semivolatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0298 - SVOC Water										
Blank (BBI0298-BLK1)					Prepared: 9/8/2021 Analyzed: 9/13/2021					
bis(2-Chloroethyl)ether	ND		0.500	ug/L						
Di-n-octyl phthalate	ND		0.500	ug/L						
Di-n-butyl phthalate	ND		0.500	ug/L						
Dimethyl phthalate	ND		0.500	ug/L						
Dibenzofuran	ND		0.500	ug/L						
Chrysene	ND		0.500	ug/L						
Carbazole	ND		0.500	ug/L						
Benzyl Butyl Phthalate	ND		0.500	ug/L						
Anthracene	ND		0.500	ug/L						
bis(2-chloroisopropyl)ether	ND		0.500	ug/L						
Hexachlorobenzene	ND		0.500	ug/L						
bis(2-Chloroethoxy)methane	ND		0.500	ug/L						
Benzyl alcohol	ND		0.500	ug/L						
Benzo[k]fluoranthene	ND		0.500	ug/L						
Benzo(g,h,i)perylene	ND		0.500	ug/L						
Benzo[b]fluoranthene	ND		0.500	ug/L						
Benzo[a]pyrene	ND		0.500	ug/L						
Benzo[a]anthracene	ND		0.500	ug/L						
Benzidine	ND		0.500	ug/L						
Di (2-ethylhexyl) phthalate	ND		0.500	ug/L						
Pyridine	ND		0.500	ug/L						
Pyrene	ND		0.500	ug/L						
Phenol	ND		0.500	ug/L						
Phenanthrene	ND		0.500	ug/L						
Pentachlorophenol	ND		0.500	ug/L						
n-Nitrosodiphenylamine	ND		0.500	ug/L						
Fluoranthene	ND		0.500	ug/L						
n-nitrosodimethylamine	ND		0.500	ug/L						
Fluorene	ND		0.500	ug/L						
Nitrobenzene	ND		0.500	ug/L						
Naphthalene	ND		0.500	ug/L						
Isophorone	ND		0.500	ug/L						
Indeno(1,2,3-cd)pyrene	ND		0.500	ug/L						
Hexachloroethane	ND		0.500	ug/L						
Hexachlorocyclopentadiene	ND		0.500	ug/L						
Hexachlorobutadiene	ND		0.500	ug/L						
Dibenz(a,h)anthracene	ND		0.500	ug/L						
n-Nitroso-di-n-propylamine	ND		0.500	ug/L						
1-Methylnaphthalene	ND		0.500	ug/L						
2,6-Dinitrotoluene	ND		0.500	ug/L						
2,4-Dinitrotoluene	ND		0.500	ug/L						
2,4-Dinitrophenol	ND		0.500	ug/L						
2,4-Dimethylphenol	ND		0.500	ug/L						

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0298 - SVOC Water (Continued)										
Blank (BBI0298-BLK1)					Prepared: 9/8/2021 Analyzed: 9/13/2021					
2,4-Dichlorophenol	ND		0.500	ug/L						
2,4,6-Trichlorophenol	ND		0.500	ug/L						
2,4,5-Trichlorophenol	ND		0.500	ug/L						
2-Chloronaphthalene	ND		0.500	ug/L						
2,3,4,6-Tetrachlorophenol	ND		0.500	ug/L						
1,4-Dichlorobenzene (para-Dichlorobenzene)	ND		0.500	ug/L						
1,4-Dinitrobenzene	ND		0.500	ug/L						
Aniline	ND		0.500	ug/L						
1,3-Dinitrobenzene	ND		0.500	ug/L						
Diethyl phthalate	ND		0.500	ug/L						
1,2-Diphenyl hydrazine	ND		0.500	ug/L						
1,2-Dinitrobenzene	ND		0.500	ug/L						
1,2-Dichlorobenzene (ortho-Dichlorobenzene)	ND		0.500	ug/L						
1,2,4-Trichlorobenzene	ND		0.500	ug/L						
2,3,5,6-Tetrachlorophenol	ND		0.500	ug/L						
4-Nitroaniline	ND		0.500	ug/L						
m-Dichlorobenzene	ND		0.500	ug/L						
2-Chlorophenol	ND		0.500	ug/L						
Acenaphthylene	ND		0.500	ug/L						
4-Nitrophenol	ND		0.500	ug/L						
4-Chlorophenyl-phenylether	ND		0.500	ug/L						
4-Chloroaniline	ND		0.500	ug/L						
4-Chloro-3-methylphenol	ND		0.500	ug/L						
4-Bromophenyl-phenylether	ND		0.500	ug/L						
4,6-Dinitro-2-methylphenol	ND		0.500	ug/L						
3-Nitroaniline	ND		0.500	ug/L						
2-Methylnaphthalene	ND		0.500	ug/L						
3,3'-Dichlorobenzidine	ND		0.500	ug/L						
2-Nitrophenol	ND		0.500	ug/L						
2-Nitroaniline	ND		0.500	ug/L						
2-Methylphenol	ND		0.500	ug/L						
Acenaphthene	ND		0.500	ug/L						
3+4-Methylphenol	ND		0.500	ug/L						
Surrogate: Phenol-2,3,4,5,6-d5			*40.4*	*ug/L*	*50.5*		*79.9*	*51-112*		
Surrogate: Nitrobenzene-d5			*19.8*	*ug/L*	*25.0*		*79.4*	*65-110*		
Surrogate: Terphenyl-d14			*26.1*	*ug/L*	*25.8*		*101*	*57-133*		
Surrogate: 2-Fluorophenol			*29.1*	*ug/L*	*50.0*		*58.1*	*37-110*		
Surrogate: 2-Fluorobiphenyl			*25.7*	*ug/L*	*25.5*		*101*	*57-120*		
Surrogate: 2,4,6-Tribromophenol			*45.2*	*ug/L*	*51.8*		*87.2*	*48-120*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0298 - SVOC Water (Continued)										
LCS (BBI0298-BS1)					Prepared: 9/8/2021 Analyzed: 9/13/2021					
2-Methylphenol	4.08		0.500	ug/L	5.00		81.6	66-120		
2-Methylnaphthalene	4.24		0.500	ug/L	5.00		84.8	67-121		
2-Chlorophenol	4.13		0.500	ug/L	5.00		82.6	64-120		
3-Nitroaniline	4.23		0.500	ug/L	5.00		84.6	49-121		
2-Chloronaphthalene	4.34		0.500	ug/L	5.00		86.8	72-120		
2,6-Dinitrotoluene	4.53		0.500	ug/L	5.00		90.6	67-116		
2-Nitroaniline	4.79		0.500	ug/L	5.00		95.8	69-120		
3+4-Methylphenol	4.26		0.500	ug/L	5.00		85.2	68-120		
4,6-Dinitro-2-methylphenol	4.72		0.500	ug/L	5.00		94.4	26-150		
2,4-Dinitrotoluene	4.79		0.500	ug/L	5.00		95.8	74-121		
4-Chloroaniline	3.01		0.500	ug/L	5.00		60.2	30-130		
1,3-Dinitrobenzene	4.70		0.500	ug/L	5.00		94.0	75-123		
4-Bromophenyl-phenylether	4.28		0.500	ug/L	5.00		85.6	71-121		
2-Nitrophenol	4.21		0.500	ug/L	5.00		84.2	69-120		
1-Methylnaphthalene	4.23		0.500	ug/L	5.00		84.6	67-121		
4-Nitroaniline	4.53		0.500	ug/L	5.00		90.6	47-128		
4-Chlorophenyl-phenylether	4.29		0.500	ug/L	5.00		85.8	72-120		
1,2,4-Trichlorobenzene	3.86		0.500	ug/L	5.00		77.2	69-120		
1,2-Dichlorobenzene (ortho-Dichlorobenzene)	3.91		0.500	ug/L	5.00		78.2	67-120		
1,2-Dinitrobenzene	4.38		0.500	ug/L	5.00		87.6	70-120		
1,4-Dinitrobenzene	5.05		0.500	ug/L	5.00		101	71-121		
1,4-Dichlorobenzene (para-Dichlorobenzene)	3.84		0.500	ug/L	5.00		76.8	67-120		
2,4-Dinitrophenol	5.00		0.500	ug/L	5.00		100	21-128		
2,3,4,6-Tetrachlorophenol	4.25		0.500	ug/L	5.00		85.0	66-120		
2,3,5,6-Tetrachlorophenol	4.28		0.500	ug/L	5.00		85.6	52-115		
2,4,5-Trichlorophenol	4.34		0.500	ug/L	5.00		86.8	71-120		
2,4,6-Trichlorophenol	4.37		0.500	ug/L	5.00		87.4	72-120		
2,4-Dichlorophenol	4.28		0.500	ug/L	5.00		85.6	72-120		
m-Dichlorobenzene	3.77		0.500	ug/L	5.00		75.4	67-120		
Di-n-octyl phthalate	4.81		0.500	ug/L	5.00		96.2	45-127		
Fluoranthene	4.56		0.500	ug/L	5.00		91.2	70-121		
Fluorene	4.41		0.500	ug/L	5.00		88.2	74-120		
Hexachlorobenzene	4.21		0.500	ug/L	5.00		84.2	67-118		
Hexachlorobutadiene	3.65		0.500	ug/L	5.00		73.0	68-120		
Hexachloroethane	3.65		0.500	ug/L	5.00		73.0	68-120		
Indeno(1,2,3-cd)pyrene	4.24		0.500	ug/L	5.00		84.8	62-123		
Isophorone	4.61		0.500	ug/L	5.00		92.2	78-120		
Di-n-butyl phthalate	4.63		0.500	ug/L	5.00		92.6	74-124		
Nitrobenzene	4.22		0.500	ug/L	5.00		84.4	71-120		
Phenanthrene	4.45		0.500	ug/L	5.00		89.0	74-120		
n-nitrosodimethylamine	4.11		0.500	ug/L	5.00		82.2	60-120		
n-Nitroso-di-n-propylamine	4.44		0.500	ug/L	5.00		88.8	71-112		
n-Nitrosodiphenylamine	4.36		0.500	ug/L	5.00		87.2	70-121		
Pentachlorophenol	4.36		0.500	ug/L	5.00		87.2	51-118		
Phenol	4.08		0.500	ug/L	5.00		81.6	54-121		
Pyrene	4.65		0.500	ug/L	5.00		93.0	59-130		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0298 - SVOC Water (Continued)										
LCS (BBI0298-BS1)					Prepared: 9/8/2021 Analyzed: 9/13/2021					
4-Nitrophenol	4.12		0.500	ug/L	5.00		82.4	52-118		
4-Chloro-3-methylphenol	4.49		0.500	ug/L	5.00		89.8	74-120		
Naphthalene	4.13		0.500	ug/L	5.00		82.6	70-120		
Benzo(g,h,i)perylene	4.23		0.500	ug/L	5.00		84.6	63-129		
Anthracene	4.51		0.500	ug/L	5.00		90.2	76-120		
Acenaphthene	4.11		0.500	ug/L	5.00		82.2	76-120		
Benzo[a]anthracene	4.35		0.500	ug/L	5.00		87.0	80-120		
Dimethyl phthalate	4.50		0.500	ug/L	5.00		90.0	72-122		
Benzo[b]fluoranthene	4.29		0.500	ug/L	5.00		85.8	72-116		
Acenaphthylene	4.36		0.500	ug/L	5.00		87.2	75-120		
Benzo[k]fluoranthene	5.03		0.500	ug/L	5.00		101	71-121		
bis(2-Chloroethoxy)methane	4.42		0.500	ug/L	5.00		88.4	74-120		
Dibenzofuran	4.46		0.500	ug/L	5.00		89.2	75-120		
bis(2-chloroisopropyl)ether	4.18		0.500	ug/L	5.00		83.6	69-120		
Di (2-ethylhexyl) phthalate	4.91		0.500	ug/L	5.00		98.2	60-144		
Benzyl Butyl Phthalate	4.71		0.500	ug/L	5.00		94.2	62-135		
Carbazole	4.92		0.500	ug/L	5.00		98.4	76-123		
Chrysene	4.53		0.500	ug/L	5.00		90.6	74-124		
Dibenz(a,h)anthracene	4.44		0.500	ug/L	5.00		88.8	62-120		
bis(2-Chloroethyl)ether	4.33		0.500	ug/L	5.00		86.6	70-120		
Benzo[a]pyrene	4.14		0.500	ug/L	5.00		82.8	66-116		
Diethyl phthalate	4.52		0.500	ug/L	5.00		90.4	76-121		
Surrogate: Phenol-2,3,4,5,6-d5			*46.5*	*ug/L*	*50.5*		*92.0*	*51-112*		
Surrogate: Nitrobenzene-d5			*22.5*	*ug/L*	*25.0*		*90.0*	*65-110*		
Surrogate: Terphenyl-d14			*26.8*	*ug/L*	*25.8*		*104*	*57-133*		
Surrogate: 2-Fluorophenol			*34.4*	*ug/L*	*50.0*		*68.7*	*37-110*		
Surrogate: 2-Fluorobiphenyl			*29.2*	*ug/L*	*25.5*		*115*	*57-120*		
Surrogate: 2,4,6-Tribromophenol			*50.5*	*ug/L*	*51.8*		*97.6*	*48-120*		

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0298 - SVOC Water (Continued)										
LCS Dup (BBI0298-BSD1)					Prepared: 9/8/2021 Analyzed: 9/13/2021					
Carbazole	4.90		0.500	ug/L	5.00		98.0	76-123	0.407	40
Chrysene	4.48		0.500	ug/L	5.00		89.6	74-124	1.11	25
Dibenz(a,h)anthracene	4.83		0.500	ug/L	5.00		96.6	62-120	8.41	30
Dibenzofuran	4.43		0.500	ug/L	5.00		88.6	75-120	0.675	25
Diethyl phthalate	4.47		0.500	ug/L	5.00		89.4	76-121	1.11	25
Di-n-butyl phthalate	4.75		0.500	ug/L	5.00		95.0	74-124	2.56	25
Dimethyl phthalate	4.51		0.500	ug/L	5.00		90.2	72-122	0.222	25
Benzyl Butyl Phthalate	4.29		0.500	ug/L	5.00		85.8	62-135	9.33	34
Di (2-ethylhexyl) phthalate	4.48		0.500	ug/L	5.00		89.6	60-144	9.16	32
bis(2-chloroisopropyl)ether	4.22		0.500	ug/L	5.00		84.4	69-120	0.952	28
bis(2-Chloroethyl)ether	4.27		0.500	ug/L	5.00		85.4	70-120	1.40	30
bis(2-Chloroethoxy)methane	4.29		0.500	ug/L	5.00		85.8	74-120	2.99	25
Benzo[k]fluoranthene	4.96		0.500	ug/L	5.00		99.2	71-121	1.40	25
Di-n-octyl phthalate	4.01		0.500	ug/L	5.00		80.2	45-127	18.1	32
Benzo[b]fluoranthene	4.10		0.500	ug/L	5.00		82.0	72-116	4.53	25
Benzo[a]pyrene	4.89		0.500	ug/L	5.00		97.8	66-116	16.6	25
Benzo(g,h,i)perylene	4.55		0.500	ug/L	5.00		91.0	63-129	7.29	25
Nitrobenzene	4.14		0.500	ug/L	5.00		82.8	71-120	1.91	25
2,6-Dinitrotoluene	4.48		0.500	ug/L	5.00		89.6	67-116	1.11	35
Benzo[a]anthracene	4.33		0.500	ug/L	5.00		86.6	80-120	0.461	25
Phenol	4.09		0.500	ug/L	5.00		81.8	54-121	0.245	33
Phenanthrene	4.50		0.500	ug/L	5.00		90.0	74-120	1.12	25
Pentachlorophenol	4.29		0.500	ug/L	5.00		85.8	51-118	1.62	25
n-Nitrosodiphenylamine	4.45		0.500	ug/L	5.00		89.0	70-121	2.04	25
Naphthalene	4.22		0.500	ug/L	5.00		84.4	70-120	2.16	25
n-nitrosodimethylamine	4.03		0.500	ug/L	5.00		80.6	60-120	1.97	35
Pyrene	4.33		0.500	ug/L	5.00		86.6	59-130	7.13	35
Isophorone	4.48		0.500	ug/L	5.00		89.6	78-120	2.86	25
Indeno(1,2,3-cd)pyrene	4.63		0.500	ug/L	5.00		92.6	62-123	8.79	25
Hexachloroethane	3.67		0.500	ug/L	5.00		73.4	68-120	0.546	28
Hexachlorobutadiene	3.74		0.500	ug/L	5.00		74.8	68-120	2.44	25
Hexachlorobenzene	4.51		0.500	ug/L	5.00		90.2	67-118	6.88	25
Fluorene	4.38		0.500	ug/L	5.00		87.6	74-120	0.683	25
Fluoranthene	4.70		0.500	ug/L	5.00		94.0	70-121	3.02	25
n-Nitroso-di-n-propylamine	4.37		0.500	ug/L	5.00		87.4	71-112	1.59	25
1,4-Dinitrobenzene	4.84		0.500	ug/L	5.00		96.8	71-121	4.25	25
2,4-Dinitrophenol	4.18		0.500	ug/L	5.00		83.6	21-128	17.9	36
2-Chlorophenol	4.13		0.500	ug/L	5.00		82.6	64-120	0.00	33
2,4,6-Trichlorophenol	4.39		0.500	ug/L	5.00		87.8	72-120	0.457	25
2,4,5-Trichlorophenol	4.39		0.500	ug/L	5.00		87.8	71-120	1.15	25
2,3,5,6-Tetrachlorophenol	4.20		0.500	ug/L	5.00		84.0	52-115	1.89	25
Anthracene	4.50		0.500	ug/L	5.00		90.0	76-120	0.222	25
1-Methylnaphthalene	4.26		0.500	ug/L	5.00		85.2	67-121	0.707	25
2,4-Dinitrotoluene	4.58		0.500	ug/L	5.00		91.6	74-121	4.48	25
1,4-Dichlorobenzene (para-Dichlorobenzene)	3.85		0.500	ug/L	5.00		77.0	67-120	0.260	25
1,3-Dinitrobenzene	4.27		0.500	ug/L	5.00		85.4	75-123	9.59	25

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Quality Control Data
(Continued)

Semivolatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0298 - SVOC Water (Continued)										
LCS Dup (BBI0298-BSD1)					Prepared: 9/8/2021 Analyzed: 9/13/2021					
m-Dichlorobenzene	3.82		0.500	ug/L	5.00		76.4	67-120	1.32	25
1,2-Dinitrobenzene	3.73		0.500	ug/L	5.00		74.6	70-120	16.0	25
1,2-Dichlorobenzene (ortho-Dichlorobenzene)	3.94		0.500	ug/L	5.00		78.8	67-120	0.764	25
1,2,4-Trichlorobenzene	4.01		0.500	ug/L	5.00		80.2	69-120	3.81	25
2,3,4,6-Tetrachlorophenol	4.03		0.500	ug/L	5.00		80.6	66-120	5.31	25
4-Bromophenyl-phenylether	4.58		0.500	ug/L	5.00		91.6	71-121	6.77	25
Acenaphthylene	4.44		0.500	ug/L	5.00		88.8	75-120	1.82	30
Acenaphthene	4.20		0.500	ug/L	5.00		84.0	76-120	2.17	25
4-Nitrophenol	3.26		0.500	ug/L	5.00		65.2	52-118	23.3	35
4-Nitroaniline	4.12		0.500	ug/L	5.00		82.4	47-128	9.48	32
4-Chlorophenyl-phenylether	4.29		0.500	ug/L	5.00		85.8	72-120	0.00	25
2,4-Dichlorophenol	4.25		0.500	ug/L	5.00		85.0	72-120	0.703	25
4-Chloro-3-methylphenol	4.22		0.500	ug/L	5.00		84.4	74-120	6.20	25
2-Chloronaphthalene	4.39		0.500	ug/L	5.00		87.8	72-120	1.15	25
4,6-Dinitro-2-methylphenol	4.38		0.500	ug/L	5.00		87.6	26-150	7.47	25
3-Nitroaniline	3.96		0.500	ug/L	5.00		79.2	49-121	6.59	39
3+4-Methylphenol	4.20		0.500	ug/L	5.00		84.0	68-120	1.42	25
2-Nitrophenol	4.24		0.500	ug/L	5.00		84.8	69-120	0.710	25
2-Nitroaniline	4.39		0.500	ug/L	5.00		87.8	69-120	8.71	25
2-Methylphenol	4.05		0.500	ug/L	5.00		81.0	66-120	0.738	25
2-Methylnaphthalene	4.27		0.500	ug/L	5.00		85.4	67-121	0.705	25
4-Chloroaniline	3.04		0.500	ug/L	5.00		60.8	30-130	0.992	40
Surrogate: Phenol-2,3,4,5,6-d5			*45.6*	*ug/L*	*50.5*		*90.3*	*51-112*		
Surrogate: Nitrobenzene-d5			*21.8*	*ug/L*	*25.0*		*87.3*	*65-110*		
Surrogate: Terphenyl-d14			*24.7*	*ug/L*	*25.8*		*95.8*	*57-133*		
Surrogate: 2-Fluorophenol			*33.5*	*ug/L*	*50.0*		*67.0*	*37-110*		
Surrogate: 2-Fluorobiphenyl			*29.9*	*ug/L*	*25.5*		*117*	*57-120*		
Surrogate: 2,4,6-Tribromophenol			*51.1*	*ug/L*	*51.8*		*98.7*	*48-120*		

Quality Control Data
(Continued)

Volatiles

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0293 - VOC										
Blank (BBI0293-BLK1)					Prepared & Analyzed: 9/10/2021					
Tetrahydrofuran	ND	U	0.500	ug/L						
LCS (BBI0293-BS1)					Prepared & Analyzed: 9/10/2021					
Tetrahydrofuran	21.9		0.500	ug/L	20.0		109	80-120		
Matrix Spike (BBI0293-MS1)		**Source: MBI0298-01**			Prepared & Analyzed: 9/10/2021					
Tetrahydrofuran	108		2.50	ug/L	100	ND	108	70-130		
Matrix Spike Dup (BBI0293-MSD1)		**Source: MBI0298-01**			Prepared & Analyzed: 9/10/2021					

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Quality Control Data
(Continued)

Volatiles (Continued)

Analyte	Result	Qual	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch: BBI0293 - VOC (Continued)										
Matrix Spike Dup (BBI0293-MSD1)			**Source: MBI0298-01**		Prepared & Analyzed: 9/10/2021					
Tetrahydrofuran	98.4		2.50	ug/L	100	ND	98.4	70-130	9.12	25

HALL ENVIRONMENTAL ANALYSIS LABORATORY

CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

MBI0301

Due: 09/22/21

SUB CONTRATOR: Anatek ID	COMPANY: Anatek Labs, Inc.	PHONE: (208) 883-2839	FAX: (208) 882-9246
ADDRESS: 1282 Alturas Dr		ACCOUNT #:	EMAIL:
CITY, STATE, ZIP: Moscow, ID 83843			

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2109132-001A	RG North-20210901	VOAHCL	Aqueous	9/1/2021 10:05:00 AM	3	8260: Tetrahydrofuran
2	2109132-001K	RG North-20210901	1LAMGU	Aqueous	9/1/2021 10:05:00 AM	1 ~~2~~	8270 See attached list
3	2109132-003A	RG South-20210902	VOAHCL	Aqueous	9/2/2021 9:20:00 AM	3	8260: Tetrahydrofuran
4	2109132-003K	RG South-20210902	1LAMGU	Aqueous	9/2/2021 9:20:00 AM	1 ~~2~~	8270 See attached list
5	2109132-006A	Trip Blank	VOAHCL	Trip Blank		2	8260: Tetrahydrofuran

SCC 9/3/21

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Relinquished By	Date	Time	Received By	Date	Time
SCC	9/2/2021	2:44 PM	CB	09/03/21	1241

TAT: Standard ✓ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

REPORT TRANSMITTAL DESIRED: ☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY

Temp of samples ____ C Attempt to Cool ? ____

Comments: ____

MBI0301

Due: 09/22/21

Collaborative Monitoring Cooperative - Analyses Li
Attach to Chain of Custody

Please refer to attached NPDES Permit No. NMR04A00 Appendix F. Methods and minimum
(MQL's) will be those approved under 40 CFR 136 and specified in the attached permit

Analyte (Bold Indicates WQS)	CAS #	Fraction	Method #	MDL (µg/L)
~~Hardness (Ca + Mg)~~	NA	Total	200.7	2.4
~~**Lead**~~	7439-92-1	Dissolved	200.8	0.09
~~Copper~~	7440-50-8	Dissolved	200.8	1.06
~~Ammonia + organic nitrogen~~	7664-41-7	Total	350.1	31.32
~~Total Kjehldal Nitrogen~~	17778-88-0	Total	351.2	58.78
~~**Nitrate + Nitrite**~~	14797-55-8	Total	353.2	10.17
~~**Polychlorinated biphenyls (PCBs)**~~	1336-36-3	Total	1668	0.014
Tetrahydrofuran (THF)	109-99-9	Total	8260C	7.9
bis(2-Ethylhexyl)phthalate	117-81-7	Total	8270D	0.2
Dibenzofuran	132-64-9	Total	8270D	0.2
Indeno(1,2,3-cd)pyrene	193-39-5	Total	8270D	0.2
Benzo(b)fluoranthene	205-99-2	Total	8270D	0.1
Benzo(k)fluoranthene	207-08-9	Total	8270D	0.1
Chrysene	218-01-9	Total	8270D	0.2
Benzo(a)pyrene	50-32-8	Total	8270D	0.3
Dibenzo(a,h)anthracene	53-70-3	Total	8270D	0.3
Benzo(a)anthracene	56-55-3	Total	8270D	0.2
~~Dieldrin~~	60-57-1	Total	8081	0.1
Pentachlorophenol	87-86-5	Total	8270D	0.2
Benzidine	92-87-5	Total	8270D	0.1
~~Chemical Oxygen Demand~~	E1641638²	Total	HACH	5100
~~**Gross alpha (adjusted)**~~	NA	Total	Method 900	0.1 pCi/L
~~Total Dissolved Solids~~	E1642222²	Total	SM 2540C	60.4
~~Total Suspended Solids~~	NA	Total	SM 2540D	3450
~~Biological Oxygen Demand~~	N/A	Total	Standard Methods	930
~~Oil and Grease~~		Total	1664A	5000
~~Ecoli enumeration~~			SM 9223B	
~~pH~~			SM 4500	
~~Phosphorus~~		Dissolved	365.1	100
~~Phosphorus~~		Total	365.1	100
~~Chromium IV~~		Total	3500Cr C-2011	100

Anatek Labs, Inc.

Sample Receipt and Preservation Form

MBI0301

Due: 09/22/21

Client Name: HAL Project:

TAT: Normal RUSH: ______ days

Samples Received From: FedEx UPS USPS Client Courier Other: ______

Custody Seal on Cooler/Box: Yes No Custody Seals Intact: Yes No N/A

Number of Coolers/Boxes: 1 Type of Ice: Ice/Ice Packs Blue Ice Dry Ice None

Packing Material: Bubble Wrap Bags Foam/Peanuts None Other: paper

Cooler Temp As Read (°C): 2.6 Cooler Temp Corrected (°C): — Thermometer Used: IR-5

				Comments:
Samples Received Intact?	Yes	No	N/A	
Chain of Custody Present?	Yes	No	N/A	
Samples Received Within Hold Time?	Yes	No	N/A	
Samples Properly Preserved?	Yes	No	N/A	
VOC Vials Free of Headspace (<6mm)?	Yes	No	N/A	
VOC Trip Blanks Present?	Yes	No	N/A	
Labels and Chains Agree?	Yes	No	N/A	
Total Number of Sample Bottles Received: 10				

Chain of Custody Fully Completed?	Yes	No	N/A	
Correct Containers Received?	Yes	No	N/A	
Anatek Bottles Used?	Yes	No	Unknown	

Record preservatives (and lot numbers, if known) for containers below:

HCl - 8260 - 544ml x.6 + 2TB

Notes, comments, etc. (also use this space if contacting the client - record names and date/time)

8270 - g1L x2

Received/Inspected By: CS Date/Time: 09/08/2021 1241

ANALYTICAL REPORT

September 13, 2021

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Hall Environmental Analysis Laboratory

Sample Delivery Group:	L1400264
Samples Received:	09/08/2021
Project Number:	
Description:	
Report To:	Jackie Bolte
	4901 Hawkins NE
	Albuquerque, NM 87109

Entire Report Reviewed By: John V Hawkins

John Hawkins

Project Manager

Pace Analytical National

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

			Collected by	Collected date/time	Received date/time	
2109132-001 RG NORTH-20210901 L1400264-01 WW				09/01/21 10:05	09/08/21 09:15	

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 3500Cr C-2011	WG1737107	1	09/10/21 16:47	09/10/21 16:47	GB	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG1737390	1	09/09/21 20:00	09/09/21 23:09	BFG	Mt. Juliet, TN

			Collected by	Collected date/time	Received date/time	
2109132-003 RG SOUTH-20210902 L1400264-02 WW				09/02/21 09:20	09/08/21 09:15	

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 3500Cr C-2011	WG1737107	1	09/10/21 17:03	09/10/21 17:03	GB	Mt. Juliet, TN
Wet Chemistry by Method 410.4	WG1737390	1	09/09/21 20:00	09/09/21 23:09	BFG	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John V Hawkins

John Hawkins
Project Manager

Wet Chemistry by Method 3500Cr C-2011

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Hexavalent Chromium	ND		0.000500	1	09/10/2021 16:47	WG1737107

Wet Chemistry by Method 410.4

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
COD	22.2		20.0	1	09/09/2021 23:09	WG1737390

Wet Chemistry by Method 3500Cr C-2011

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
Hexavalent Chromium	ND		0.000500	1	09/10/2021 17:03	WG1737107

Wet Chemistry by Method 410.4

Analyte	Result mg/l	Qualifier	RDL mg/l	Dilution	Analysis date / time	Batch
COD	54.2		20.0	1	09/09/2021 23:09	WG1737390

Method Blank (MB)

(MB) R3703139-1 09/10/21 11:55

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Hexavalent Chromium	U		0.000150	0.000500

L1397842-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1397842-03 09/10/21 13:33 • (DUP) R3703139-3 09/10/21 13:43

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Hexavalent Chromium	ND	ND	1	0.000		20

L1400264-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1400264-02 09/10/21 17:03 • (DUP) R3703139-7 09/10/21 17:11

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Hexavalent Chromium	ND	ND	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3703139-2 09/10/21 12:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Hexavalent Chromium	0.00200	0.00200	100	90.0-110	

L1397842-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1397842-04 09/10/21 13:51 • (MS) R3703139-4 09/10/21 13:58 • (MSD) R3703139-5 09/10/21 14:06

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Hexavalent Chromium	0.0500	0.109	0.152	0.152	86.1	87.0	1	90.0-110	E J6	E J6	0.294	20

L1400264-01 Original Sample (OS) • Matrix Spike (MS)

(OS) L1400264-01 09/10/21 16:47 • (MS) R3703139-6 09/10/21 16:55

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Hexavalent Chromium	0.0500	ND	0.0492	98.5	1	90.0-110	

Cp Tc Ss Cn Sr Qc Gl Al Sc

Method Blank (MB)

(MB) R3702571-1 09/09/21 23:07

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
COD	U		11.7	20.0

L1400084-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1400084-01 09/09/21 23:07 • (DUP) R3702571-3 09/09/21 23:08

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	ND	ND	1	200	P1	20

L1400373-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1400373-03 09/09/21 23:11 • (DUP) R3702571-6 09/09/21 23:11

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
COD	ND	ND	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3702571-2 09/09/21 23:07

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
COD	500	495	98.9	90.0-110	

L1400264-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1400264-02 09/09/21 23:09 • (MS) R3702571-4 09/09/21 23:10 • (MSD) R3702571-5 09/09/21 23:10

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
COD	500	54.2	568	570	103	103	1	80.0-120			0.399	20

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
ND	Not detected at the Reporting Limit (or MDL where applicable).
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975
FAX: 505-345-4107
Website: clients.hallenvironmental.com

SUB CONTRATOR: Pace TN	COMPANY: PACE TN	PHONE: (800) 767-5859	FAX: (615) 758-5859
ADDRESS: 12065 Lebanon Rd		ACCOUNT #:	EMAIL:
CITY, STATE, ZIP: Mt. Juliet, TN 37122			

L1400264

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS	
1	2109132-001H	RG North-20210901	500HDPEH2SO4	Aqueous	9/1/2021 10:05:00 AM	1	COD	-01
~~2~~	~~2109132-001I~~	~~RG North-20210901~~	~~1LHDPEHNO3~~	~~Aqueous~~	~~9/1/2021 10:05:00 AM~~	~~1~~	~~Adjusted Gross Alpha~~	
3	2109132-001J	RG North-20210901	120mL	Aqueous	9/1/2021 10:05:00 AM	1	Cr 6	-01
4	2109132-003H	RG South-20210902	500HDPEH2SO4	Aqueous	9/2/2021 9:20:00 AM	1	COD	-02
~~5~~	~~2109132-003I~~	~~RG South-20210902~~	~~1LHDPEHNO3~~	~~Aqueous~~	~~9/2/2021 9:20:00 AM~~	~~1~~	~~Adjusted Gross Alpha~~	
6	2109132-003J	RG South-20210902	120mL	Aqueous	9/2/2021 9:20:00 AM	1	Cr 6	-02

```
                 Sample Receipt Checklist
COC Seal Present/Intact:  Y  N        If Applicable
COC Signed/Accurate:      Y  N   VOA Zero Headspace:  _Y_N
Bottles arrive intact:    Y  N   Pres.Correct/Check:  _Y_N
Correct bottles used:     Y  N
Sufficient volume sent:   Y  N
RAD Screen <0.5 mR/hr:    Y  N
```

B182

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

* in separate cooler SGL 9/7/21

Relinquished By	Date	Time	Received By	Date	Time
SGL	9/2/2021	2:48 PM			
			[signature]	9/8/21	9:15

TAT: Standard ✓ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

REPORT TRANSMITTAL DESIRED: ☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY

Temp of samples 1.3+.1=1.4 A20 °C Attempt to Cool ?

Comments

2834 1837 3460

CFA Cape Fear Analytical LLC
an affiliate of The GEL Group INC

3306 Kitty Hawk Road, Suite 120 Wilmington, NC 28405
P 910.795.0421

www.capefearanalytical.com

October 01, 2021

Mr. Andy Freeman
Hall Environmental
4901 Hawkins NE
Suite D
Albuquerque, New Mexico 87109

Re: Routine Analysis
Work Order: 18708
SDG: 2109132

Dear Mr. Freeman:

Cape Fear Analytical LLC (CFA) appreciates the opportunity to provide the enclosed analytical results for the sample(s) we received on September 08, 2021. This original data report has been prepared and reviewed in accordance with CFA's standard operating procedures.

Our policy is to provide high quality, personalized analytical services to enable you to meet your analytical needs on time every time. We trust that you will find everything in order and to your satisfaction. If you have any questions, please do not hesitate to call me at 910-795-0421.

Sincerely,

Cynde Larkins

Cynde Larkins
Project Manager

Purchase Order: IDIQ Pricing
Enclosures

HALL ENVIRONMENTAL ANALYSIS LABORATORY

CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975
FAX: 505-345-4107
Website: clients.hallenvironmental.com

CFA WO#18708

SUB CONTRATOR: Cape Fear Analytical	COMPANY: Cape Fear Analytical	PHONE: (910) 795-0421	FAX:
ADDRESS: 3306 Kitty Hawk Rd Ste 120		ACCOUNT #:	EMAIL:
CITY, STATE, ZIP: Wilmington, NC 28405			

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2109132-001G	RG North-20210901	1LAMGU	Aqueous	9/1/2021 10:05:00 AM	2	PCB Congeners 1668
2	2109132-003G	RG South-20210902	1LAMGU	Aqueous	9/2/2021 9:20:00 AM	2	PCB Congeners 1668

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Ple

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By: Sed	Date: 9/2/2021	Time: 2:49 PM	Received By: [signature]	Date: 9/3/21	Time: 1320
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

TAT: Standard ☑ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

REPORT TRANSMITTAL DESIRED:
☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY

Temp of samples 7.7 °C Attempt to Cool? ✓

Comments:

SAMPLE RECEIPT CHECKLIST

Cape Fear Analytical

Client: HALL	Work Order: 18708
Shipping Company: FedEx	Date/Time Received: 9/8/21 13:20

Suspected Hazard Information	Yes	NA	No
Shipped as DOT Hazardous?			✓
Samples identified as Foreign Soil?			✓

DOE Site Sample Packages	Yes	NA	No*
Screened <0.5 mR/hr?		✓	
Samples < 2x background?		✓	

* Notify RSO of any responses in this column immediately.

Air Sample Receipt Specifics	Yes	NA	No
Air sample in shipment?			✓

Air Witness:

	Sample Receipt Criteria	Yes	NA	No	Comments/Qualifiers (required for Non-Conforming Items)
1	Shipping containers received intact and sealed?	✓			Circle Applicable: seals broken damaged container leaking container other(describe)
2	Custody seal/s present on cooler?	✓			Seal intact? Yes No
3	Chain of Custody documents included with shipment?	✓			
4	Samples requiring cold preservation within 0-6°C?			✓	Preservation Method: ice bags loose ice blue ice dry ice none other (describe) Temperature Blank present: Yes No 7.7+0.0=7.7
5	Aqueous samples found to have visible solids?	✓			Sample IDs, containers affected: all-minimal solids
5	Samples requiring chemical preservation at proper pH?	✓			Sample IDs, containers affected and pH observed: all -pH=7 If preservative added, Lot#:
7	Samples requiring preservation have no residual chlorine?	✓			Sample IDs, containers affected: If preservative added, Lot#:
8	Samples received within holding time?	✓			Sample IDs, tests affected:
9	Sample IDs on COC match IDs on containers?	✓			Sample IDs, containers affected:
10	Date & time of COC match date & time on containers?	✓			Sample IDs, containers affected:
11	Number of containers received match number indicated on COC?			✓	List type and number of containers / Sample IDs, containers affected: # containers listed on COC = 2 bottles per sample received 2-1L amber - 1 per sample
12	COC form is properly signed in relinquished/received sections?	✓			

Comments:

Checklist performed by: Initials: No Date: 9/8/21 CF-UD-F-7

Cynde Larkins

From:	Andy Freeman <andy@hallenvironmental.com>
Sent:	Wednesday, September 8, 2021 3:39 PM
To:	Cynde Larkins
Subject:	RE: 2109132

Please proceed with the analysis and note the temperature.

CFA WO#18708

Thank you,

Andy Freeman - Hall Environmental, 4901 Hawkins NE, Albuquerque, NM 87109, 505-345-3975, 505-345-4107 fax
www.hallenvironmental.com - andy@hallenvironmental.com - https://www.surveymonkey.com/r/NGVXRBV
For easy access to all of your past reports, setup an account on the Hall Environmental Web Portal. Just visit our website and follow the instructions for setting up an account.
We welcome your feedback. Please visit the survey monkey link to complete a brief survey on your experience with Hall Environmental.

From: Cynde Larkins <Cynde.Larkins@cfanalytical.com>
Sent: Wednesday, September 8, 2021 1:39 PM
To: Andy Freeman <andy@hallenvironmental.com>
Subject: 2109132

Andy,
CFA received these samples today in good condition but out of temperature at 7.7°C. Please advise if the lab can proceed with extraction and analysis.
Thank you,

Cynde Larkins
Project Manager
Cape Fear Analytical, LLC
3306 Kitty Hawk Road, Suite 120
Wilmington, NC 28405
(910) 795-0421

CFA | Cape Fear Analytical

PCB Congeners Analysis

Case Narrative

PCBC Case Narrative
Hall Environmental Analysis Laboratory (HALL)
SDG 2109132
Work Order 18708

Method/Analysis Information

Product:	**PCB Congeners by EPA Method 1668A in Liquids**
Analytical Method:	EPA Method 1668A
Extraction Method:	SW846 3520C
Analytical Batch Number:	47901
Clean Up Batch Number:	47899
Extraction Batch Number:	47898

Sample Analysis

Samples were received at 7.7°C. (18708001,18708002).
The following samples were analyzed using the analytical protocol as established in EPA Method 1668A:

Sample ID	Client ID
12030238	Method Blank (MB)
12030239	Laboratory Control Sample (LCS)
12030240	Laboratory Control Sample Duplicate (LCSD)
18708001	2109132-001G RG North-20210901
18708002	2109132-003G RG South-20210902

The samples in this SDG were analyzed on an "as received" basis.

SOP Reference

Procedure for preparation, analysis and reporting of analytical data are controlled by Cape Fear Analytical LLC (CFA) as Standard Operating Procedure (SOP). The data discussed in this narrative has been analyzed in accordance with CF-OA-E-003 REV# 9.

Raw data reports are processed and reviewed by the analyst using the TargetLynx software package.

Calibration Information

Initial Calibration

All initial calibration requirements have been met for this sample delivery group (SDG).

Continuing Calibration Verification (CCV) Requirements
All associated calibration verification standard(s) (ICV or CCV) met the acceptance criteria.

Quality Control (QC) Information

Certification Statement
The test results presented in this document are certified to meet all requirements of the 2009 TNI Standard.

Method Blank (MB) Statement
The MB(s) analyzed with this SDG met the acceptance criteria.

Surrogate Recoveries
All surrogate recoveries were within the established acceptance criteria for this SDG.

Laboratory Control Sample (LCS) Recovery
The LCS spike recoveries met the acceptance limits.

Laboratory Control Sample Duplicate (LCSD) Recovery
The LCSD spike recoveries met the acceptance limits.

LCS/LCSD Relative Percent Difference (RPD) Statement
The RPD(s) between the LCS and LCSD met the acceptance limits.

QC Sample Designation
A matrix spike and matrix spike duplicate analysis was not required for this SDG.

Technical Information

Receipt Temperature
Samples were outside of the recommended range of 0-6°C. The client was notified of the temperature exceedance and the laboratory was instructed to proceed with analysis.

Holding Time Specifications
CFA assigns holding times based on the associated methodology, which assigns the date and time from sample collection. Those holding times expressed in hours are calculated in the AlphaLIMS system. Those holding times expressed as days expire at midnight on the day of expiration. All samples in this SDG met the specified holding time.

Preparation/Analytical Method Verification
All procedures were performed as stated in the SOP.

Sample Dilutions
The samples in this SDG did not require dilutions.

Sample Re-extraction/Re-analysis
Re-extractions or re-analyses were not required in this SDG.

Miscellaneous Information

Manual Integrations
Manual integrations were required for data files in this SDG. Certain standards and QC samples required manual integrations to correctly position the baseline as set in the calibration standard injections. Where manual integrations were performed, copies of all manual integration peak profiles are included in the raw data section of this fraction.

System Configuration
This analysis was performed on the following instrument configuration:

Instrument ID	Instrument	System Configuration	Column ID	Column Description
HRP875_1	PCB Analysis	PCB Analysis	SPB-Octyl	30m x 0.25mm, 0.25um

Sample Data Summary

Cape Fear Analytical, LLC

3306 Kitty Hawk Road Suite 120, Wilmington, NC 28405 - (910) 795-0421 - www.capefearanalytical.com

Certificate of Analysis Report
for

HALL001 Hall Environmental Analysis Laboratory

Client SDG: 2109132 CFA Work Order: 18708

The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- ** Analyte is a surrogate compound
- B The target analyte was detected in the associated blank.
- C Congener has coeluters. When Cxxx, refer to congener number xxx for data
- J Value is estimated
- U Analyte was analyzed for, but not detected above the specified detection limit.

Review/Validation

Cape Fear Analytical requires all analytical data to be verified by a qualified data reviewer.

The following data validator verified the information presented in this case narrative:

Signature: ESuhrie **Name: Erin Suhrie**

Date: 01 OCT 2021 **Title: Data Validator**

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
2051-60-7	1-MoCB	U	ND	pg/L	1.26	109
2051-61-8	2-MoCB	U	ND	pg/L	1.63	109
2051-62-9	3-MoCB	U	ND	pg/L	1.57	109
13029-08-8	4-DiCB	U	ND	pg/L	8.47	109
16605-91-7	5-DiCB	U	ND	pg/L	6.23	109
25569-80-6	6-DiCB	U	ND	pg/L	5.82	109
33284-50-3	7-DiCB	U	ND	pg/L	5.31	109
34883-43-7	8-DiCB	U	ND	pg/L	5.12	109
34883-39-1	9-DiCB	U	ND	pg/L	6.73	109
33146-45-1	10-DiCB	U	ND	pg/L	5.51	109
2050-67-1	11-DiCB	J	41.6	pg/L	6.47	109
2974-92-7	12-DiCB	CU	ND	pg/L	5.84	218
2974-90-5	13-DiCB	C12				
34883-41-5	14-DiCB	U	ND	pg/L	6.27	109
2050-68-2	15-DiCB	U	ND	pg/L	6.49	109
38444-78-9	16-TrCB	U	ND	pg/L	2.83	109
37680-66-3	17-TrCB	U	ND	pg/L	2.74	109
37680-65-2	18-TrCB	CJ	3.85	pg/L	2.31	218
38444-73-4	19-TrCB	U	ND	pg/L	2.83	109
38444-84-7	20-TrCB	CJ	6.60	pg/L	1.85	218
55702-46-0	21-TrCB	CJ	3.20	pg/L	1.89	218
38444-85-8	22-TrCB	J	2.48	pg/L	1.81	109
55720-44-0	23-TrCB	U	ND	pg/L	1.81	109
55702-45-9	24-TrCB	U	ND	pg/L	1.85	109
55712-37-3	25-TrCB	U	ND	pg/L	1.68	109
38444-81-4	26-TrCB	CU	ND	pg/L	1.96	218
38444-76-7	27-TrCB	U	ND	pg/L	2.13	109
7012-37-5	28-TrCB	C20				
15862-07-4	29-TrCB	C26				
35693-92-6	30-TrCB	C18				
16606-02-3	31-TrCB	J	5.10	pg/L	1.92	109
38444-77-8	32-TrCB	U	ND	pg/L	1.89	109

Comments:

B The target analyte was detected in the associated blank.
C Congener has coeluters. When Cxxx, refer to congener number xxx for data
J Value is estimated
U Analyte was analyzed for, but not detected above the specified detection limit.

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
38444-86-9	33-TrCB	C21				
37680-68-5	34-TrCB	U	ND	pg/L	2.20	109
37680-69-6	35-TrCB	U	ND	pg/L	1.83	109
38444-87-0	36-TrCB	U	ND	pg/L	1.59	109
38444-90-5	37-TrCB	U	ND	pg/L	2.53	109
53555-66-1	38-TrCB	U	ND	pg/L	1.81	109
38444-88-1	39-TrCB	U	ND	pg/L	1.50	109
38444-93-8	40-TeCB	CU	ND	pg/L	2.81	218
52663-59-9	41-TeCB	U	ND	pg/L	4.18	109
36559-22-5	42-TeCB	U	ND	pg/L	3.35	109
70362-46-8	43-TeCB	U	ND	pg/L	4.53	109
41464-39-5	44-TeCB	CJ	5.03	pg/L	3.03	327
70362-45-7	45-TeCB	CJ	2.11	pg/L	1.81	218
41464-47-5	46-TeCB	U	ND	pg/L	1.85	109
2437-79-8	47-TeCB	C44				
70362-47-9	48-TeCB	U	ND	pg/L	2.96	109
41464-40-8	49-TeCB	CU	ND	pg/L	2.87	218
62796-65-0	50-TeCB	CU	ND	pg/L	1.70	218
68194-04-7	51-TeCB	C45				
35693-99-3	52-TeCB	U	ND	pg/L	5.92	218
41464-41-9	53-TeCB	C50				
15968-05-5	54-TeCB	U	ND	pg/L	1.37	109
74338-24-2	55-TeCB	U	ND	pg/L	1.66	109
41464-43-1	56-TeCB	U	ND	pg/L	1.79	109
70424-67-8	57-TeCB	U	ND	pg/L	1.76	109
41464-49-7	58-TeCB	U	ND	pg/L	1.59	109
74472-33-6	59-TeCB	CU	ND	pg/L	2.42	327
33025-41-1	60-TeCB	U	ND	pg/L	1.59	109
33284-53-6	61-TeCB	BCJ	7.21	pg/L	1.66	436
54230-22-7	62-TeCB	C59				
74472-34-7	63-TeCB	U	ND	pg/L	1.70	109
52663-58-8	64-TeCB	U	ND	pg/L	2.24	109

Comments:

B The target analyte was detected in the associated blank.
C Congener has coeluters. When Cxxx, refer to congener number xxx for data
J Value is estimated
U Analyte was analyzed for, but not detected above the specified detection limit.

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
33284-54-7	65-TeCB	C44				
32598-10-0	66-TeCB	U	ND	pg/L	3.22	109
73575-53-8	67-TeCB	U	ND	pg/L	1.52	109
73575-52-7	68-TeCB	U	ND	pg/L	1.46	109
60233-24-1	69-TeCB	C49				
32598-11-1	70-TeCB	C61				
41464-46-4	71-TeCB	C40				
41464-42-0	72-TeCB	U	ND	pg/L	1.74	109
74338-23-1	73-TeCB	U	ND	pg/L	2.29	109
32690-93-0	74-TeCB	C61				
32598-12-2	75-TeCB	C59				
70362-48-0	76-TeCB	C61				
32598-13-3	77-TeCB	U	ND	pg/L	1.83	109
70362-49-1	78-TeCB	U	ND	pg/L	1.98	109
41464-48-6	79-TeCB	U	ND	pg/L	1.63	109
33284-52-5	80-TeCB	U	ND	pg/L	1.48	109
70362-50-4	81-TeCB	U	ND	pg/L	1.72	109
52663-62-4	82-PeCB	U	ND	pg/L	3.14	109
60145-20-2	83-PeCB	U	ND	pg/L	3.22	109
52663-60-2	84-PeCB	U	ND	pg/L	2.70	109
65510-45-4	85-PeCB	CU	ND	pg/L	2.05	327
55312-69-1	86-PeCB	CJ	5.03	pg/L	2.18	653
38380-02-8	87-PeCB	C86				
55215-17-3	88-PeCB	CU	ND	pg/L	2.59	218
73575-57-2	89-PeCB	U	ND	pg/L	3.20	109
68194-07-0	90-PeCB	CU	ND	pg/L	6.16	327
68194-05-8	91-PeCB	C88				
52663-61-3	92-PeCB	U	ND	pg/L	3.03	109
73575-56-1	93-PeCB	CU	ND	pg/L	2.33	218
73575-55-0	94-PeCB	U	ND	pg/L	2.46	109
38379-99-6	95-PeCB	J	4.97	pg/L	2.98	109
73575-54-9	96-PeCB	U	ND	pg/L	1.79	109

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
41464-51-1	97-PeCB	C86				
60233-25-2	98-PeCB	CU	ND	pg/L	2.59	218
38380-01-7	99-PeCB	U	ND	pg/L	2.05	109
39485-83-1	100-PeCB	C93				
37680-73-2	101-PeCB	C90				
68194-06-9	102-PeCB	C98				
60145-21-3	103-PeCB	U	ND	pg/L	2.70	109
56558-16-8	104-PeCB	U	ND	pg/L	1.63	109
32598-14-4	105-PeCB	J	3.85	pg/L	2.59	109
70424-69-0	106-PeCB	U	ND	pg/L	2.81	109
70424-68-9	107-PeCB	U	ND	pg/L	2.00	109
70362-41-3	108-PeCB	CU	ND	pg/L	2.42	218
74472-35-8	109-PeCB	C86				
38380-03-9	110-PeCB	CJ	7.36	pg/L	1.96	218
39635-32-0	111-PeCB	U	ND	pg/L	1.72	109
74472-36-9	112-PeCB	U	ND	pg/L	1.94	109
68194-10-5	113-PeCB	C90				
74472-37-0	114-PeCB	U	ND	pg/L	2.44	109
74472-38-1	115-PeCB	C110				
18259-05-7	116-PeCB	C85				
68194-11-6	117-PeCB	C85				
31508-00-6	118-PeCB	J	5.38	pg/L	2.40	109
56558-17-9	119-PeCB	C86				
68194-12-7	120-PeCB	U	ND	pg/L	2.05	109
56558-18-0	121-PeCB	U	ND	pg/L	1.76	109
76842-07-4	122-PeCB	U	ND	pg/L	3.29	109
65510-44-3	123-PeCB	U	ND	pg/L	2.40	109
70424-70-3	124-PeCB	C108				
74472-39-2	125-PeCB	C86				
57465-28-8	126-PeCB	U	ND	pg/L	2.83	109
39635-33-1	127-PeCB	U	ND	pg/L	2.66	109
38380-07-3	128-HxCB	CU	ND	pg/L	1.87	218

Comments:

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
55215-18-4	129-HxCB	CJ	22.1	pg/L	1.94	327
52663-66-8	130-HxCB	U	ND	pg/L	2.37	109
61798-70-7	131-HxCB	U	ND	pg/L	2.33	109
38380-05-1	132-HxCB	J	4.31	pg/L	2.11	109
35694-04-3	133-HxCB	U	ND	pg/L	2.40	109
52704-70-8	134-HxCB	U	ND	pg/L	2.48	109
52744-13-5	135-HxCB	CU	ND	pg/L	6.71	218
38411-22-2	136-HxCB	U	ND	pg/L	2.44	109
35694-06-5	137-HxCB	U	ND	pg/L	1.79	109
35065-28-2	138-HxCB	C129				
56030-56-9	139-HxCB	CU	ND	pg/L	1.92	218
59291-64-4	140-HxCB	C139				
52712-04-6	141-HxCB	J	4.97	pg/L	2.13	109
41411-61-4	142-HxCB	U	ND	pg/L	2.64	109
68194-15-0	143-HxCB	U	ND	pg/L	2.81	109
68194-14-9	144-HxCB	U	ND	pg/L	1.85	109
74472-40-5	145-HxCB	U	ND	pg/L	1.24	109
51908-16-8	146-HxCB	U	ND	pg/L	2.92	109
68194-13-8	147-HxCB	CJ	14.6	pg/L	2.13	218
74472-41-6	148-HxCB	U	ND	pg/L	1.79	109
38380-04-0	149-HxCB	C147				
68194-08-1	150-HxCB	U	ND	pg/L	1.22	109
52663-63-5	151-HxCB	C135				
68194-09-2	152-HxCB	U	ND	pg/L	1.42	109
35065-27-1	153-HxCB	BCJ	20.3	pg/L	1.59	218
60145-22-4	154-HxCB	U	ND	pg/L	1.48	109
33979-03-2	155-HxCB	U	ND	pg/L	1.22	109
38380-08-4	156-HxCB	BCJ	3.35	pg/L	2.03	218
69782-90-7	157-HxCB	C156				
74472-42-7	158-HxCB	U	ND	pg/L	1.76	109
39635-35-3	159-HxCB	U	ND	pg/L	1.57	109
41411-62-5	160-HxCB	U	ND	pg/L	1.66	109

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PCB Congeners
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Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
74472-43-8	161-HxCB	U	ND	pg/L	1.76	109
39635-34-2	162-HxCB	U	ND	pg/L	1.42	109
74472-44-9	163-HxCB	C129				
74472-45-0	164-HxCB	U	ND	pg/L	1.70	109
74472-46-1	165-HxCB	U	ND	pg/L	1.59	109
41411-63-6	166-HxCB	C128				
52663-72-6	167-HxCB	U	ND	pg/L	1.50	109
59291-65-5	168-HxCB	C153				
32774-16-6	169-HxCB	U	ND	pg/L	1.72	109
35065-30-6	170-HpCB	J	10.0	pg/L	2.05	109
52663-71-5	171-HpCB	CU	ND	pg/L	3.14	218
52663-74-8	172-HpCB	U	ND	pg/L	2.16	109
68194-16-1	173-HpCB	C171				
38411-25-5	174-HpCB	J	14.0	pg/L	2.03	109
40186-70-7	175-HpCB	U	ND	pg/L	2.05	109
52663-65-7	176-HpCB	U	ND	pg/L	1.61	109
52663-70-4	177-HpCB	U	ND	pg/L	7.95	109
52663-67-9	178-HpCB	U	ND	pg/L	3.99	109
52663-64-6	179-HpCB	U	ND	pg/L	5.42	109
35065-29-3	180-HpCB	CJ	25.4	pg/L	1.68	218
74472-47-2	181-HpCB	U	ND	pg/L	1.76	109
60145-23-5	182-HpCB	U	ND	pg/L	1.98	109
52663-69-1	183-HpCB	CJ	6.53	pg/L	1.85	218
74472-48-3	184-HpCB	U	ND	pg/L	1.37	109
52712-05-7	185-HpCB	C183				
74472-49-4	186-HpCB	U	ND	pg/L	1.48	109
52663-68-0	187-HpCB	J	15.1	pg/L	1.74	109
74487-85-7	188-HpCB	U	ND	pg/L	1.57	109
39635-31-9	189-HpCB	U	ND	pg/L	1.57	109
41411-64-7	190-HpCB	U	ND	pg/L	3.18	109
74472-50-7	191-HpCB	U	ND	pg/L	1.57	109
74472-51-8	192-HpCB	U	ND	pg/L	1.57	109

Comments:
B The target analyte was detected in the associated blank.
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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
69782-91-8	193-HpCB	C180				
35694-08-7	194-OcCB	BJ	7.08	pg/L	1.79	109
52663-78-2	195-OcCB	J	3.20	pg/L	1.85	109
42740-50-1	196-OcCB	J	3.35	pg/L	1.70	109
33091-17-7	197-OcCB	CU	ND	pg/L	1.28	218
68194-17-2	198-OcCB	CJ	8.04	pg/L	1.66	218
52663-75-9	199-OcCB	C198				
52663-73-7	200-OcCB	C197				
40186-71-8	201-OcCB	U	ND	pg/L	1.28	109
2136-99-4	202-OcCB	U	ND	pg/L	1.85	109
52663-76-0	203-OcCB	BJ	3.99	pg/L	1.48	109
74472-52-9	204-OcCB	U	ND	pg/L	1.28	109
74472-53-0	205-OcCB	U	ND	pg/L	1.42	109
40186-72-9	206-NoCB	U	ND	pg/L	2.48	109
52663-79-3	207-NoCB	U	ND	pg/L	1.85	109
52663-77-1	208-NoCB	U	ND	pg/L	1.92	109
2051-24-3	209-DeCB	U	ND	pg/L	1.81	109
1336-36-3	Total PCB Congeners	J	270	pg/L		109

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-1-MoCB		780	2180	pg/L	35.8	(15%-150%)
13C-3-MoCB		864	2180	pg/L	39.7	(15%-150%)
13C-4-DiCB		1020	2180	pg/L	46.6	(25%-150%)
13C-15-DiCB		1360	2180	pg/L	62.4	(25%-150%)
13C-19-TrCB		1330	2180	pg/L	60.9	(25%-150%)
13C-37-TrCB		1340	2180	pg/L	61.7	(25%-150%)
13C-54-TeCB		1180	2180	pg/L	54.3	(25%-150%)
13C-77-TeCB		1930	2180	pg/L	88.6	(25%-150%)
13C-81-TeCB		1940	2180	pg/L	88.9	(25%-150%)
13C-104-PeCB		1060	2180	pg/L	48.9	(25%-150%)
13C-105-PeCB		1610	2180	pg/L	73.8	(25%-150%)
13C-114-PeCB		1590	2180	pg/L	72.8	(25%-150%)
13C-118-PeCB		1560	2180	pg/L	71.6	(25%-150%)
13C-123-PeCB		1650	2180	pg/L	76.0	(25%-150%)
13C-126-PeCB		1740	2180	pg/L	79.9	(25%-150%)
13C-155-HxCB		1240	2180	pg/L	57.0	(25%-150%)
13C-156-HxCB	C	2620	4360	pg/L	60.2	(25%-150%)
13C-157-HxCB	C156L					
13C-167-HxCB		1350	2180	pg/L	62.1	(25%-150%)
13C-169-HxCB		1400	2180	pg/L	64.1	(25%-150%)
13C-188-HpCB		1670	2180	pg/L	76.6	(25%-150%)
13C-189-HpCB		1460	2180	pg/L	67.0	(25%-150%)

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708001**	**Date Collected:**	**09/01/2021 10:05**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-001G RG North-20210901**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 08:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**918.3 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-202-OcCB		1540	2180	pg/L	70.6	(25%-150%)
13C-205-OcCB		1750	2180	pg/L	80.1	(25%-150%)
13C-206-NoCB		1840	2180	pg/L	84.6	(25%-150%)
13C-208-NoCB		1550	2180	pg/L	71.3	(25%-150%)
13C-209-DeCB		1640	2180	pg/L	75.4	(25%-150%)
13C-28-TrCB		1610	2180	pg/L	74.1	(30%-135%)
13C-111-PeCB		1830	2180	pg/L	84.0	(30%-135%)
13C-178-HpCB		1920	2180	pg/L	88.3	(30%-135%)

Comments:

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
2051-60-7	1-MoCB	J	2.09	pg/L	0.938	107
2051-61-8	2-MoCB	J	2.03	pg/L	1.24	107
2051-62-9	3-MoCB	J	3.07	pg/L	1.22	107
13029-08-8	4-DiCB	U	ND	pg/L	7.80	107
16605-91-7	5-DiCB	U	ND	pg/L	5.52	107
25569-80-6	6-DiCB	U	ND	pg/L	5.14	107
33284-50-3	7-DiCB	U	ND	pg/L	4.71	107
34883-43-7	8-DiCB	U	ND	pg/L	4.52	107
34883-39-1	9-DiCB	U	ND	pg/L	5.95	107
33146-45-1	10-DiCB	U	ND	pg/L	5.97	107
2050-67-1	11-DiCB	J	95.7	pg/L	5.71	107
2974-92-7	12-DiCB	CU	ND	pg/L	5.16	213
2974-90-5	13-DiCB	C12				
34883-41-5	14-DiCB	U	ND	pg/L	5.54	107
2050-68-2	15-DiCB	J	10.4	pg/L	6.25	107
38444-78-9	16-TrCB	J	4.05	pg/L	2.69	107
37680-66-3	17-TrCB	U	ND	pg/L	3.97	107
37680-65-2	18-TrCB	CU	ND	pg/L	8.68	213
38444-73-4	19-TrCB	U	ND	pg/L	2.39	107
38444-84-7	20-TrCB	CU	ND	pg/L	17.0	213
55702-46-0	21-TrCB	CJ	7.08	pg/L	1.79	213
38444-85-8	22-TrCB	J	5.59	pg/L	1.71	107
55720-44-0	23-TrCB	U	ND	pg/L	1.73	107
55702-45-9	24-TrCB	U	ND	pg/L	1.75	107
55712-37-3	25-TrCB	U	ND	pg/L	1.60	107
38444-81-4	26-TrCB	CU	ND	pg/L	3.01	213
38444-76-7	27-TrCB	U	ND	pg/L	2.03	107
7012-37-5	28-TrCB	C20				
15862-07-4	29-TrCB	C26				
35693-92-6	30-TrCB	C18				
16606-02-3	31-TrCB	J	12.5	pg/L	1.81	107
38444-77-8	32-TrCB	J	3.20	pg/L	1.79	107

Comments:

B The target analyte was detected in the associated blank.
C Congener has coeluters. When Cxxx, refer to congener number xxx for data
J Value is estimated
U Analyte was analyzed for, but not detected above the specified detection limit.

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
38444-86-9	33-TrCB	C21				
37680-68-5	34-TrCB	U	ND	pg/L	2.09	107
37680-69-6	35-TrCB	U	ND	pg/L	2.07	107
38444-87-0	36-TrCB	U	ND	pg/L	1.79	107
38444-90-5	37-TrCB	J	7.84	pg/L	2.28	107
53555-66-1	38-TrCB	U	ND	pg/L	2.05	107
38444-88-1	39-TrCB	U	ND	pg/L	1.71	107
38444-93-8	40-TeCB	CJ	5.90	pg/L	3.45	213
52663-59-9	41-TeCB	U	ND	pg/L	5.12	107
36559-22-5	42-TeCB	J	4.67	pg/L	4.11	107
70362-46-8	43-TeCB	U	ND	pg/L	5.54	107
41464-39-5	44-TeCB	CJ	19.9	pg/L	3.71	320
70362-45-7	45-TeCB	CJ	3.56	pg/L	1.96	213
41464-47-5	46-TeCB	U	ND	pg/L	2.03	107
2437-79-8	47-TeCB	C44				
70362-47-9	48-TeCB	U	ND	pg/L	3.62	107
41464-40-8	49-TeCB	CJ	10.7	pg/L	3.52	213
62796-65-0	50-TeCB	CJ	3.07	pg/L	1.85	213
68194-04-7	51-TeCB	C45				
35693-99-3	52-TeCB	J	35.8	pg/L	4.31	213
41464-41-9	53-TeCB	C50				
15968-05-5	54-TeCB	U	ND	pg/L	1.41	107
74338-24-2	55-TeCB	U	ND	pg/L	2.00	107
41464-43-1	56-TeCB	J	8.16	pg/L	2.17	107
70424-67-8	57-TeCB	U	ND	pg/L	2.15	107
41464-49-7	58-TeCB	U	ND	pg/L	1.92	107
74472-33-6	59-TeCB	CU	ND	pg/L	2.96	320
33025-41-1	60-TeCB	J	3.97	pg/L	1.94	107
33284-53-6	61-TeCB	BCJ	34.4	pg/L	2.00	426
54230-22-7	62-TeCB	C59				
74472-34-7	63-TeCB	U	ND	pg/L	2.07	107
52663-58-8	64-TeCB	J	8.16	pg/L	2.75	107

Comments:

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
33284-54-7	65-TeCB	C44				
32598-10-0	66-TeCB	J	13.5	pg/L	2.03	107
73575-53-8	67-TeCB	U	ND	pg/L	1.83	107
73575-52-7	68-TeCB	U	ND	pg/L	1.77	107
60233-24-1	69-TeCB	C49				
32598-11-1	70-TeCB	C61				
41464-46-4	71-TeCB	C40				
41464-42-0	72-TeCB	U	ND	pg/L	2.11	107
74338-23-1	73-TeCB	U	ND	pg/L	2.79	107
32690-93-0	74-TeCB	C61				
32598-12-2	75-TeCB	C59				
70362-48-0	76-TeCB	C61				
32598-13-3	77-TeCB	J	6.31	pg/L	2.30	107
70362-49-1	78-TeCB	U	ND	pg/L	2.41	107
41464-48-6	79-TeCB	U	ND	pg/L	1.98	107
33284-52-5	80-TeCB	U	ND	pg/L	1.79	107
70362-50-4	81-TeCB	U	ND	pg/L	2.13	107
52663-62-4	82-PeCB	J	9.23	pg/L	5.73	107
60145-20-2	83-PeCB	U	ND	pg/L	5.90	107
52663-60-2	84-PeCB	J	13.1	pg/L	4.97	107
65510-45-4	85-PeCB	CJ	8.25	pg/L	3.75	320
55312-69-1	86-PeCB	CJ	47.1	pg/L	3.99	640
38380-02-8	87-PeCB	C86				
55215-17-3	88-PeCB	CJ	7.53	pg/L	4.75	213
73575-57-2	89-PeCB	U	ND	pg/L	5.86	107
68194-07-0	90-PeCB	CJ	63.7	pg/L	4.16	320
68194-05-8	91-PeCB	C88				
52663-61-3	92-PeCB	J	12.4	pg/L	5.52	107
73575-56-1	93-PeCB	CU	ND	pg/L	4.26	213
73575-55-0	94-PeCB	U	ND	pg/L	4.52	107
38379-99-6	95-PeCB	J	47.6	pg/L	5.46	107
73575-54-9	96-PeCB	U	ND	pg/L	1.79	107

Comments:

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
41464-51-1	97-PeCB	C86				
60233-25-2	98-PeCB	CU	ND	pg/L	4.75	213
38380-01-7	99-PeCB	J	19.2	pg/L	3.77	107
39485-83-1	100-PeCB	C93				
37680-73-2	101-PeCB	C90				
68194-06-9	102-PeCB	C98				
60145-21-3	103-PeCB	U	ND	pg/L	4.95	107
56558-16-8	104-PeCB	U	ND	pg/L	1.64	107
32598-14-4	105-PeCB	J	32.6	pg/L	2.73	107
70424-69-0	106-PeCB	U	ND	pg/L	2.98	107
70424-68-9	107-PeCB	U	ND	pg/L	4.60	107
70362-41-3	108-PeCB	CU	ND	pg/L	2.56	213
74472-35-8	109-PeCB	C86				
38380-03-9	110-PeCB	CJ	93.9	pg/L	3.58	213
39635-32-0	111-PeCB	U	ND	pg/L	3.13	107
74472-36-9	112-PeCB	U	ND	pg/L	3.54	107
68194-10-5	113-PeCB	C90				
74472-37-0	114-PeCB	U	ND	pg/L	2.66	107
74472-38-1	115-PeCB	C110				
18259-05-7	116-PeCB	C85				
68194-11-6	117-PeCB	C85				
31508-00-6	118-PeCB	J	64.2	pg/L	2.56	107
56558-17-9	119-PeCB	C86				
68194-12-7	120-PeCB	U	ND	pg/L	3.75	107
56558-18-0	121-PeCB	U	ND	pg/L	3.22	107
76842-07-4	122-PeCB	U	ND	pg/L	3.50	107
65510-44-3	123-PeCB	U	ND	pg/L	2.54	107
70424-70-3	124-PeCB	C108				
74472-39-2	125-PeCB	C86				
57465-28-8	126-PeCB	U	ND	pg/L	2.92	107
39635-33-1	127-PeCB	U	ND	pg/L	2.84	107
38380-07-3	128-HxCB	CJ	20.6	pg/L	2.69	213

Comments:

B The target analyte was detected in the associated blank.
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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
55215-18-4	129-HxCB	CJ	151	pg/L	2.88	320
52663-66-8	130-HxCB	J	7.74	pg/L	3.56	107
61798-70-7	131-HxCB	U	ND	pg/L	3.50	107
38380-05-1	132-HxCB	J	38.2	pg/L	3.15	107
35694-04-3	133-HxCB	U	ND	pg/L	3.58	107
52704-70-8	134-HxCB	U	ND	pg/L	4.73	107
52744-13-5	135-HxCB	CJ	38.2	pg/L	1.68	213
38411-22-2	136-HxCB	J	13.3	pg/L	1.41	107
35694-06-5	137-HxCB	J	4.73	pg/L	2.66	107
35065-28-2	138-HxCB	C129				
56030-56-9	139-HxCB	CU	ND	pg/L	2.86	213
59291-64-4	140-HxCB	C139				
52712-04-6	141-HxCB	J	25.4	pg/L	3.20	107
41411-61-4	142-HxCB	U	ND	pg/L	3.92	107
68194-15-0	143-HxCB	U	ND	pg/L	4.20	107
68194-14-9	144-HxCB	J	5.44	pg/L	1.79	107
74472-40-5	145-HxCB	U	ND	pg/L	1.19	107
51908-16-8	146-HxCB	J	16.6	pg/L	2.69	107
68194-13-8	147-HxCB	CJ	83.4	pg/L	3.18	213
74472-41-6	148-HxCB	U	ND	pg/L	1.75	107
38380-04-0	149-HxCB	C147				
68194-08-1	150-HxCB	U	ND	pg/L	1.19	107
52663-63-5	151-HxCB	C135				
68194-09-2	152-HxCB	U	ND	pg/L	1.39	107
35065-27-1	153-HxCB	CJ	105	pg/L	2.37	213
60145-22-4	154-HxCB	U	ND	pg/L	1.43	107
33979-03-2	155-HxCB	U	ND	pg/L	1.22	107
38380-08-4	156-HxCB	BCJ	16.1	pg/L	2.69	213
69782-90-7	157-HxCB	C156				
74472-42-7	158-HxCB	J	14.0	pg/L	2.17	107
39635-35-3	159-HxCB	U	ND	pg/L	2.11	107
41411-62-5	160-HxCB	U	ND	pg/L	2.45	107

Comments:
B The target analyte was detected in the associated blank.
C Congener has coeluters. When Cxxx, refer to congener number xxx for data
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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
74472-43-8	161-HxCB	U	ND	pg/L	2.64	107
39635-34-2	162-HxCB	U	ND	pg/L	1.92	107
74472-44-9	163-HxCB	C129				
74472-45-0	164-HxCB	J	10.3	pg/L	2.54	107
74472-46-1	165-HxCB	U	ND	pg/L	2.37	107
41411-63-6	166-HxCB	C128				
52663-72-6	167-HxCB	J	6.35	pg/L	2.03	107
59291-65-5	168-HxCB	C153				
32774-16-6	169-HxCB	U	ND	pg/L	2.26	107
35065-30-6	170-HpCB	J	40.6	pg/L	2.64	107
52663-71-5	171-HpCB	CJ	12.3	pg/L	2.77	213
52663-74-8	172-HpCB	U	ND	pg/L	9.55	107
68194-16-1	173-HpCB	C171				
38411-25-5	174-HpCB	J	42.6	pg/L	2.62	107
40186-70-7	175-HpCB	U	ND	pg/L	1.85	107
52663-65-7	176-HpCB	J	3.90	pg/L	1.47	107
52663-70-4	177-HpCB	J	27.4	pg/L	2.75	107
52663-67-9	178-HpCB	J	9.06	pg/L	2.00	107
52663-64-6	179-HpCB	J	16.2	pg/L	1.43	107
35065-29-3	180-HpCB	CJ	92.0	pg/L	2.15	213
74472-47-2	181-HpCB	U	ND	pg/L	2.28	107
60145-23-5	182-HpCB	U	ND	pg/L	1.79	107
52663-69-1	183-HpCB	CJ	26.5	pg/L	2.39	213
74472-48-3	184-HpCB	U	ND	pg/L	1.24	107
52712-05-7	185-HpCB	C183				
74472-49-4	186-HpCB	U	ND	pg/L	1.34	107
52663-68-0	187-HpCB	J	47.2	pg/L	1.58	107
74487-85-7	188-HpCB	U	ND	pg/L	1.49	107
39635-31-9	189-HpCB	U	ND	pg/L	2.34	107
41411-64-7	190-HpCB	J	9.61	pg/L	1.96	107
74472-50-7	191-HpCB	U	ND	pg/L	2.03	107
74472-51-8	192-HpCB	U	ND	pg/L	2.00	107

Comments:

B **The target analyte was detected in the associated blank.**
C **Congener has coeluters. When Cxxx, refer to congener number xxx for data**
J **Value is estimated**
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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
69782-91-8	193-HpCB	C180				
35694-08-7	194-OcCB	BJ	22.0	pg/L	1.98	107
52663-78-2	195-OcCB	J	8.83	pg/L	2.07	107
42740-50-1	196-OcCB	J	10.4	pg/L	1.88	107
33091-17-7	197-OcCB	CJ	4.01	pg/L	1.43	213
68194-17-2	198-OcCB	CJ	21.9	pg/L	1.83	213
52663-75-9	199-OcCB	C198				
52663-73-7	200-OcCB	C197				
40186-71-8	201-OcCB	J	2.54	pg/L	1.41	107
2136-99-4	202-OcCB	J	5.09	pg/L	1.62	107
52663-76-0	203-OcCB	BJ	13.2	pg/L	1.66	107
74472-52-9	204-OcCB	U	ND	pg/L	1.43	107
74472-53-0	205-OcCB	U	ND	pg/L	1.83	107
40186-72-9	206-NoCB	J	9.64	pg/L	2.98	107
52663-79-3	207-NoCB	U	ND	pg/L	2.22	107
52663-77-1	208-NoCB	U	ND	pg/L	4.22	107
2051-24-3	209-DeCB	J	7.97	pg/L	1.79	107
1336-36-3	Total PCB Congeners	J	1720	pg/L		107

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-1-MoCB		909	2130	pg/L	42.6	(15%-150%)
13C-3-MoCB		980	2130	pg/L	46.0	(15%-150%)
13C-4-DiCB		1170	2130	pg/L	55.0	(25%-150%)
13C-15-DiCB		1310	2130	pg/L	61.5	(25%-150%)
13C-19-TrCB		1350	2130	pg/L	63.5	(25%-150%)
13C-37-TrCB		1300	2130	pg/L	61.1	(25%-150%)
13C-54-TeCB		1120	2130	pg/L	52.7	(25%-150%)
13C-77-TeCB		1820	2130	pg/L	85.4	(25%-150%)
13C-81-TeCB		1850	2130	pg/L	86.7	(25%-150%)
13C-104-PeCB		954	2130	pg/L	44.8	(25%-150%)
13C-105-PeCB		1470	2130	pg/L	69.1	(25%-150%)
13C-114-PeCB		1460	2130	pg/L	68.4	(25%-150%)
13C-118-PeCB		1430	2130	pg/L	67.0	(25%-150%)
13C-123-PeCB		1500	2130	pg/L	70.2	(25%-150%)
13C-126-PeCB		1670	2130	pg/L	78.2	(25%-150%)
13C-155-HxCB		1100	2130	pg/L	51.5	(25%-150%)
13C-156-HxCB	C	2420	4260	pg/L	56.6	(25%-150%)
13C-157-HxCB	C156L					
13C-167-HxCB		1230	2130	pg/L	57.6	(25%-150%)
13C-169-HxCB		1340	2130	pg/L	62.8	(25%-150%)
13C-188-HpCB		1440	2130	pg/L	67.4	(25%-150%)
13C-189-HpCB		1360	2130	pg/L	63.6	(25%-150%)

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**18708002**	**Date Collected:**	**09/02/2021 09:20**	**Matrix:**	**WATER**
Client Sample:	**1668A Water**	**Date Received:**	**09/08/2021 13:20**		
Client ID:	**2109132-003G RG South-20210902**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/23/2021 09:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a_2-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**938.2 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-202-OcCB		1320	2130	pg/L	61.9	(25%-150%)
13C-205-OcCB		1540	2130	pg/L	72.4	(25%-150%)
13C-206-NoCB		1650	2130	pg/L	77.4	(25%-150%)
13C-208-NoCB		1400	2130	pg/L	65.5	(25%-150%)
13C-209-DeCB		1440	2130	pg/L	67.5	(25%-150%)
13C-28-TrCB		1590	2130	pg/L	74.4	(30%-135%)
13C-111-PeCB		1750	2130	pg/L	82.0	(30%-135%)
13C-178-HpCB		1840	2130	pg/L	86.5	(30%-135%)

Comments:
B The target analyte was detected in the associated blank.
C Congener has coeluters. When Cxxx, refer to congener number xxx for data
J Value is estimated
U Analyte was analyzed for, but not detected above the specified detection limit.

Quality Control Summary

PCB Congeners
Surrogate Recovery Report

SDG Number: 2109132
Matrix Type: LIQUID

Sample ID	Client ID	Surrogate	QUAL	Recovery (%)	Acceptance Limits
12030239	LCS for batch 47898	13C-1-MoCB		53.1	(15%-140%)
		13C-3-MoCB		58.3	(15%-140%)
		13C-4-DiCB		67.2	(30%-140%)
		13C-15-DiCB		80.8	(30%-140%)
		13C-19-TrCB		85.3	(30%-140%)
		13C-37-TrCB		64.0	(30%-140%)
		13C-54-TeCB		57.2	(30%-140%)
		13C-77-TeCB		84.3	(30%-140%)
		13C-81-TeCB		85.6	(30%-140%)
		13C-104-PeCB		55.9	(30%-140%)
		13C-105-PeCB		69.7	(30%-140%)
		13C-114-PeCB		70.5	(30%-140%)
		13C-118-PeCB		68.8	(30%-140%)
		13C-123-PeCB		73.0	(30%-140%)
		13C-126-PeCB		75.6	(30%-140%)
		13C-155-HxCB		65.9	(30%-140%)
		13C-156-HxCB	C	65.4	(30%-140%)
		13C-157-HxCB	C156L		
		13C-167-HxCB		66.8	(30%-140%)
		13C-169-HxCB		67.6	(30%-140%)
		13C-188-HpCB		83.6	(30%-140%)
		13C-189-HpCB		71.4	(30%-140%)
		13C-202-OcCB		77.8	(30%-140%)
		13C-205-OcCB		84.9	(30%-140%)
		13C-206-NoCB		90.1	(30%-140%)
		13C-208-NoCB		77.1	(30%-140%)
		13C-209-DeCB		82.2	(30%-140%)
		13C-28-TrCB		77.2	(40%-125%)
		13C-111-PeCB		87.1	(40%-125%)
		13C-178-HpCB		98.3	(40%-125%)
12030240	LCSD for batch 47898	13C-1-MoCB		51.1	(15%-140%)
		13C-3-MoCB		58.1	(15%-140%)
		13C-4-DiCB		67.8	(30%-140%)
		13C-15-DiCB		83.4	(30%-140%)
		13C-19-TrCB		84.3	(30%-140%)
		13C-37-TrCB		66.1	(30%-140%)
		13C-54-TeCB		58.5	(30%-140%)
		13C-77-TeCB		85.7	(30%-140%)
		13C-81-TeCB		87.1	(30%-140%)
		13C-104-PeCB		54.9	(30%-140%)
		13C-105-PeCB		70.2	(30%-140%)
		13C-114-PeCB		70.1	(30%-140%)
		13C-118-PeCB		68.4	(30%-140%)
		13C-123-PeCB		72.6	(30%-140%)
		13C-126-PeCB		74.8	(30%-140%)
		13C-155-HxCB		63.3	(30%-140%)
		13C-156-HxCB	C	63.6	(30%-140%)
		13C-157-HxCB	C156L		
		13C-167-HxCB		64.4	(30%-140%)
		13C-169-HxCB		66.2	(30%-140%)
		13C-188-HpCB		81.7	(30%-140%)
		13C-189-HpCB		69.5	(30%-140%)

PCB Congeners
Surrogate Recovery Report

SDG Number: 2109132

Matrix Type: LIQUID

Sample ID	Client ID	Surrogate	QUAL	Recovery (%)	Acceptance Limits
12030240	LCSD for batch 47898	13C-202-OcCB		76.3	(30%-140%)
		13C-205-OcCB		81.2	(30%-140%)
		13C-206-NoCB		84.7	(30%-140%)
		13C-208-NoCB		75.5	(30%-140%)
		13C-209-DeCB		77.0	(30%-140%)
		13C-28-TrCB		71.3	(40%-125%)
		13C-111-PeCB		80.9	(40%-125%)
		13C-178-HpCB		86.5	(40%-125%)
12030238	MB for batch 47898	13C-1-MoCB		36.6	(15%-150%)
		13C-3-MoCB		39.9	(15%-150%)
		13C-4-DiCB		47.9	(25%-150%)
		13C-15-DiCB		60.2	(25%-150%)
		13C-19-TrCB		59.9	(25%-150%)
		13C-37-TrCB		52.5	(25%-150%)
		13C-54-TeCB		47.0	(25%-150%)
		13C-77-TeCB		68.3	(25%-150%)
		13C-81-TeCB		68.5	(25%-150%)
		13C-104-PeCB		44.0	(25%-150%)
		13C-105-PeCB		57.8	(25%-150%)
		13C-114-PeCB		57.7	(25%-150%)
		13C-118-PeCB		56.2	(25%-150%)
		13C-123-PeCB		59.2	(25%-150%)
		13C-126-PeCB		60.9	(25%-150%)
		13C-155-HxCB		50.0	(25%-150%)
		13C-156-HxCB	C	49.2	(25%-150%)
		13C-157-HxCB	C156L		
		13C-167-HxCB		50.2	(25%-150%)
		13C-169-HxCB		51.5	(25%-150%)
		13C-188-HpCB		67.2	(25%-150%)
		13C-189-HpCB		55.8	(25%-150%)
		13C-202-OcCB		59.6	(25%-150%)
		13C-205-OcCB		65.5	(25%-150%)
		13C-206-NoCB		69.3	(25%-150%)
		13C-208-NoCB		61.0	(25%-150%)
		13C-209-DeCB		62.0	(25%-150%)
		13C-28-TrCB		60.1	(30%-135%)
		13C-111-PeCB		69.1	(30%-135%)
		13C-178-HpCB		73.3	(30%-135%)
18708001	2109132-001G RG North-20210901	13C-1-MoCB		35.8	(15%-150%)
		13C-3-MoCB		39.7	(15%-150%)
		13C-4-DiCB		46.6	(25%-150%)
		13C-15-DiCB		62.4	(25%-150%)
		13C-19-TrCB		60.9	(25%-150%)
		13C-37-TrCB		61.7	(25%-150%)
		13C-54-TeCB		54.3	(25%-150%)
		13C-77-TeCB		88.6	(25%-150%)
		13C-81-TeCB		88.9	(25%-150%)
		13C-104-PeCB		48.9	(25%-150%)
		13C-105-PeCB		73.8	(25%-150%)
		13C-114-PeCB		72.8	(25%-150%)
		13C-118-PeCB		71.6	(25%-150%)

PCB Congeners
Surrogate Recovery Report

SDG Number: 2109132

Matrix Type: LIQUID

Sample ID	Client ID	Surrogate	QUAL	Recovery (%)	Acceptance Limits
18708001	2109132-001G RG North-20210901	13C-123-PeCB		76.0	(25%-150%)
		13C-126-PeCB		79.9	(25%-150%)
		13C-155-HxCB		57.0	(25%-150%)
		13C-156-HxCB	C	60.2	(25%-150%)
		13C-157-HxCB	C156L		
		13C-167-HxCB		62.1	(25%-150%)
		13C-169-HxCB		64.1	(25%-150%)
		13C-188-HpCB		76.6	(25%-150%)
		13C-189-HpCB		67.0	(25%-150%)
		13C-202-OcCB		70.6	(25%-150%)
		13C-205-OcCB		80.1	(25%-150%)
		13C-206-NoCB		84.6	(25%-150%)
		13C-208-NoCB		71.3	(25%-150%)
		13C-209-DeCB		75.4	(25%-150%)
		13C-28-TrCB		74.1	(30%-135%)
		13C-111-PeCB		84.0	(30%-135%)
		13C-178-HpCB		88.3	(30%-135%)
18708002	2109132-003G RG South-20210902	13C-1-MoCB		42.6	(15%-150%)
		13C-3-MoCB		46.0	(15%-150%)
		13C-4-DiCB		55.0	(25%-150%)
		13C-15-DiCB		61.5	(25%-150%)
		13C-19-TrCB		63.5	(25%-150%)
		13C-37-TrCB		61.1	(25%-150%)
		13C-54-TeCB		52.7	(25%-150%)
		13C-77-TeCB		85.4	(25%-150%)
		13C-81-TeCB		86.7	(25%-150%)
		13C-104-PeCB		44.8	(25%-150%)
		13C-105-PeCB		69.1	(25%-150%)
		13C-114-PeCB		68.4	(25%-150%)
		13C-118-PeCB		67.0	(25%-150%)
		13C-123-PeCB		70.2	(25%-150%)
		13C-126-PeCB		78.2	(25%-150%)
		13C-155-HxCB		51.5	(25%-150%)
		13C-156-HxCB	C	56.6	(25%-150%)
		13C-157-HxCB	C156L		
		13C-167-HxCB		57.6	(25%-150%)
		13C-169-HxCB		62.8	(25%-150%)
		13C-188-HpCB		67.4	(25%-150%)
		13C-189-HpCB		63.6	(25%-150%)
		13C-202-OcCB		61.9	(25%-150%)
		13C-205-OcCB		72.4	(25%-150%)
		13C-206-NoCB		77.4	(25%-150%)
		13C-208-NoCB		65.5	(25%-150%)
		13C-209-DeCB		67.5	(25%-150%)
		13C-28-TrCB		74.4	(30%-135%)
		13C-111-PeCB		82.0	(30%-135%)
		13C-178-HpCB		86.5	(30%-135%)

* Recovery outside Acceptance Limits
# Column to be used to flag recovery values
D Sample Diluted

PCB Congeners
Quality Control Summary
Spike Recovery Report

SDG Number: 2109132
Sample Type: Laboratory Control Sample
Client ID: LCS for batch 47898
Matrix: WATER
Lab Sample ID: 12030239
Instrument: HRP875
Analysis Date: 09/22/2021 18:01
Dilution: 1
Analyst: MJC
Prep Batch ID: 47898
Batch ID: 47901

CAS No.		Parmname	Amount Added pg/L		Spike Conc. pg/L	Recovery %	Acceptance Limits
2051-60-7	LCS	1-MoCB	500		433	86.7	50-150
2051-62-9	LCS	3-MoCB	500		481	96.1	50-150
13029-08-8	LCS	4-DiCB	500		427	85.5	50-150
2050-68-2	LCS	15-DiCB	500		494	98.8	50-150
38444-73-4	LCS	19-TrCB	500		454	90.9	50-150
38444-90-5	LCS	37-TrCB	500		477	95.4	50-150
15968-05-5	LCS	54-TeCB	1000		1040	104	50-150
32598-13-3	LCS	77-TeCB	1000		928	92.8	50-150
70362-50-4	LCS	81-TeCB	1000		792	79.2	50-150
56558-16-8	LCS	104-PeCB	1000		1080	108	50-150
32598-14-4	LCS	105-PeCB	1000		887	88.7	50-150
74472-37-0	LCS	114-PeCB	1000		1080	108	50-150
31508-00-6	LCS	118-PeCB	1000		1050	105	50-150
65510-44-3	LCS	123-PeCB	1000		989	98.9	50-150
57465-28-8	LCS	126-PeCB	1000		967	96.7	50-150
33979-03-2	LCS	155-HxCB	1000		1040	104	50-150
38380-08-4	LCS	156-HxCB	2000	C	2160	108	50-150
69782-90-7	LCS	157-HxCB		C156			
52663-72-6	LCS	167-HxCB	1000		1020	102	50-150
32774-16-6	LCS	169-HxCB	1000		964	96.4	50-150
74487-85-7	LCS	188-HpCB	1000		954	95.4	50-150
39635-31-9	LCS	189-HpCB	1000		976	97.6	50-150
2136-99-4	LCS	202-OcCB	1500		1600	107	50-150
74472-53-0	LCS	205-OcCB	1500		1380	91.8	50-150
40186-72-9	LCS	206-NoCB	1500		1360	90.8	50-150
52663-77-1	LCS	208-NoCB	1500		1600	107	50-150
2051-24-3	LCS	209-DeCB	1500		1470	97.7	50-150

PCB Congeners
Quality Control Summary
Spike Recovery Report

SDG Number: 2109132
Client ID: LCSD for batch 47898
Lab Sample ID: 12030240
Instrument: HRP875
Analyst: MJC

Sample Type: Laboratory Control Sample Duplicate
Matrix: WATER
Analysis Date: 09/22/2021 19:11
Dilution: 1
Prep Batch ID: 47898
Batch ID: 47901

CAS No.		Parmname	Amount Added pg/L		Spike Conc. pg/L	Recovery %	Acceptance Limits	RPD %	Acceptance Limits
2051-60-7	LCSD	1-MoCB	500		447	89.4	50-150	3.06	0-20
2051-62-9	LCSD	3-MoCB	500		504	101	50-150	4.68	0-20
13029-08-8	LCSD	4-DiCB	500		434	86.9	50-150	1.62	0-20
2050-68-2	LCSD	15-DiCB	500		507	101	50-150	2.49	0-20
38444-73-4	LCSD	19-TrCB	500		478	95.7	50-150	5.12	0-20
38444-90-5	LCSD	37-TrCB	500		484	96.8	50-150	1.48	0-20
15968-05-5	LCSD	54-TeCB	1000		1040	104	50-150	0.148	0-20
32598-13-3	LCSD	77-TeCB	1000		937	93.7	50-150	0.912	0-20
70362-50-4	LCSD	81-TeCB	1000		808	80.8	50-150	2.01	0-20
56558-16-8	LCSD	104-PeCB	1000		1090	109	50-150	0.877	0-20
32598-14-4	LCSD	105-PeCB	1000		905	90.5	50-150	2.10	0-20
74472-37-0	LCSD	114-PeCB	1000		1110	111	50-150	2.80	0-20
31508-00-6	LCSD	118-PeCB	1000		1070	107	50-150	1.55	0-20
65510-44-3	LCSD	123-PeCB	1000		1000	100	50-150	1.49	0-20
57465-28-8	LCSD	126-PeCB	1000		1010	101	50-150	4.46	0-20
33979-03-2	LCSD	155-HxCB	1000		1050	105	50-150	1.34	0-20
38380-08-4	LCSD	156-HxCB	2000	C	2200	110	50-150	1.40	0-20
69782-90-7	LCSD	157-HxCB		C156					
52663-72-6	LCSD	167-HxCB	1000		1030	103	50-150	1.29	0-20
32774-16-6	LCSD	169-HxCB	1000		990	99	50-150	2.65	0-20
74487-85-7	LCSD	188-HpCB	1000		980	98	50-150	2.75	0-20
39635-31-9	LCSD	189-HpCB	1000		1000	100	50-150	2.82	0-20
2136-99-4	LCSD	202-OcCB	1500		1610	107	50-150	0.759	0-20
74472-53-0	LCSD	205-OcCB	1500		1390	92.8	50-150	1.12	0-20
40186-72-9	LCSD	206-NoCB	1500		1380	92.3	50-150	1.71	0-20
52663-77-1	LCSD	208-NoCB	1500		1610	107	50-150	0.721	0-20
2051-24-3	LCSD	209-DeCB	1500		1490	99.2	50-150	1.50	0-20

Method Blank Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Matrix:**	**WATER**
Client ID:	**MB for batch 47898**	**Instrument ID:**	**HRP875**	**Data File:**	**d22sep21a-5**
Lab Sample ID:	**12030238**	**Prep Date:**	**21-SEP-21**	**Analyzed:**	**09/22/21 20:21**
Column:					

This method blank applies to the following samples and quality control samples:

	Client Sample ID	Lab Sample ID	File ID	Date Analyzed	Time Analyzed
01	LCS for batch 47898	12030239	d22sep21a-3	09/22/21	1801
02	LCSD for batch 47898	12030240	d22sep21a-4	09/22/21	1911
03	2109132-001G RG North-20210901	18708001	d22sep21a_2-4	09/23/21	0811
04	2109132-003G RG South-20210902	18708002	d22sep21a_2-5	09/23/21	0921

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
2051-60-7	1-MoCB	U	ND	pg/L	1.48	100
2051-61-8	2-MoCB	U	ND	pg/L	2.02	100
2051-62-9	3-MoCB	U	ND	pg/L	1.86	100
13029-08-8	4-DiCB	U	ND	pg/L	12.2	100
16605-91-7	5-DiCB	U	ND	pg/L	9.28	100
25569-80-6	6-DiCB	U	ND	pg/L	8.66	100
33284-50-3	7-DiCB	U	ND	pg/L	7.94	100
34883-43-7	8-DiCB	U	ND	pg/L	7.82	100
34883-39-1	9-DiCB	U	ND	pg/L	10.3	100
33146-45-1	10-DiCB	U	ND	pg/L	8.30	100
2050-67-1	11-DiCB	U	ND	pg/L	52.4	100
2974-92-7	12-DiCB	CU	ND	pg/L	8.88	200
2974-90-5	13-DiCB	C12				
34883-41-5	14-DiCB	U	ND	pg/L	9.44	100
2050-68-2	15-DiCB	U	ND	pg/L	9.80	100
38444-78-9	16-TrCB	U	ND	pg/L	3.14	100
37680-66-3	17-TrCB	U	ND	pg/L	3.18	100
37680-65-2	18-TrCB	CU	ND	pg/L	2.62	200
38444-73-4	19-TrCB	U	ND	pg/L	3.28	100
38444-84-7	20-TrCB	CU	ND	pg/L	2.08	200
55702-46-0	21-TrCB	CU	ND	pg/L	2.20	200
38444-85-8	22-TrCB	U	ND	pg/L	2.08	100
55720-44-0	23-TrCB	U	ND	pg/L	2.10	100
55702-45-9	24-TrCB	U	ND	pg/L	2.14	100
55712-37-3	25-TrCB	U	ND	pg/L	1.94	100
38444-81-4	26-TrCB	CU	ND	pg/L	2.24	200
38444-76-7	27-TrCB	U	ND	pg/L	2.48	100
7012-37-5	28-TrCB	C20				
15862-07-4	29-TrCB	C26				
35693-92-6	30-TrCB	C18				
16606-02-3	31-TrCB	U	ND	pg/L	2.46	100
38444-77-8	32-TrCB	U	ND	pg/L	2.18	100

Comments:

C Congener has coeluters. When Cxxx, refer to congener number xxx for data

J Value is estimated

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
38444-86-9	33-TrCB	C21				
37680-68-5	34-TrCB	U	ND	pg/L	2.44	100
37680-69-6	35-TrCB	U	ND	pg/L	2.52	100
38444-87-0	36-TrCB	U	ND	pg/L	2.24	100
38444-90-5	37-TrCB	U	ND	pg/L	2.58	100
53555-66-1	38-TrCB	U	ND	pg/L	2.52	100
38444-88-1	39-TrCB	U	ND	pg/L	2.10	100
38444-93-8	40-TeCB	CU	ND	pg/L	2.56	200
52663-59-9	41-TeCB	U	ND	pg/L	3.92	100
36559-22-5	42-TeCB	U	ND	pg/L	3.08	100
70362-46-8	43-TeCB	U	ND	pg/L	4.04	100
41464-39-5	44-TeCB	CU	ND	pg/L	2.78	300
70362-45-7	45-TeCB	CU	ND	pg/L	2.38	200
41464-47-5	46-TeCB	U	ND	pg/L	2.46	100
2437-79-8	47-TeCB	C44				
70362-47-9	48-TeCB	U	ND	pg/L	2.72	100
41464-40-8	49-TeCB	CU	ND	pg/L	2.62	200
62796-65-0	50-TeCB	CU	ND	pg/L	2.24	200
68194-04-7	51-TeCB	C45				
35693-99-3	52-TeCB	U	ND	pg/L	3.36	200
41464-41-9	53-TeCB	C50				
15968-05-5	54-TeCB	U	ND	pg/L	1.80	100
74338-24-2	55-TeCB	U	ND	pg/L	2.46	100
41464-43-1	56-TeCB	U	ND	pg/L	2.64	100
70424-67-8	57-TeCB	U	ND	pg/L	2.60	100
41464-49-7	58-TeCB	U	ND	pg/L	2.30	100
74472-33-6	59-TeCB	CU	ND	pg/L	2.24	300
33025-41-1	60-TeCB	U	ND	pg/L	2.38	100
33284-53-6	61-TeCB	CJ	5.62	pg/L	2.46	400
54230-22-7	62-TeCB	C59				
74472-34-7	63-TeCB	U	ND	pg/L	2.56	100
52663-58-8	64-TeCB	U	ND	pg/L	2.10	100

Comments:
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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
33284-54-7	65-TeCB	C44				
32598-10-0	66-TeCB	U	ND	pg/L	2.52	100
73575-53-8	67-TeCB	U	ND	pg/L	2.28	100
73575-52-7	68-TeCB	U	ND	pg/L	2.14	100
60233-24-1	69-TeCB	C49				
32598-11-1	70-TeCB	C61				
41464-46-4	71-TeCB	C40				
41464-42-0	72-TeCB	U	ND	pg/L	2.56	100
74338-23-1	73-TeCB	U	ND	pg/L	2.12	100
32690-93-0	74-TeCB	C61				
32598-12-2	75-TeCB	C59				
70362-48-0	76-TeCB	C61				
32598-13-3	77-TeCB	U	ND	pg/L	2.68	100
70362-49-1	78-TeCB	U	ND	pg/L	3.02	100
41464-48-6	79-TeCB	U	ND	pg/L	2.48	100
33284-52-5	80-TeCB	U	ND	pg/L	2.20	100
70362-50-4	81-TeCB	U	ND	pg/L	2.60	100
52663-62-4	82-PeCB	U	ND	pg/L	4.58	100
60145-20-2	83-PeCB	U	ND	pg/L	4.64	100
52663-60-2	84-PeCB	U	ND	pg/L	3.82	100
65510-45-4	85-PeCB	CU	ND	pg/L	2.96	300
55312-69-1	86-PeCB	CU	ND	pg/L	3.08	600
38380-02-8	87-PeCB	C86				
55215-17-3	88-PeCB	CU	ND	pg/L	3.66	200
73575-57-2	89-PeCB	U	ND	pg/L	4.48	100
68194-07-0	90-PeCB	CU	ND	pg/L	3.18	300
68194-05-8	91-PeCB	C88				
52663-61-3	92-PeCB	U	ND	pg/L	4.24	100
73575-56-1	93-PeCB	CU	ND	pg/L	3.26	200
73575-55-0	94-PeCB	U	ND	pg/L	3.44	100
38379-99-6	95-PeCB	U	ND	pg/L	4.20	100
73575-54-9	96-PeCB	U	ND	pg/L	2.36	100

Comments:

C Congener has coeluters. When Cxxx, refer to congener number xxx for data

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
41464-51-1	97-PeCB	C86				
60233-25-2	98-PeCB	CU	ND	pg/L	3.60	200
38380-01-7	99-PeCB	U	ND	pg/L	2.80	100
39485-83-1	100-PeCB	C93				
37680-73-2	101-PeCB	C90				
68194-06-9	102-PeCB	C98				
60145-21-3	103-PeCB	U	ND	pg/L	3.76	100
56558-16-8	104-PeCB	U	ND	pg/L	2.20	100
32598-14-4	105-PeCB	U	ND	pg/L	3.74	100
70424-69-0	106-PeCB	U	ND	pg/L	4.36	100
70424-68-9	107-PeCB	U	ND	pg/L	2.90	100
70362-41-3	108-PeCB	CU	ND	pg/L	3.48	200
74472-35-8	109-PeCB	C86				
38380-03-9	110-PeCB	CU	ND	pg/L	2.86	200
39635-32-0	111-PeCB	U	ND	pg/L	2.50	100
74472-36-9	112-PeCB	U	ND	pg/L	2.90	100
68194-10-5	113-PeCB	C90				
74472-37-0	114-PeCB	U	ND	pg/L	3.52	100
74472-38-1	115-PeCB	C110				
18259-05-7	116-PeCB	C85				
68194-11-6	117-PeCB	C85				
31508-00-6	118-PeCB	U	ND	pg/L	3.44	100
56558-17-9	119-PeCB	C86				
68194-12-7	120-PeCB	U	ND	pg/L	2.98	100
56558-18-0	121-PeCB	U	ND	pg/L	2.44	100
76842-07-4	122-PeCB	U	ND	pg/L	4.80	100
65510-44-3	123-PeCB	U	ND	pg/L	3.42	100
70424-70-3	124-PeCB	C108				
74472-39-2	125-PeCB	C86				
57465-28-8	126-PeCB	U	ND	pg/L	4.22	100
39635-33-1	127-PeCB	U	ND	pg/L	4.00	100
38380-07-3	128-HxCB	CU	ND	pg/L	3.58	200

Comments:

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
55215-18-4	129-HxCB	CU	ND	pg/L	6.84	300
52663-66-8	130-HxCB	U	ND	pg/L	3.76	100
61798-70-7	131-HxCB	U	ND	pg/L	3.56	100
38380-05-1	132-HxCB	U	ND	pg/L	3.22	100
35694-04-3	133-HxCB	U	ND	pg/L	3.74	100
52704-70-8	134-HxCB	U	ND	pg/L	3.94	100
52744-13-5	135-HxCB	CU	ND	pg/L	1.86	200
38411-22-2	136-HxCB	U	ND	pg/L	1.50	100
35694-06-5	137-HxCB	U	ND	pg/L	2.82	100
35065-28-2	138-HxCB	C129				
56030-56-9	139-HxCB	CU	ND	pg/L	2.90	200
59291-64-4	140-HxCB	C139				
52712-04-6	141-HxCB	U	ND	pg/L	3.50	100
41411-61-4	142-HxCB	U	ND	pg/L	4.04	100
68194-15-0	143-HxCB	U	ND	pg/L	4.34	100
68194-14-9	144-HxCB	U	ND	pg/L	2.00	100
74472-40-5	145-HxCB	U	ND	pg/L	1.30	100
51908-16-8	146-HxCB	U	ND	pg/L	2.78	100
68194-13-8	147-HxCB	CU	ND	pg/L	3.40	200
74472-41-6	148-HxCB	U	ND	pg/L	1.92	100
38380-04-0	149-HxCB	C147				
68194-08-1	150-HxCB	U	ND	pg/L	1.28	100
52663-63-5	151-HxCB	C135				
68194-09-2	152-HxCB	U	ND	pg/L	1.50	100
35065-27-1	153-HxCB	CJ	2.90	pg/L	2.46	200
60145-22-4	154-HxCB	U	ND	pg/L	1.56	100
33979-03-2	155-HxCB	U	ND	pg/L	1.28	100
38380-08-4	156-HxCB	CJ	5.02	pg/L	2.68	200
69782-90-7	157-HxCB	C156				
74472-42-7	158-HxCB	U	ND	pg/L	2.32	100
39635-35-3	159-HxCB	U	ND	pg/L	2.06	100
41411-62-5	160-HxCB	U	ND	pg/L	2.64	100

Comments:

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
74472-43-8	161-HxCB	U	ND	pg/L	2.74	100
39635-34-2	162-HxCB	U	ND	pg/L	1.84	100
74472-44-9	163-HxCB	C129				
74472-45-0	164-HxCB	U	ND	pg/L	2.68	100
74472-46-1	165-HxCB	U	ND	pg/L	2.44	100
41411-63-6	166-HxCB	C128				
52663-72-6	167-HxCB	U	ND	pg/L	2.46	100
59291-65-5	168-HxCB	C153				
32774-16-6	169-HxCB	U	ND	pg/L	2.32	100
35065-30-6	170-HpCB	U	ND	pg/L	2.82	100
52663-71-5	171-HpCB	CU	ND	pg/L	2.84	200
52663-74-8	172-HpCB	U	ND	pg/L	2.88	100
68194-16-1	173-HpCB	C171				
38411-25-5	174-HpCB	U	ND	pg/L	2.66	100
40186-70-7	175-HpCB	U	ND	pg/L	2.04	100
52663-65-7	176-HpCB	U	ND	pg/L	1.58	100
52663-70-4	177-HpCB	U	ND	pg/L	2.78	100
52663-67-9	178-HpCB	U	ND	pg/L	2.20	100
52663-64-6	179-HpCB	U	ND	pg/L	1.56	100
35065-29-3	180-HpCB	CU	ND	pg/L	2.22	200
74472-47-2	181-HpCB	U	ND	pg/L	2.32	100
60145-23-5	182-HpCB	U	ND	pg/L	1.98	100
52663-69-1	183-HpCB	CU	ND	pg/L	2.42	200
74472-48-3	184-HpCB	U	ND	pg/L	1.34	100
52712-05-7	185-HpCB	C183				
74472-49-4	186-HpCB	U	ND	pg/L	1.46	100
52663-68-0	187-HpCB	U	ND	pg/L	1.74	100
74487-85-7	188-HpCB	U	ND	pg/L	1.50	100
39635-31-9	189-HpCB	U	ND	pg/L	2.32	100
41411-64-7	190-HpCB	U	ND	pg/L	2.16	100
74472-50-7	191-HpCB	U	ND	pg/L	2.10	100
74472-51-8	192-HpCB	U	ND	pg/L	2.08	100

Comments:
C **Congener has coeluters. When Cxxx, refer to congener number xxx for data**
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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
69782-91-8	193-HpCB	C180				
35694-08-7	194-OcCB	J	3.38	pg/L	2.26	100
52663-78-2	195-OcCB	U	ND	pg/L	2.38	100
42740-50-1	196-OcCB	U	ND	pg/L	1.98	100
33091-17-7	197-OcCB	CU	ND	pg/L	1.42	200
68194-17-2	198-OcCB	CU	ND	pg/L	1.98	200
52663-75-9	199-OcCB	C198				
52663-73-7	200-OcCB	C197				
40186-71-8	201-OcCB	U	ND	pg/L	1.42	100
2136-99-4	202-OcCB	U	ND	pg/L	1.56	100
52663-76-0	203-OcCB	J	1.88	pg/L	1.74	100
74472-52-9	204-OcCB	U	ND	pg/L	1.44	100
74472-53-0	205-OcCB	U	ND	pg/L	1.78	100
40186-72-9	206-NoCB	U	ND	pg/L	3.08	100
52663-79-3	207-NoCB	U	ND	pg/L	2.30	100
52663-77-1	208-NoCB	U	ND	pg/L	2.30	100
2051-24-3	209-DeCB	U	ND	pg/L	1.94	100
1336-36-3	Total PCB Congeners	J	18.8	pg/L		100

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-1-MoCB		732	2000	pg/L	36.6	(15%-150%)
13C-3-MoCB		798	2000	pg/L	39.9	(15%-150%)
13C-4-DiCB		959	2000	pg/L	47.9	(25%-150%)
13C-15-DiCB		1200	2000	pg/L	60.2	(25%-150%)
13C-19-TrCB		1200	2000	pg/L	59.9	(25%-150%)
13C-37-TrCB		1050	2000	pg/L	52.5	(25%-150%)
13C-54-TeCB		941	2000	pg/L	47.0	(25%-150%)
13C-77-TeCB		1370	2000	pg/L	68.3	(25%-150%)
13C-81-TeCB		1370	2000	pg/L	68.5	(25%-150%)
13C-104-PeCB		880	2000	pg/L	44.0	(25%-150%)
13C-105-PeCB		1160	2000	pg/L	57.8	(25%-150%)
13C-114-PeCB		1150	2000	pg/L	57.7	(25%-150%)
13C-118-PeCB		1120	2000	pg/L	56.2	(25%-150%)
13C-123-PeCB		1180	2000	pg/L	59.2	(25%-150%)
13C-126-PeCB		1220	2000	pg/L	60.9	(25%-150%)
13C-155-HxCB		1000	2000	pg/L	50.0	(25%-150%)
13C-156-HxCB	C	1970	4000	pg/L	49.2	(25%-150%)
13C-157-HxCB	C156L					
13C-167-HxCB		1000	2000	pg/L	50.2	(25%-150%)
13C-169-HxCB		1030	2000	pg/L	51.5	(25%-150%)
13C-188-HpCB		1340	2000	pg/L	67.2	(25%-150%)
13C-189-HpCB		1120	2000	pg/L	55.8	(25%-150%)

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030238**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**MB for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 20:21**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-5**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-202-OcCB		1190	2000	pg/L	59.6	(25%-150%)
13C-205-OcCB		1310	2000	pg/L	65.5	(25%-150%)
13C-206-NoCB		1390	2000	pg/L	69.3	(25%-150%)
13C-208-NoCB		1220	2000	pg/L	61.0	(25%-150%)
13C-209-DeCB		1240	2000	pg/L	62.0	(25%-150%)
13C-28-TrCB		1200	2000	pg/L	60.1	(30%-135%)
13C-111-PeCB		1380	2000	pg/L	69.1	(30%-135%)
13C-178-HpCB		1470	2000	pg/L	73.3	(30%-135%)

Comments:

C **Congener has coeluters. When Cxxx, refer to congener number xxx for data**

J **Value is estimated**

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PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030239**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**LCS for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 18:01**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-3**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
2051-60-7	1-MoCB		433	pg/L	2.16	100
2051-62-9	3-MoCB		481	pg/L	2.58	100
13029-08-8	4-DiCB		427	pg/L	13.1	100
2050-68-2	15-DiCB		494	pg/L	9.78	100
38444-73-4	19-TrCB		454	pg/L	3.84	100
38444-90-5	37-TrCB		477	pg/L	7.66	100
15968-05-5	54-TeCB		1040	pg/L	1.68	100
32598-13-3	77-TeCB		928	pg/L	8.20	100
70362-50-4	81-TeCB		792	pg/L	7.64	100
56558-16-8	104-PeCB		1080	pg/L	2.12	100
32598-14-4	105-PeCB		887	pg/L	9.04	100
74472-37-0	114-PeCB		1080	pg/L	8.26	100
31508-00-6	118-PeCB		1050	pg/L	8.16	100
65510-44-3	123-PeCB		989	pg/L	7.86	100
57465-28-8	126-PeCB		967	pg/L	9.82	100
33979-03-2	155-HxCB		1040	pg/L	1.56	100
38380-08-4	156-HxCB	C	2160	pg/L	8.28	200
69782-90-7	157-HxCB	C156				
52663-72-6	167-HxCB		1020	pg/L	6.02	100
32774-16-6	169-HxCB		964	pg/L	7.04	100
74487-85-7	188-HpCB		954	pg/L	2.02	100
39635-31-9	189-HpCB		976	pg/L	3.06	100
2136-99-4	202-OcCB		1600	pg/L	1.94	100
74472-53-0	205-OcCB		1380	pg/L	2.78	100
40186-72-9	206-NoCB		1360	pg/L	3.44	100
52663-77-1	208-NoCB		1600	pg/L	2.68	100
2051-24-3	209-DeCB		1470	pg/L	1.78	100

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-1-MoCB		1060	2000	pg/L	53.1	(15%-140%)
13C-3-MoCB		1170	2000	pg/L	58.3	(15%-140%)
13C-4-DiCB		1340	2000	pg/L	67.2	(30%-140%)
13C-15-DiCB		1620	2000	pg/L	80.8	(30%-140%)
13C-19-TrCB		1710	2000	pg/L	85.3	(30%-140%)
13C-37-TrCB		1280	2000	pg/L	64.0	(30%-140%)
13C-54-TeCB		1140	2000	pg/L	57.2	(30%-140%)
13C-77-TeCB		1690	2000	pg/L	84.3	(30%-140%)
13C-81-TeCB		1710	2000	pg/L	85.6	(30%-140%)
13C-104-PeCB		1120	2000	pg/L	55.9	(30%-140%)
13C-105-PeCB		1390	2000	pg/L	69.7	(30%-140%)
13C-114-PeCB		1410	2000	pg/L	70.5	(30%-140%)
13C-118-PeCB		1380	2000	pg/L	68.8	(30%-140%)

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030239**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**LCS for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 18:01**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-3**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-123-PeCB		1460	2000	pg/L	73.0	(30%-140%)
13C-126-PeCB		1510	2000	pg/L	75.6	(30%-140%)
13C-155-HxCB		1320	2000	pg/L	65.9	(30%-140%)
13C-156-HxCB	C	2610	4000	pg/L	65.4	(30%-140%)
13C-157-HxCB	C156L					
13C-167-HxCB		1340	2000	pg/L	66.8	(30%-140%)
13C-169-HxCB		1350	2000	pg/L	67.6	(30%-140%)
13C-188-HpCB		1670	2000	pg/L	83.6	(30%-140%)
13C-189-HpCB		1430	2000	pg/L	71.4	(30%-140%)
13C-202-OcCB		1560	2000	pg/L	77.8	(30%-140%)
13C-205-OcCB		1700	2000	pg/L	84.9	(30%-140%)
13C-206-NoCB		1800	2000	pg/L	90.1	(30%-140%)
13C-208-NoCB		1540	2000	pg/L	77.1	(30%-140%)
13C-209-DeCB		1640	2000	pg/L	82.2	(30%-140%)
13C-28-TrCB		1540	2000	pg/L	77.2	(40%-125%)
13C-111-PeCB		1740	2000	pg/L	87.1	(40%-125%)
13C-178-HpCB		1970	2000	pg/L	98.3	(40%-125%)

Comments:

C **Congener has coeluters. When Cxxx, refer to congener number xxx for data**

U **Analyte was analyzed for, but not detected above the specified detection limit.**

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030240**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**LCSD for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 19:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL
2051-60-7	1-MoCB		447	pg/L	2.22	100
2051-62-9	3-MoCB		504	pg/L	2.60	100
13029-08-8	4-DiCB		434	pg/L	8.98	100
2050-68-2	15-DiCB		507	pg/L	7.66	100
38444-73-4	19-TrCB		478	pg/L	3.56	100
38444-90-5	37-TrCB		484	pg/L	2.84	100
15968-05-5	54-TeCB		1040	pg/L	1.44	100
32598-13-3	77-TeCB		937	pg/L	6.96	100
70362-50-4	81-TeCB		808	pg/L	6.58	100
56558-16-8	104-PeCB		1090	pg/L	1.70	100
32598-14-4	105-PeCB		905	pg/L	7.98	100
74472-37-0	114-PeCB		1110	pg/L	7.72	100
31508-00-6	118-PeCB		1070	pg/L	7.52	100
65510-44-3	123-PeCB		1000	pg/L	7.36	100
57465-28-8	126-PeCB		1010	pg/L	9.14	100
33979-03-2	155-HxCB		1050	pg/L	9.20	100
38380-08-4	156-HxCB	C	2200	pg/L	7.88	200
69782-90-7	157-HxCB	C156				
52663-72-6	167-HxCB		1030	pg/L	5.84	100
32774-16-6	169-HxCB		990	pg/L	6.86	100
74487-85-7	188-HpCB		980	pg/L	1.50	100
39635-31-9	189-HpCB		1000	pg/L	4.86	100
2136-99-4	202-OcCB		1610	pg/L	1.56	100
74472-53-0	205-OcCB		1390	pg/L	4.38	100
40186-72-9	206-NoCB		1380	pg/L	2.54	100
52663-77-1	208-NoCB		1610	pg/L	1.86	100
2051-24-3	209-DeCB		1490	pg/L	1.50	100

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-1-MoCB		1020	2000	pg/L	51.1	(15%-140%)
13C-3-MoCB		1160	2000	pg/L	58.1	(15%-140%)
13C-4-DiCB		1360	2000	pg/L	67.8	(30%-140%)
13C-15-DiCB		1670	2000	pg/L	83.4	(30%-140%)
13C-19-TrCB		1690	2000	pg/L	84.3	(30%-140%)
13C-37-TrCB		1320	2000	pg/L	66.1	(30%-140%)
13C-54-TeCB		1170	2000	pg/L	58.5	(30%-140%)
13C-77-TeCB		1710	2000	pg/L	85.7	(30%-140%)
13C-81-TeCB		1740	2000	pg/L	87.1	(30%-140%)
13C-104-PeCB		1100	2000	pg/L	54.9	(30%-140%)
13C-105-PeCB		1400	2000	pg/L	70.2	(30%-140%)
13C-114-PeCB		1400	2000	pg/L	70.1	(30%-140%)
13C-118-PeCB		1370	2000	pg/L	68.4	(30%-140%)

PCB Congeners
Certificate of Analysis
Sample Summary

SDG Number:	**2109132**	**Client:**	**HALL001**	**Project:**	**HALL00113**
Lab Sample ID:	**12030240**			**Matrix:**	**WATER**
Client Sample:	**QC for batch 47898**				
Client ID:	**LCSD for batch 47898**			**Prep Basis:**	**As Received**
Batch ID:	**47901**	**Method:**	**EPA Method 1668A**		
Run Date:	**09/22/2021 19:11**	**Analyst:**	**MJC**	**Instrument:**	**HRP875**
Data File:	**d22sep21a-4**			**Dilution:**	**1**
Prep Batch:	**47898**	**Prep Method:**	**SW846 3520C**	**Prep SOP Ref:**	**CF-OA-E-001**
Prep Date:	**21-SEP-21**	**Prep Aliquot:**	**1000 mL**		

CAS No.	Parmname	Qual	Result	Units	EDL	PQL

Surrogate/Tracer recovery	Qual	Result	Nominal	Units	Recovery%	Acceptable Limits
13C-123-PeCB		1450	2000	pg/L	72.6	(30%-140%)
13C-126-PeCB		1500	2000	pg/L	74.8	(30%-140%)
13C-155-HxCB		1270	2000	pg/L	63.3	(30%-140%)
13C-156-HxCB	C	2540	4000	pg/L	63.6	(30%-140%)
13C-157-HxCB	C156L					
13C-167-HxCB		1290	2000	pg/L	64.4	(30%-140%)
13C-169-HxCB		1320	2000	pg/L	66.2	(30%-140%)
13C-188-HpCB		1630	2000	pg/L	81.7	(30%-140%)
13C-189-HpCB		1390	2000	pg/L	69.5	(30%-140%)
13C-202-OcCB		1530	2000	pg/L	76.3	(30%-140%)
13C-205-OcCB		1620	2000	pg/L	81.2	(30%-140%)
13C-206-NoCB		1690	2000	pg/L	84.7	(30%-140%)
13C-208-NoCB		1510	2000	pg/L	75.5	(30%-140%)
13C-209-DeCB		1540	2000	pg/L	77.0	(30%-140%)
13C-28-TrCB		1430	2000	pg/L	71.3	(40%-125%)
13C-111-PeCB		1620	2000	pg/L	80.9	(40%-125%)
13C-178-HpCB		1730	2000	pg/L	86.5	(40%-125%)

Comments:

C **Congener has coeluters. When Cxxx, refer to congener number xxx for data**

U **Analyte was analyzed for, but not detected above the specified detection limit.**

ANALYTICAL REPORT

September 17, 2021

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Hall Environmental Analysis Laboratory

Sample Delivery Group:	L1400265
Samples Received:	09/08/2021
Project Number:	
Description:	
Report To:	Andy Freeman

Entire Report Reviewed By:

John Hawkins
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.

Pace Analytical National

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

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	Collected by	Collected date/time	Received date/time
2109132-001I RG NORTH-20210901 L1400265-01 Non-Potable Water		09/01/21 10:05	09/08/21 09:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 900	WG1737547	1	09/13/21 14:07	09/14/21 22:57	JMR	Mt. Juliet, TN
Radiochemistry by Method D5174	WG1739188	1	09/15/21 10:53	09/16/21 12:31	KK	Mt. Juliet, TN

	Collected by	Collected date/time	Received date/time
2109132-003I RG SOUTH-20210901 L1400265-02 Non-Potable Water		09/01/21 10:05	09/08/21 09:15

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 900	WG1737547	1	09/13/21 14:07	09/14/21 22:57	JMR	Mt. Juliet, TN
Radiochemistry by Method D5174	WG1739188	1	09/15/21 10:53	09/16/21 12:33	KK	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

John V Hawkins

John Hawkins
Project Manager

Radiochemistry by Method 900

Analyte	Result pCi/l	Qualifier	Uncertainty +/-	MDA pCi/l	Analysis Date date / time	Batch
GROSS ALPHA	7.03		1.76	1.25	09/14/2021 22:57	WG1737547

Radiochemistry by Method D5174

Analyte	Result mg/l	Qualifier	Uncertainty +/-	RDL mg/l	Analysis Date date / time	Batch
Uranium	0.00312			0.00100	09/16/2021 12:31	WG1739188

Uranium = 0.00312 mg/l = 2.09 pCi/L
milligrams per liter (mg/L) can be converted to pCi/L by multiplying the U (mg/L) by 670

Adjusted Gross Alpha = Gross Alpha minus Uranium.
Adjusted Gross Alpha =7.03 pCi/L - 2.09 = 4.94 pCi/L
* Compliance gross alpha equals the concentration of analytical gross alpha minus the concentration of Uranium
Reference: http://www.eai-labs.com/assets/docs/radioactive_in_water.pdf

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

SAMPLE RESULTS - 02

L1400265

Radiochemistry by Method 900

	Result	Qualifier	Uncertainty	MDA	Analysis Date	Batch
Analyte	pCi/l		+ / -	pCi/l	date / time	
GROSS ALPHA	34.4		7.82	5.87	09/14/2021 22:57	WG1737547

Radiochemistry by Method D5174

	Result	Qualifier	Uncertainty	RDL	Analysis Date	Batch
Analyte	mg/l		+ / -	mg/l	date / time	
Uranium	0.00424			0.00100	09/16/2021 12:33	WG1739188

Uranium = 0.00424 mg/l = 2.84 pCi/L
milligrams per liter (mg/L) can be converted to pCi/L by multiplying the U (mg/L) by 670

Adjusted Gross Alpha = Gross Alpha minus Uranium.
Adjusted Gross Alpha =34.4 pCi/L - 2.84 = 31.56 pCi/L
* Compliance gross alpha equals the concentration of analytical gross alpha minus the concentration of Uranium
Reference: http://www.eai-labs.com/assets/docs/radioactive_in_water.pdf

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3704721-1 09/14/21 22:57

Analyte	MB Result pCi/l	MB Qualifier	MB MDA pCi/l
GROSS ALPHA	0.0501	U	0.704

Original Sample (OS) • Duplicate (DUP)

(OS) • (DUP) R3704721-5 09/14/21 22:57

Analyte	Original Result	DUP Result pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
GROSS ALPHA		3.03	1	64.8	0.900		20	3

Laboratory Control Sample (LCS)

(LCS) R3704721-2 09/14/21 22:57

Analyte	Spike Amount pCi/l	LCS Result pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
GROSS ALPHA	15.0	14.3	95.4	80.0-120	

1 Cp
2 Tc
3 Ss
4 Cn
5 Sr
6 Qc
7 Gl
8 Al
9 Sc

Method Blank (MB)

(MB) R3705183-1 09/16/21 11:45

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Uranium	U		0.00100	0.00100

L1397565-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1397565-03 09/16/21 12:02 • (DUP) R3705183-5 09/16/21 11:57

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Uranium	0.00556	0.00559	1	0.427		20

Laboratory Control Sample (LCS)

(LCS) R3705183-2 09/16/21 11:48

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Uranium	0.0300	0.0287	95.7	80.0-120	

L1397565-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1397565-01 09/16/21 11:59 • (MS) R3705183-3 09/16/21 11:52 • (MSD) R3705183-4 09/16/21 11:54

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Uranium	0.0200	0.0915	0.109	0.110	88.8	93.4	1	75.0-125			0.840	20

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
MDL	Method Detection Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
U	Not detected at the Reporting Limit (or MDL where applicable).
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
U	Below Detectable Limits: Indicates that the analyte was not detected.

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

CHAIN OF CUSTODY RECORD

PAGE: 1 OF: 1

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975
FAX: 505-345-4107
Website: clients.hallenvironmental.com

COPY

SUB CONTRATOR: Pace TN	COMPANY: PACE TN	PHONE: (800) 767-5859	FAX: (615) 758-5859
ADDRESS: 12065 Lebanon Rd		ACCOUNT #:	EMAIL:
CITY, STATE, ZIP: Mt. Juliet, TN 37122			

L1400265

ITEM	SAMPLE	CLIENT SAMPLE ID	BOTTLE TYPE	MATRIX	COLLECTION DATE	# CONTAINERS	ANALYTICAL COMMENTS
1	2109132-001H	RG North-20210901	500HDPEH2SO4	Aqueous	9/1/2021 10:05:00 AM	1	COD
2	2109132-001I	RG North-20210901	1LHDPEHNO3	Aqueous	9/1/2021 10:05:00 AM	1	Adjusted Gross Alpha L2 -01
3	2109132-001J	RG North-20210901	120mL	Aqueous	9/1/2021 10:05:00 AM	1	Cr 6
4	2109132-003H	RG South-20210902	500HDPEH2SO4	Aqueous	9/2/2021 9:20:00 AM	1	COD
5	2109132-003I	RG South-20210902	1LHDPEHNO3	Aqueous	9/2/2021 9:20:00 AM	1	Adjusted Gross Alpha L2 -02
6	2109132-003J	RG South-20210902	120mL	Aqueous	9/2/2021 9:20:00 AM	1	Cr 6

Sample Receipt Checklist

COC Seal Present/Intact: Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
RAD Screen <0.5 mR/hr: Y N

If Applicable
VOA Zero Headspace: Y N
Pres.Correct/Check: Y N

B185

SPECIAL INSTRUCTIONS / COMMENTS:

Please include the LAB ID and the CLIENT SAMPLE ID on all final reports. Please e-mail results to lab@hallenvironmental.com. Please return all coolers and blue ice. Thank you.

Samples 001I, 003I in this cooler

Relinquished By: SC	Date: 9/2/2021	Time: 2:48 PM	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Relinquished By:	Date:	Time:	Received By: [signature]	9/4/21	9:15

TAT: Standard ☑ RUSH Next BD ☐ 2nd BD ☐ 3rd BD ☐

REPORT TRANSMITTAL DESIRED: ☐ HARDCOPY (extra cost) ☐ FAX ☐ EMAIL ☐ ONLINE

FOR LAB USE ONLY

Temp of samples: 1.9+.1=2.0 A2ST Attempt to Cool?

Comments:

2834 1886 3777

QC SUMMARY REPORT

WO#: **2109132**

Hall Environmental Analysis Laboratory, Inc.

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB-62408** SampType: **MBLK** TestCode: **EPA Method 1664B**
Client ID: **PBW** Batch ID: **62408** RunNo: **81111**
Prep Date: **9/7/2021** Analysis Date: **9/8/2021** SeqNo: **2863208** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
N-Hexane Extractable Material	ND	10.0								

Sample ID: **LCS-62408** SampType: **LCS** TestCode: **EPA Method 1664B**
Client ID: **LCSW** Batch ID: **62408** RunNo: **81111**
Prep Date: **9/7/2021** Analysis Date: **9/8/2021** SeqNo: **2863209** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
N-Hexane Extractable Material	32.2	10.0	40.00	0	80.5	78	114			

Sample ID: **LCSD-62408** SampType: **LCSD** TestCode: **EPA Method 1664B**
Client ID: **LCSS02** Batch ID: **62408** RunNo: **81111**
Prep Date: **9/7/2021** Analysis Date: **9/8/2021** SeqNo: **2863210** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
N-Hexane Extractable Material	32.8	10.0	40.00	0	82.0	78	114	1.85	20	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA

Project: CMC

Sample ID: **LCS-62544** SampType: **LCS** TestCode: **EPA Method 200.7: Metals**

Client ID: **LCSW** Batch ID: **62544** RunNo: **81263**

Prep Date: **9/13/2021** Analysis Date: **9/14/2021** SeqNo: **2869383** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	49	1.0	50.00	0	97.9	85	115			
Magnesium	49	1.0	50.00	0	98.0	85	115			

Sample ID: **MB-62544** SampType: **MBLK** TestCode: **EPA Method 200.7: Metals**

Client ID: **PBW** Batch ID: **62544** RunNo: **81263**

Prep Date: **9/13/2021** Analysis Date: **9/14/2021** SeqNo: **2869399** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	ND	1.0								
Magnesium	ND	1.0								

Sample ID: **LLLCS-62544** SampType: **LCSLL** TestCode: **EPA Method 200.7: Metals**

Client ID: **BatchQC** Batch ID: **62544** RunNo: **81263**

Prep Date: **9/13/2021** Analysis Date: **9/14/2021** SeqNo: **2869401** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Calcium	0.48	1.0	0.5000	0	95.7	50	150			J
Magnesium	0.49	1.0	0.5000	0	97.5	50	150			J

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB** SampType: **MBLK** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **PBW** Batch ID: **A81374** RunNo: **81374**
Prep Date: Analysis Date: **9/18/2021** SeqNo: **2873894** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Copper	ND	0.0010								
Lead	ND	0.00050								

Sample ID: **LCSLL** SampType: **LCSLL** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **BatchQC** Batch ID: **A81374** RunNo: **81374**
Prep Date: Analysis Date: **9/18/2021** SeqNo: **2873895** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Copper	0.0010	0.0010	0.001000	0	101	50	150			
Lead	0.00051	0.00050	0.0005001	0	101	50	150			

Sample ID: **LCS** SampType: **LCS** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **LCSW** Batch ID: **A81374** RunNo: **81374**
Prep Date: Analysis Date: **9/18/2021** SeqNo: **2873896** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Copper	0.024	0.0010	0.02500	0	94.7	85	115			
Lead	0.012	0.00050	0.01250	0	97.7	85	115			

Sample ID: **2109132-003FMSLL** SampType: **MS** TestCode: **EPA 200.8: Dissolved Metals**
Client ID: **RG South-20210902** Batch ID: **A81374** RunNo: **81374**
Prep Date: Analysis Date: **9/18/2021** SeqNo: **2873927** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Copper	0.026	0.0010	0.02500	0.001481	96.1	70	130			
Lead	0.013	0.00050	0.01250	0.0003243	98.2	70	130			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB** SampType: **mblk** TestCode: **EPA Method 300.0: Anions**
Client ID: **PBW** Batch ID: **R81067** RunNo: **81067**
Prep Date: Analysis Date: **9/3/2021** SeqNo: **2861406** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	ND	0.10								
Nitrogen, Nitrate (As N)	ND	0.10								
Nitrate+Nitrite as N	ND	0.20								

Sample ID: **LCS** SampType: **lcs** TestCode: **EPA Method 300.0: Anions**
Client ID: **LCSW** Batch ID: **R81067** RunNo: **81067**
Prep Date: Analysis Date: **9/3/2021** SeqNo: **2861407** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Nitrite (As N)	0.97	0.10	1.000	0	96.6	90	110			
Nitrogen, Nitrate (As N)	2.5	0.10	2.500	0	102	90	110			
Nitrate+Nitrite as N	3.5	0.20	3.500	0	100	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

WO#: **2109132**

Hall Environmental Analysis Laboratory, Inc.

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB-62459** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBW** Batch ID: **62459** RunNo: **81383**
Prep Date: **9/8/2021** Analysis Date: **9/17/2021** SeqNo: **2896453** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dieldrin	ND	0.10								
Surr: Decachlorobiphenyl	0		2.500		0	41.7	129			S
Surr: Tetrachloro-m-xylene	0		2.500		0	31.8	88.5			S

Sample ID: **MB-62459** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBW** Batch ID: **62459** RunNo: **81383**
Prep Date: **9/8/2021** Analysis Date: **9/17/2021** SeqNo: **2896456** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dieldrin	ND	0.10								
Surr: Decachlorobiphenyl	0		2.500		0	41.7	129			S
Surr: Tetrachloro-m-xylene	0		2.500		0	31.8	88.5			S

Sample ID: **LCS-62459** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSW** Batch ID: **62459** RunNo: **81383**
Prep Date: **9/8/2021** Analysis Date: **9/17/2021** SeqNo: **2896457** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dieldrin	0.38	0.10	0.5000	0	76.2	17.4	145			
Surr: Decachlorobiphenyl	2.8		2.500		112	41.7	129			
Surr: Tetrachloro-m-xylene	1.5		2.500		61.1	31.8	88.5			

Sample ID: **LCSD-62459** SampType: **LCSD** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSS02** Batch ID: **62459** RunNo: **81383**
Prep Date: **9/8/2021** Analysis Date: **9/17/2021** SeqNo: **2896458** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dieldrin	0.42	0.10	0.5000	0	84.4	17.4	145	10.2	20	
Surr: Decachlorobiphenyl	2.9		2.500		116	41.7	129	0	20	
Surr: Tetrachloro-m-xylene	1.6		2.500		63.4	31.8	88.5	0	20	

Sample ID: **LCS-62459** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSW** Batch ID: **62459** RunNo: **81383**
Prep Date: **9/8/2021** Analysis Date: **9/17/2021** SeqNo: **2896467** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dieldrin	0.36	0.10	0.5000	0	72.7	17.4	145			
Surr: Decachlorobiphenyl	2.7		2.500		108	41.7	129			
Surr: Tetrachloro-m-xylene	1.4		2.500		55.5	31.8	88.5			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **LCSD-62459** SampType: **LCSD** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSS02** Batch ID: **62459** RunNo: **81383**
Prep Date: **9/8/2021** Analysis Date: **9/17/2021** SeqNo: **2896468** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Dieldrin	0.40	0.10	0.5000	0	80.5	17.4	145	10.2	20	
Surr: Decachlorobiphenyl	2.8		2.500		112	41.7	129	0	20	
Surr: Tetrachloro-m-xylene	1.7		2.500		69.2	31.8	88.5	0	20	

Sample ID: **MB-62710** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBW** Batch ID: **62710** RunNo: **81863**
Prep Date: **9/21/2021** Analysis Date: **9/23/2021** SeqNo: **2896469** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.5		2.500		100	41.7	129			
Surr: Tetrachloro-m-xylene	1.6		2.500		64.6	31.8	88.5			

Sample ID: **MB-62710** SampType: **MBLK** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **PBW** Batch ID: **62710** RunNo: **81863**
Prep Date: **9/21/2021** Analysis Date: **9/23/2021** SeqNo: **2896470** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.5		2.500		98.3	41.7	129			
Surr: Tetrachloro-m-xylene	1.5		2.500		60.0	31.8	88.5			

Sample ID: **LCS-62710** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSW** Batch ID: **62710** RunNo: **81863**
Prep Date: **9/21/2021** Analysis Date: **9/23/2021** SeqNo: **2896471** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.5		2.500		102	41.7	129			
Surr: Tetrachloro-m-xylene	1.4		2.500		56.4	31.8	88.5			

Sample ID: **LCS-62710** SampType: **LCS** TestCode: **EPA Method 8081: PESTICIDES**
Client ID: **LCSW** Batch ID: **62710** RunNo: **81863**
Prep Date: **9/21/2021** Analysis Date: **9/23/2021** SeqNo: **2896472** Units: **%Rec**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: Decachlorobiphenyl	2.5		2.500		99.5	41.7	129			
Surr: Tetrachloro-m-xylene	1.3		2.500		52.5	31.8	88.5			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA

Project: CMC

Sample ID: **MB-62380**	SampType: **MBLK**	TestCode: **SM5210B: BOD**								
Client ID: **PBW**	Batch ID: **62380**	RunNo: **81139**								
Prep Date: **9/3/2021**	Analysis Date: **9/8/2021**	SeqNo: **2864260**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Biochemical Oxygen Demand	ND	2.0								

Sample ID: **LCS-62380**	SampType: **LCS**	TestCode: **SM5210B: BOD**								
Client ID: **LCSW**	Batch ID: **62380**	RunNo: **81139**								
Prep Date: **9/3/2021**	Analysis Date: **9/8/2021**	SeqNo: **2864261**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Biochemical Oxygen Demand	188	2.0	198.0	0	94.9	84.6	115.4			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**
13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB-62378** SampType: **MBLK** TestCode: **SM 9223B Fecal Indicator: E. coli MPN**
Client ID: **PBW** Batch ID: **62378** RunNo: **81068**
Prep Date: **9/2/2021** Analysis Date: **9/3/2021** SeqNo: **2861458** Units: **MPN/100mL**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
E. Coli	<1	1.000								

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

WO#: **2109132**

Hall Environmental Analysis Laboratory, Inc.

13-Oct-21

Client: AMAFCA

Project: CMC

Sample ID: **MB**	SampType: **MBLK**	TestCode: **SM 4500 NH3: Ammonia**		
Client ID: **PBW**	Batch ID: **R81339**	RunNo: **81339**		
Prep Date:	Analysis Date: **9/16/2021**	SeqNo: **2872464**	Units: **mg/L**	

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	ND	1.0								

Sample ID: **LCS**	SampType: **LCS**	TestCode: **SM 4500 NH3: Ammonia**		
Client ID: **LCSW**	Batch ID: **R81339**	RunNo: **81339**		
Prep Date:	Analysis Date: **9/16/2021**	SeqNo: **2872465**	Units: **mg/L**	

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Ammonia	10	1.0	10.00	0	102	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB-62548** SampType: **MBLK** TestCode: **EPA Method 365.1: Total Phosphorous**
Client ID: **PBW** Batch ID: **62548** RunNo: **81302**
Prep Date: **9/13/2021** Analysis Date: **9/15/2021** SeqNo: **2871378** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Phosphorus, Total (As P)	ND	0.010								

Sample ID: **LCS-62548** SampType: **LCS** TestCode: **EPA Method 365.1: Total Phosphorous**
Client ID: **LCSW** Batch ID: **62548** RunNo: **81302**
Prep Date: **9/13/2021** Analysis Date: **9/15/2021** SeqNo: **2871379** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Phosphorus, Total (As P)	0.24	0.010	0.2500	0	97.4	90	110			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**

13-Oct-21

Client: AMAFCA

Project: CMC

Sample ID: **MB-62453** SampType: **MBLK** TestCode: **SM2540C MOD: Total Dissolved Solids**

Client ID: **PBW** Batch ID: **62453** RunNo: **81180**

Prep Date: **9/8/2021** Analysis Date: **9/10/2021** SeqNo: **2865947** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	ND	20.0								

Sample ID: **LCS-62453** SampType: **LCS** TestCode: **SM2540C MOD: Total Dissolved Solids**

Client ID: **LCSW** Batch ID: **62453** RunNo: **81180**

Prep Date: **9/8/2021** Analysis Date: **9/10/2021** SeqNo: **2865948** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Total Dissolved Solids	1010	20.0	1000	0	101	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT

WO#: **2109132**

Hall Environmental Analysis Laboratory, Inc.

13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB-62630** SampType: **MBLK** TestCode: **SM 4500 Norg C: TKN**
Client ID: **PBW** Batch ID: **62630** RunNo: **81365**
Prep Date: **9/16/2021** Analysis Date: **9/17/2021** SeqNo: **2873549** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Kjeldahl, Total	ND	1.0								

Sample ID: **LCS-62630** SampType: **LCS** TestCode: **SM 4500 Norg C: TKN**
Client ID: **LCSW** Batch ID: **62630** RunNo: **81365**
Prep Date: **9/16/2021** Analysis Date: **9/17/2021** SeqNo: **2873550** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Nitrogen, Kjeldahl, Total	9.9	1.0	10.00	0	99.4	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

QC SUMMARY REPORT
Hall Environmental Analysis Laboratory, Inc.

WO#: **2109132**
13-Oct-21

Client: AMAFCA
Project: CMC

Sample ID: **MB-62455**	SampType: **MBLK**	TestCode: **SM 2540D: TSS**								
Client ID: **PBW**	Batch ID: **62455**	RunNo: **81152**								
Prep Date: **9/8/2021**	Analysis Date: **9/9/2021**	SeqNo: **2864535**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	ND	4.0								

Sample ID: **LCS-62455**	SampType: **LCS**	TestCode: **SM 2540D: TSS**								
Client ID: **LCSW**	Batch ID: **62455**	RunNo: **81152**								
Prep Date: **9/8/2021**	Analysis Date: **9/9/2021**	SeqNo: **2864536**	Units: **mg/L**							
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Suspended Solids	97	4.0	92.10	0	105	83.71	119.44			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
D	Sample Diluted Due to Matrix	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	J	Analyte detected below quantitation limits
ND	Not Detected at the Reporting Limit	P	Sample pH Not In Range
PQL	Practical Quanitative Limit	RL	Reporting Limit
S	% Recovery outside of range due to dilution or matrix		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: clients.hallenvironmental.com

Sample Log-In Check List

Client Name: AMAFCA   Work Order Number: 2109132   RcptNo: 1

Received By: Cheyenne Cason   9/2/2021 12:17:00 PM   Chul

Completed By: Sean Livingston   9/2/2021 2:19:27 PM   Sean Livingston

Reviewed By: IO 9.3.21 @

UNPRES: SPA 9.2.21 17:01

Chain of Custody

1. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
2. How was the sample delivered? Client

Log In

3. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
4. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
5. Sample(s) in proper container(s)? Yes ☑ No ☐
6. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
7. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
8. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
9. Received at least 1 vial with headspace <1/4" for AQ VOA? Yes ☑ No ☐ NA ☐
10. Were any sample containers received broken? Yes ☐ No ☑
11. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
12. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
13. Is it clear what analyses were requested? Yes ☑ No ☐
14. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

# of preserved bottles checked for pH: 1 2
(<2 or >12 unless noted)
Adjusted? NO
Checked by: JR 9/3/21
Bod & coliform: JR 9/2/21

Special Handling (if applicable)

15. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: Date:
By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:
Client Instructions:

16. Additional remarks:

17. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.9	Good				
2	4.9	Good				

Chain-of-Custody Record

Client: AMAFCA

Mailing Address:

Phone #:

email or Fax#: pchavez@amafca.org

QA/QC Package:
☑ Standard ☐ Level 4 (Full Validation)

Accreditation: ☐ Az Compliance
☐ NELAC ☐ Other
☐ EDD (Type)

Turn-Around Time:
☑ Standard ☐ **Rush**

Project Name: CMC

Project #:

Project Manager: Patrick Chavez

Sampler: A. Ewing, DBS+A
On Ice: ☑ Yes ☐ No
# of Coolers: 2 2.1-0.2=1.9
Cooler Temp(including CF): 5.1-0.2=4.9 (°C)

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Name	Container Type and #	Preservative Type	HEAL No. 2109132	BTEX / MTBE / TMB's (8021)	TPH:8015D(GRO / DRO / MRO)	8081 Pesticides/8082 PCB's	EDB (Method 504.1)	PAHs by 8310 or 8270SIMS	RCRA 8 Metals	Cl, F, Br, NO_3, NO_2, PO_4, SO_4	8260 (VOA)	8270 (Semi-VOA)	Total Coliform (Present/Absent)	See attached	CMC list	E·coli enumeration
9/1/21	1005	AQ	RGNorth-20210901			001/002											X		
			Trip blank			006								X					
9/2/21	0920	AQ	RGSouth-20210902			003/004 ~~002~~	see 9/2/21										X		X
9/2/21	1030	AQ	RGAlameda-20210902			005 ~~003~~													X

Amy Ewing 9/2/21

Date:	Time:	Relinquished by:	Received by:	Via:	Date	Time
9/2/21	1125	Amy Ewing	[signature]	Hand off	9/2/21	1127
9/2/21	1137	[signature]	CMC	CDO	9/2/21	1217

Remarks: RGNorth-20210901 E.coli sample was dropped off yesterday.

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Collaborative Monitoring Cooperative - Analyses List
Attach to Chain of Custody

Please refer to attached NPDES Permit No. NMR04A00 Appendix F. Methods and minimum quantification levels (MQL's) will be those approved under 40 CFR 136 and specified in the attached permit

Analyte (Bold Indicates WQS)	CAS #	Fraction	Method #	MDL (μg/L)
Hardness (Ca + Mg)	NA	Total	200.7	2.4
Lead	7439-92-1	Dissolved	200.8	0.09
Copper	7440-50-8	Dissolved	200.8	1.06
Ammonia + organic nitrogen	7664-41-7	Total	350.1	31.32
Total Kjehldal Nitrogen	17778-88-0	Total	351.2	58.78
Nitrate + Nitrite	14797-55-8	Total	353.2	10.17
Polychlorinated biphenyls (PCBs)	1336-36-3	Total	1668	0.014
Tetrahydrofuran (THF)	109-99-9	Total	8260C	7.9
bis(2-Ethylhexyl)phthalate	117-81-7	Total	8270D	0.2
Dibenzofuran	132-64-9	Total	8270D	0.2
Indeno(1,2,3-cd)pyrene	193-39-5	Total	8270D	0.2
Benzo(b)fluoranthene	205-99-2	Total	8270D	0.1
Benzo(k)fluoranthene	207-08-9	Total	8270D	0.1
Chrysene	218-01-9	Total	8270D	0.2
Benzo(a)pyrene	50-32-8	Total	8270D	0.3
Dibenzo(a,h)anthracene	53-70-3	Total	8270D	0.3
Benzo(a)anthracene	56-55-3	Total	8270D	0.2
Dieldrin	60-57-1	Total	8081	0.1
Pentachlorophenol	87-86-5	Total	8270D	0.2
Benzidine	92-87-5	Total	8270D	0.1
Chemical Oxygen Demand	E1641638[2]	Total	HACH	5100
Gross alpha (adjusted)	NA	Total	Method 900	0.1 pCi/L
Total Dissolved Solids	E1642222[2]	Total	SM 2540C	60.4
Total Suspended Solids	NA	Total	SM 2540D	3450
Biological Oxygen Demand	N/A	Total	Standard Methods	930
Oil and Grease		Total	1664A	5000
Ecoli-enumeration			SM 9223B	
pH			SM 4500	
Phosphorus		Dissolved	365.1	100
Phosphorus		Total	365.1	100
Chromium IV		Total	3500Cr C-2011	100

ATTACHMENT 2

FY 2022 WET SEASON COMPLETED DATA VERIFICATION AND VALIDATION (V&V) FORMS

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (August 2021 – Wet Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Rio Grande North – 08/16/21 – E. coli Only Sample – Was Not Qualifying Storm Event
Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
_____	_____
_____	_____

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	________
_____	_____	________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
_____	_____	_____	________
_____	_____	_____	________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?
☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: **0**

☒ **Step 1 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

Step 2: Verify Data Deliverables

A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: **0**

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?
______	______	______	______	______

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 3: Verify Flow Data
*Note – Not Applicable – no flow data provided with CMC sample collection
A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	__________
______	______	__________	__________

Total number of occurrences: 0

Not Applicable
☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☐ Yes ☒ No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken

Total number of occurrences: 0

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results
Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database? *
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: 0

☒ **Step 5 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 6: Validate Holding Times Violations
Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 6 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?

☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 7 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

****

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

Sarah Gurney 8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes. The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (September 2021 – Wet Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Rio Grande North – 9/1/21
Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
______	______
______	______

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_________
_____	_____	_________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?
☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: **<u>0</u>**

☒ **Step 1 Completed** ***Initials:*** <u>SJG</u> ***Date:*** <u>8/9/22</u>

- -

<u>Step 2: Verify Data Deliverables</u>
A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: **<u>0</u>**

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.
*Note – Lab report identifies "Dissolved Phosphorous" as "Total Phosphorous" on a filtered sample. Also, reports gross alpha and uranium and not adjusted gross alpha. See Section 4.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?

*Note – HEAL Lab report order number 2109132.

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 3: Verify Flow Data

*Note – Not Applicable – no flow data provided with CMC sample collection

A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	__________
______	______	__________	__________

Total number of occurrences: 0

Not Applicable

☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☒ Yes ☐ No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken
Rio Grande North	9/1/2021	Lab report lists Dissolved Phosphorous results as “Total Phosphorous” for “filtered sample”.	BHI added note to the lab report.
Rio Grande North	9/1/2021	Lab report did not report Adjusted gross alpha. Reported gross alpha and uranium values.	AMAFCA and HEAL were informed of this. BHI Added notes to the lab report & calculated adjusted gross alpha (gross alpha minus uranium).

*Note – HEAL Lab report order number 2109132.

Total number of occurrences: 2

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results

Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database?*
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: 0

☒ **Step 5 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 6: Validate Holding Times Violations

Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged.
*Note – Lab reports lists pH with hold time flag. Database uses field data reported pH, so this is hold time is not applicable.
Total number of occurrences: 0

☒ **Step 6 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?
☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 7 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

****

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

Sarah Corney 8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes. The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (September 2021 – Wet Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Alameda – 9/1/21 – E. coli Only Sample
Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
______	______
______	______

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_________
_____	_____	_________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?

☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

☒ **Step 1 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

Step 2: Verify Data Deliverables

A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: 0

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?
______	______	______	______	______

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

Step 3: Verify Flow Data
*Note – Not Applicable – no flow data provided with CMC sample collection
A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	_________
______	______	__________	_________

Total number of occurrences: 0

Not Applicable
☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☐ Yes ☒No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken

Total number of occurrences: 0

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results
Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database? *
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: **<u>0</u>**

☒ **Step 5 Completed** ***Initials:*** <u>SJG</u> ***Date:*** <u>8/9/22</u>

- -

Step 6: Validate Holding Times Violations
Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged.
Total number of occurrences: **<u>0</u>**

☒ **Step 6 Completed** ***Initials:*** <u>SJG</u> ***Date:*** <u>8/9/22</u>

- -

Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?
☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: <u>**0**</u>

☒ **Step 7 Completed** ***Initials:*** <u>SJG</u> ***Date:*** <u>8/9/22</u>

****

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the <u>entire study</u> (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide <u>copies</u> of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain <u>originals</u> in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes. The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (September 2021 – Wet Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Alameda – 9/2/21 – E. coli Only Sample
Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
______	______
______	______

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_________
_____	_____	_________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?
☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

☒ **Step 1 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 2: Verify Data Deliverables
A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: 0

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?
______	______	______	______	______

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 3: Verify Flow Data
*Note – Not Applicable – no flow data provided with CMC sample collection
A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	_________
______	______	__________	_________

Total number of occurrences: 0

Not Applicable
☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☐ Yes ☒ No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken

Total number of occurrences: 0

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results
Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database?*
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: 0

☒ **Step 5 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 6: Validate Holding Times Violations
Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged.
Total number of occurrences: 0

☒ **Step 6 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?
☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 7 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

****

After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

Sarah Gomez 8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes. The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	

Attachment 1.1 Water Quality Sample Data Verification and Validation Worksheet

Study Name: Compliance Monitoring Cooperative (CMC)
Year: FY 2022 (September 2021 – Wet Season Sample)
Project Coordinator: For Data Review and Reporting – SJG, BHI
V&V Reviewer: SJG
Data covered by this worksheet: Rio Grande South – 9/2/21
Version of Verification/Validation Procedures: QAPP –AMAFCA SOP #5 (7/2022)

Step 1: Verify Field Data

A. Are all Field Data forms present and complete? ☒ Yes ☐ No

If yes, proceed; if no, attempt to locate missing forms, then indicate any remaining missing forms and action taken.

Missing Field Data Forms	Action Taken
_____	_____
_____	_____

Total number of occurrences: 0

B. Are station name and ID, and sampling date and time on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station and Parameter	Action Taken	Re-verified?
_____	_____	_________
_____	_____	_________

Total number of occurrences: 0

C. Are field data on forms consistent with database? ☒ Yes ☐ No
If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify.

Station	Sampling Date	Parameter(s) Corrected	Re-verified?
_____	_____	_____	_________
_____	_____	_____	_________

Total number of occurrences: 0

D. Are RIDs correct and associated with the correct analytical suite, media subdivision (e.g. surface water, municipal waste, etc.) and activity type (e.g. Field observation, Routine sample, QA sample etc.)?
☒ Yes ☐ No

If yes, proceed; if no, indicate errors identified, correct errors in database and re-verify

Station/RID	Sampling Date	RID Corrected	Re-verified?
______	______	______	_________
______	______	______	_________

Total number of occurrences: 0

☒ **Step 1 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 2: Verify Data Deliverables
A. Have all data in question been delivered? ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing data (samples or blanks) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken. Complete this step upon receipt of all missing data.

RID	Submittal Date	Missing Data/Parameters	Date of Initial Verification	Date Missing Data Were Received
______	______	______	______	______

Total number of occurrences: 0

B. Do all of the analytical suites have the correct number and type of analytes. ☒ Yes ☐ No

If yes, proceed; if no, indicate RIDs with missing or incorrect analyte(s) or attach report with applicable RIDs highlighted. Contact data source and indicate action taken.
*Note – Lab report identifies “Dissolved Phosphorous” as “Total Phosphorous” on a filtered sample. Also, reports gross alpha and uranium and not adjusted gross alpha. See Section 4.

RID	Submittal Date	Missing or Incorrect Parameters	Action Taken	Re-verified?

*Note – HEAL Lab report order number 2109132.

☒ **Step 2 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 3: Verify Flow Data

*Note – Not Applicable – no flow data provided with CMC sample collection
A. Identify incorrect or missing data on the flow calculation spreadsheet and correct errors.

Station	Sampling Date	Flow data missing or incorrect?
______	______	__________
______	______	__________

Total number of occurrences: 0

B. Identify incorrect or missing discharge measurements, correct errors in database and re-verify.

Station	Sampling Date	Flow data missing or incorrect?	Re-verified?
______	______	__________	_________
______	______	__________	_________

Total number of occurrences: 0

Not Applicable
☐ **Step 3 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 4: Verify Analytical Results for Missing Information or Questionable Results

Were any results with missing/questionable information identified? ☒ Yes ☐ No

If no, proceed; if yes, indicate results with missing information or questionable results or attach report. Contact data source and indicate action taken. Complete this step upon receipt of missing information or clarification of questionable results (clarify questionable results only, DO NOT change results without written approval (from lab or QA officer) and associated documentation).

RID	Sample Date	Missing or Questionable Information/Results	Action Taken
Rio Grande South	9/2/2021	Lab report lists Dissolved Phosphorous results as "Total Phosphorous" for "filtered sample".	BHI added note to the lab report.
Rio Grande South	9/2/2021	Lab report did not report Adjusted gross alpha. Reported gross alpha and uranium values.	AMAFCA and HEAL were informed of this. BHI Added notes to the lab report & calculated adjusted gross alpha (gross alpha minus uranium).

*Note – HEAL Lab report order number 2109132.

Total number of occurrences: 2

☒ **Step 4 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

- -

Step 5: Validate Blanks Results
Were any analytes of concern detected in blank samples? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager, with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes have been added to database correctly.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database?*
_____	______	______	______	______		_________
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged and include on *Validation Codes Form*.

Total number of occurrences: 0

☒ **Step 5 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

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Step 6: Validate Holding Times Violations

Were any samples submitted that did not meet specified holding times? ☐ Yes ☒ No

If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID	Sample Date	Parameter	[Blank]	[Sample]	Validation Code/Flag Applied	Code/Flag verified in database to ALL associated data?*
______	______	______	______	______		_________

*See validation procedures to determine which associated data need to be flagged.
*Note – Lab reports lists pH with hold time flag. Database uses field data reported pH, so this is hold time is not applicable.
Total number of occurrences: 0

☒ **Step 6 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

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Step 7: Validate Replicate/Duplicate Results (if applicable)
Were any replicate/duplicate pairs submitted outside of the established control limit of 20%?
☐ Yes ☒ No
If no, proceed; if yes, list results that need to have validation codes applied in the database save these results as an excel file and forward to QA officer or Program Manager with a request to add appropriate validation codes to database. Complete this step after verifying that validation codes/flags have been added to database.

RID Pairs		Replicate or Duplicate?	Sample Date	Parameter	RPD	Validation Code/Flag Applied	Code/Flag verified in database applied?*
______	______	______	______	______	______		_________
______	______	______	______	______	______		_________

Total number of occurrences: 0

☒ **Step 7 Completed** ***Initials:*** SJG ***Date:*** 8/9/22

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After all of the above steps have been completed, save and print the worksheet, attach all applicable supplemental information and sign below.

I acknowledge that the data verification and validation process has been completed for the data identified above in accordance with the procedures described in the CMC QAPP, SOP #2

8/9/22

Data Verifier/Validator Signature Date

COMPLETION OF DATA VERIFICATION AND VALIDATION PROCESS

Once the data verification and validation process has been completed for the entire study (note: if the worksheet is for a subset of the data from a study, be sure ALL the data for the entire study is included before final completion of the data verification and validation process), notify the NMSQUID administrator that the process is complete and request that "V V in STORET" be added to the project title.

Once all data have been verified and validated for a study provide copies of ALL *Data Verification and Validation Worksheets* and attachments associated with the study to the Quality Assurance Officer and retain originals in the project binder.

Attachment 1.2 SWQB Validation Codes

When deficiencies are identified through the data verification and validation process, AMAFCA documents or “flags” the deficiencies by assigning validation codes. All data collected from the last compliant QC sample and up to the next compliant QC sample are assigned validation codes.
The validation code alerts the data user that the results are outside QA control limits and may require re-sampling or a separate, qualitative analysis based on professional judgment.

Validation Code	Definition	WQX Equivalent
A1	Sample not collected according to SOP	
B1	Chemical was detected in the field blank at a concentration less than 5% of the sample concentration.	
BN	Blanks NOT collected during sampling run	
BU	Detection in blank. Analyte was not detected in this sample above the method's sample detection limit.	BU
RB1	Chemical was detected in the field blank at a concentration greater than or equal to 5% of the sample concentration. Results for this sample are rejected because they may be the result of contamination; the results may not be reported or used for regulatory compliance purposes.	B
R1	Rejected due to incorrect sample preservation	R
R2	Rejected due to equipment failure in the field	R
R3	Rejected based on best professional judgment	R
D1	Spike recovery not within method acceptance limits	
F1	Sample filter time exceeded	
J1	Estimated: the analyte was positively identified and the associated value is an approximate concentration of the analyte in the sample	J
K1	Holding time violation	H
Ea	Estimated-Incubation temperature between 35.5 and 38.0° Celsius	
Er	Rejected-Incubation temperature < 34.5 or >38.0° Celsius	
PD1	Percent difference between duplicate samples excessive	
S1	Per SLD, uncertainties (sigmas) are expressed as one standard deviation, i.e. one standard error. Small negative or positive values that are less than two standard deviations should be interpreted as “less than the detection limit.”	
S2	Data are suspect but deemed usable based on best professional judgment; documentation of justification is required and should be included in the Data Verification and Validation Packet and reported with results	
Z1	Macroinvertebrate data did not meet QC criteria specified in Section 2.5 of QAPP	
H1	Habitat data did not meet QC criteria specified in Section 2.5 of QAPP	