


**Arizona Water Protection Fund
Application Cover Page
FY 2022**

Title of Project: Ravenna & Pampas Grass Control Along the Colorado River from Glen Canyon Dam to Diamond Creek											
Type of Project: <input checked="" type="checkbox"/> Capital or Other <input type="checkbox"/> Water Conservation <input type="checkbox"/> Research	Stream Type: <input checked="" type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Ephemeral										
Your level of commitment to maintenance of project benefits and capital improvements: <input type="checkbox"/> < 5 years <input type="checkbox"/> 5-10 years <input type="checkbox"/> 11-15 years <input checked="" type="checkbox"/> 16-20 years											
Applicant Information: Name/Organization: RiversEdge West Address 1: PO Box 1907 Address 2: City: Grand Junction State: Colorado ZIP Code: 81502 Phone: 970-256-7400 Fax: Tax ID No.: XXXXXXXXXX	Inside an AMA: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, which AMA: <input type="checkbox"/> Phoenix <input type="checkbox"/> Tucson <input type="checkbox"/> Prescott <input type="checkbox"/> Pinal <input type="checkbox"/> Santa Cruz										
Contact Person: Name: Rusty Lloyd Title: Executive Director Phone: 970-256-7400 Fax: e-mail: rlloyd@riversedgewest.org	Type of Application: <input checked="" type="checkbox"/> New <input type="checkbox"/> Continuation Any Previous AWPf Grants: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If yes, please provide Grant #(s):										
Arizona Water Protection Fund Grant Amount Requested: \$43,178 If the application is funded, will the Grantee intend to request an advance: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Matching Funds Obtained and Secured: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Applicant/Agency/Organization:</u></th> <th style="text-align: right;"><u>Amount (\$):</u></th> </tr> </thead> <tbody> <tr> <td>1. Applicant</td> <td style="text-align: right;">\$11,720</td> </tr> <tr> <td>2. Grand Canyon Nation Park</td> <td style="text-align: right;">\$8,101</td> </tr> <tr> <td>3. Glen Canyon National Recreation Area</td> <td style="text-align: right;">\$960</td> </tr> <tr> <td style="text-align: right;">Total:</td> <td style="text-align: right;">20,781</td> </tr> </tbody> </table>	<u>Applicant/Agency/Organization:</u>	<u>Amount (\$):</u>	1. Applicant	\$11,720	2. Grand Canyon Nation Park	\$8,101	3. Glen Canyon National Recreation Area	\$960	Total:	20,781
<u>Applicant/Agency/Organization:</u>	<u>Amount (\$):</u>										
1. Applicant	\$11,720										
2. Grand Canyon Nation Park	\$8,101										
3. Glen Canyon National Recreation Area	\$960										
Total:	20,781										
Has your legal counsel or contracting authority reviewed and accepted the Grant Award Contract General Provisions? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A											
Signature of the undersigned certifies understanding and compliance with all terms, conditions and specifications in the attached application. Additionally, signature certifies that all information provided by the applicant is true and accurate. The undersigned acknowledges that intentional presentation of any false or fraudulent information, or knowingly concealing a material fact regarding this application is subject to criminal penalties as provided in A.R.S. Title 13. The Arizona Water Protection Fund Commission may approve Grant Awards with modifications to scope items, methodology, schedule, final products and/or budget.											
Rusty Lloyd	Executive Director – (970) 256-7400										
Typed Name of Applicant or Applicant's Authorized Representative	Title and Telephone Number										
	8/31/2021										
Signature	Date Signed										

Ravenna & Pampas Grass Control Along the Colorado River from Glen Canyon Dam to Diamond Creek

Executive Summary

This project will take place along the Colorado River within Grand Canyon National Park (GRCA) and Glen Canyon National Recreation Area (GLCA) and is a collaborative effort between the National Park Service (NPS), RiversEdge West (501(c)3 nonprofit organization), and Mariposa Ecological and Botanical Consulting. This project will involve the mapping and removal of Ravenna grass (*Saccharum ravennae*) and pampas grass (*Cortaderia selloana*) throughout the entire river corridor from Glen Canyon Dam River Mile -15 to Diamond Creek River Mile 225.0 (240 total river miles) and will continue to build on 28 years of control.

Ravenna grass is an invasive, non-native species that was planted as an ornamental grass within Glen Canyon National Recreation Area (e.g., Lees Ferry, Wahweap Marina) in the 1970's. Ravenna is a large, fast growing grass that quickly creates monocultures and outcompetes native grasses and forbs in riparian areas. It was first documented in the Grand Canyon in 1981 and spread rampantly from 1987 to 1992. Ravenna grass has proven to be invasive in the fragile riparian environment of the river corridor in GRCA and GLCA and the biggest concern is that it could spread into side canyons and impact sensitive habitats such as springs, seeps, and hanging gardens. GRCA's Vegetation Program instigated a removal program in 1993 in attempt control the spread and diminish the existing populations. The GRCA Vegetation Program continued to actively control Ravenna grass until 2014 and immense progress had been made during those years through the removal of more than 25,000 plants. There was a gap in a concerted effort to control Ravenna grass within GRCA from the summer of 2014 until the fall of 2020 due to a lack of staff and funding and we intend to fill that gap and move towards total eradication in the next few years with only an occasional river trip to monitor after three more years of treatment.

This project will involve two river trips; a 4 day up-river trip from Lees Ferry to Glen Canyon Dam and the a 15-day oar-powered river trip from Lees Ferry to Diamond Creek. On both trips, crews will map, monitor, and remove all Ravenna grass and pampas grass along the river. The timing for this project is critical as the Ravenna and pampas grass populations are currently well mapped and small and complete eradication is feasible within the next few years. The populations of Ravenna and pampas are spread throughout the entire length of the canyon from Glen Canyon Dam to Diamond Creek. GRCA has a database with all known mapped and treated populations from 1993-2020.

This project is a collaborative effort and is a unique collaboration as all of the partners have worked together in the past on various projects, but this will be the first endeavor as a team to combat Ravenna and pampas grass. This type of collaboration is essential to be able to implement this project to continue to help protect our national treasures.

Applications: Ravenna & Pampas Grass Control along the Colorado River from Glen Canyon Dam to Diamond Creek

Profile

rlloyd@riversedgewest.org

Project Title

Ravenna & Pampas Grass Control along the Colorado River from Glen Canyon Dam to Diamond Creek

Application Cover Page

REW_Ravenna_ApplicationCoverPageForm_AWPF_FY2022_signed.doc

Executive Summary

REW_Ravenna_ExecutiveSummary_AWPF_FY2022.doc

Project Overview

REW_Ravenna_AWPF_ProjectOverviewTemplate_AWPF_FY2022.doc

Project Location and Environmental Contaminant Information

REW_RAvenna_ProjectLocation_EnvironmentalContaminantInformationForm_AWPF_FY2022.doc

Scope of Work

REW_Ravenna_AWPF_ScopeOfWorkTemplate_AWPF_FY2022.doc

AWPF Detailed Budget

REW_Ravenna_AWPF_ApplicationDetailedBudgetTemplate.xlsx

Matching / Cost Share Budget

REW_Ravenna_AWPF_MatchingFunds_CostShare_ApplicationDetailedBudgetTemplate.xlsx

Arizona Watershed Map

REW_Ravenna_ArizonaWatershedMapForm_AWPF_FY2022.doc

Project Location: Schematic Maps

RavennaGrassRemovalV2Map.pdf

Project Location: Schematic Maps (cont.)

Project Location: Ownership Maps

RavennaGrassRemovalV2Map.pdf

Project Location: Ownership Maps (cont.)

REW_RAvenna_StateHistoricPreservationOfficeForms_AWPF_FY2022.doc

State Historic Preservation Office (SHPO) Review Forms

RavennaGrassRemovalV2Map.pdf

State Historic Preservation Office (SHPO) Review Forms (cont.)

State Historic Preservation Office (SHPO) Review Forms (cont.)

State Historic Preservation Office (SHPO) Review Forms (cont.)

State Historic Preservation Office (SHPO) Review Forms (cont.)

Key Personnel

Project Administrator- Rusty Lloyd, RiversEdge West

Project Coordinator- Melissa McMaster, Mariposa Ecological and Botanical Consulting

Trip Leader- Dan Hall, Mariposa Ecological and Botanical Consulting

Project Permits and Data Management- Lonnie Pilkington, Grand Canyon National Park

Key Personnel (cont.)

MelissaMcMaster_CV_Hualapai.docx

Project Site Photographs

REW_Ravenna_Photos.docx

Project Implementation Plans

We propose to map and treat all ravenna and pampas grass plants that we find along the river from Glen Canyon Dam to Diamond Creek Road. We will scan the shore while moving down river for new populations and will stop at known sites from previous years. We will fill out a Glen Canyon National Recreation Area and Grand Canyon Exotic Plant Management field datasheet for each mapped and/or treated population. Data collections will include species name, location name, GPS coordinates, number of plants mapped and/or treated, and native species growing adjacent to treated area/s. After all field work is completed, a final report will be completed which will include the following sections: abstract, introduction, methods, results, discussion, maps, and photos.

Existing Plans / Reports / Information

FY2020_GRCA LTEMP ExperimentalVegetationTreatmentAnnualReport_20210203.docx

Existing Plans / Reports / Information (cont.)

GRCA LTEMP VegetationTripReportToBOR_20201004_20201016.docx

Existing Plans / Reports / Information (cont.)

Letters of Community Support

RavennaProposal_RecLet_MScott.docx

Letters from Entities Pledging Matching Funds

Promise of funds.docx

Evidence of Control and Tenure of Land

Evidence of control and tenure of land.docx

Evidence of Control and Tenure of Land (cont.)

Project Site Access / Permission to Conduct Work

This is a collaborative effort between RiversEdge West, Grand Canyon National Park and Glen Canyon National Recreation Area. Because of the nature of this collaboration, the grant applicant will have permission for work and access. All permits will be secured through the National Park or National Recreation Area

Evidence of Physical and Legal Availability of Water

Evidence of physical and legal availability of water.docx

Evidence of Physical and Legal Availability of Water (cont.)

OPTIONAL: Additional Project Information

OPTIONAL: Additional Project Information

OPTIONAL: Additional Project Information

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OPTIONAL: Additional Project Information

Applications: File Attachments

Application Cover Page

REW R venni ApplicationCoverPageForm AWPFFY2022 Signed.doc

Executive Summary

REW R venni ExecutiveSummary AWPFFY2022.doc

Project Overview

REW R venni AWPFF ProjectOverviewTemplate AWPFFY2022.doc

Project Location and Environmental Contaminant Information

REW R venni ProjectLocationEnvironmentContaminantInformationForm AWPFFY2022.doc

Scope of Work

REW R venni AWPFF ScopeOfWorkTemplate AWPFFY2022.doc

AWPF Detailed Budget

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Matching / Cost Share Budget

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Arizona Watershed Map

REW R venni ArizonaWatershedMapForm AWPFFY2022.doc

Project Location: Schematic Maps

R venni GravelRemoval2M.pdf

Project Location: Ownership Maps

R venni GravelRemoval2M.pdf

Project Location: Ownership Maps (cont.)

REW R venni TitleHistoricalPreervationOfficialForm AWPFFY2022.doc

State Historic Preservation Office (SHPO) Review Forms

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Key Personnel (cont.)

MelissaMatterCVUpload.docx

Project Site Photographs

REW R venni Photo.docx

Existing Plans / Reports / Information

FY2020 GRCA LTEMP Experiment VegetationTreatmentAnnualReport 2021020.docx

Existing Plans / Reports / Information (cont.)

GRCA LTEMP VegetationTripReportToBOR_20201004_20201016.docx

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Evidence of Control and Tenure of Land

Evidence of control and tenure of land.docx

Evidence of Physical and Legal Availability of Water

Evidence of physical and legal availability of water.docx

Project Overview

Ravenna & Pampas Grass Control along the Colorado River from Glen Canyon Dam to Diamond Creek

This project would take place along the Colorado River within Grand Canyon National Park (GRCA) and Glen Canyon National Recreation Area (GLCA) and is a collaborative effort between the National Park Service (NPS), RiversEdge West (501(c)3 nonprofit organization), and Mariposa Ecological and Botanical Consulting. This project will involve the mapping and removal of Ravenna grass (*Saccharum ravennae*) and pampas grass (*Cortaderia selloana*) throughout the entire river corridor from Glen Canyon Dam River Mile -15 to Diamond Creek River Mile 225.0 (240 total river miles) and will continue to build on 28 years of control.

Ravenna grass is an invasive, non-native species that was planted as an ornamental grass within Glen Canyon National Recreation Area (e.g., Lees Ferry, Wahweap Marina) in the 1970's. Ravenna is a large, fast growing grass that quickly creates monocultures and outcompetes native grasses and forbs in riparian areas. It was first documented in the Grand Canyon in 1981 and spread rampantly from 1987 to 1992. Ravenna grass has proven to be invasive in the fragile riparian environment of the river corridor in GRCA and GLCA and the biggest concern is that it could spread into side canyons and impact sensitive habitats such as springs, seeps, and hanging gardens. GRCA's Vegetation Program instigated a removal program in 1993 in attempt control the spread and diminish the existing populations. The GRCA Vegetation Program continued to actively control Ravenna grass until 2014 and immense progress had been made during those years through the removal of more than 25,000 plants.

There was a gap in a concerted effort to control Ravenna grass within GRCA from the summer of 2014 until the fall of 2020 due to a lack of staff and funding. A few river guides who had worked for the National Park Service on previous Ravenna control river trips would opportunistically map and remove plants on commercial river trips. In 2020, GRCA granted Mariposa Ecological and Botanical Consulting (Dan Hall and Melissa McMaster) an administrative river permit to spend 15 days in October mapping and controlling Ravenna grass. In total they removed 337 Ravenna plants and 177 seed heads at 22 sites and found 12 new populations.

For this project, we will scan the river shoreline, stop at known sites, and treat/remove Ravenna and pampas grass along the entire river corridor. The timing for this project is critical as the Ravenna and pampas grass populations are currently well mapped and small and complete eradication is feasible within the next few years. The populations of Ravenna and pampas are spread throughout the entire length of the canyon from Glen Canyon Dam to Diamond Creek. GRCA has a database with all known mapped and treated populations from 1993-2020. For this project, we will continue to build on the previous work in both GRCA and GLCA and are hopeful that with a few more years of mapping and treating, the river corridor between Glen Canyon Dam and Diamond Creek will be mostly cleared of Ravenna and pampas grass and only an occasional river trips to monitor will be necessary after three more years of treatment.

Removing Ravenna and pampas grass is one of the more simple treatments for invasive plant species. It involves clipping and immediately bagging seed heads and then digging up the plant, being sure to get the terminal root ball and then hanging the grass in a tree or shrub to dry out. In other areas where the populations are dense and ubiquitous, treatment efforts involve using herbicide, however, in Grand Canyon, herbicides have rarely been used as the populations have thus far all been manageable with manual methods

This project will involve two river trips. The first is a 4 day up-river trip from Lees Ferry to Glen Canyon Dam and the second is a 16-day oar-powered river mission from Lees Ferry to Diamond Creek. On both trips, crews will map, monitor, and remove all Ravenna grass and pampas grass along the river. The GRCA Science and Resource Management Division has issued Mariposa Ecological and Botanical Consulting a Scientific Research and Collecting Permit (GRCA-2020-SCI-0008) to conduct

work within GRCA for the next several years and an administrative river permit for October 2021 with the promise of at least one administrative river permit a year.

To date, we have not found any Ravenna grass in side canyons in Grand Canyon National Park, but are cognizant of that fact that several of the side canyons with perennial water should be surveyed to ensure that there are no infestations. This work would be best paired with the Park's efforts to control tamarisk in the side canyons. Active restoration actions are not necessary at the identified Ravenna and pampas grass infestations. The infestations are relatively small and there is ample native vegetation that will naturally reseed or grow in voids created by Ravenna and pampas grass control.

This project is a collaborative effort between RiversEdge West, Grand Canyon National Park, Glen Canyon National Recreation Area and Mariposa Ecological and Botanical Consulting. This is a unique collaboration as all of the partners have worked together in the past on various projects, but this will be the first endeavor as a team to combat Ravenna and pampas grass. This type of collaboration is essential to be able to implement this project to continue to help protect our national treasures.

The proposed project is covered under National Environmental Policy Act Categorical Exclusion #100360.

Goals

The goals of this project are to:

- 1) Map all Ravenna and pampas grass populations along the Colorado River from Glen Canyon Dam to Diamond Creek through Glen Canyon National Recreation Area and Grand Canyon National Park.
- 2) Manually treat (i.e., clip all seed heads and dig up plants) all Ravenna and pampas grass plants that are found along the river.

Objectives

The Objectives of the project are to:

- 1) Revisit all known Ravenna and pampas populations mapped between 2012-2020.
- 2) Treat all observed populations of Ravenna grass in Grand Canyon National Park and Glen Canyon National Recreation Area.
- 3) Continue to foster the collaborative efforts between the GRCA, GLCA, consultants, the river community, and RiversEdge West.

Statement of Problems/Causes

One of the greatest threats to riparian areas in the Southwest is the invasion of non-native plants. They displace the native plants that provide essential habitat for various wildlife species. Both Ravenna and pampas grass are prolific seed producers and establish easily along the rivers' edge. They are fast growers and quickly out-compete native grasses and forbs. The Grand Canyon National Park Exotic Plant Management Plan (2009) and Glen Canyon National Recreation Area Integrated Pest Management Plan (Draft) (2009) list Ravenna and pampas grass as high priority species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled. The biggest concern is the potential for these invasive species to move into side canyons containing perennial water sources and intact native plant communities.

Statement of Solutions

This project will prevent the spread the Ravenna and pampas grass along the Colorado River and into the side canyons/streams. It will provide more habitat for native grasses, forbs and shrubs. This project jumpstart needed collaboration between GRCA, GLCA, RiversEdge West, river guides, and consultants to complete this work in the most efficient and effective manner. While on the water, we will conduct outreach with as many private and commercial river trips as possible, and will present our results and efforts at the Grand Canyon River Guides-Guides Training Seminar in April of 2022 and at the RiversEdge West Conference in 2023.

Statement of Project Years of Benefit to the Resource and General Public

An ongoing trend with operations since the completion of the dam has been the encroachment of invasive plants in the riparian zone which restrict visitor access to the river & recreational activities such as fishing & camping. This collaborative project will protect and restore biologically diverse riparian areas, expand access to public lands for recreational activities, and benefit 22,000+ visitors (e.g., river runners, backcountry travelers) annually.

GRCA and GLCA will continue with the momentum of Ravenna and pampas grass control along the river and project that there will be 50+ years of benefit to the resource and community from this project.

Project Location & Environmental Contaminant Information FY 2022

Project Location Information			
1. County: <u>Coconino</u>	2. Section(s): <u>24,34,32</u>	3. Township: <u>41,32,27.5</u>	4. Range: <u>10,16,8</u>
<p>5. Watershed: <u>Colorado River</u></p> <p>6. 8 or 10 Digit Hydrologic Unit Code (HUC): <u>15010002</u></p> <p>7. Name of USGS Topographic Map where project area is located: <u>Too many to list as we are working along the entire length of the Colorado River from Glen Canyon Dam to Diamond Creek Road</u></p> <p>8. State Legislative District: <u>06</u> (Information available at: https://azredistricting.org/districtlocator/)</p> <p>9. Land ownership of project area: <u>Grand Canyon National Park and Glen Canyon National Recreation Area</u></p> <p>10. Current land use of project area: <u>National Park- potentially used recreationally</u></p> <p>11. Size of project area (in acres): <u>19,000</u></p> <p>12. Stream Name: <u>Colorado River</u></p> <p>13. Length of stream through project area: <u>240</u></p> <p>14. Miles of stream benefited: <u>240 miles</u></p> <p>15. Acres of riparian habitat: <u>19,000 acres</u> will be:</p> <div style="margin-left: 40px;"> <input checked="" type="checkbox"/> Enhanced <input checked="" type="checkbox"/> Maintained <input type="checkbox"/> Restored <input type="checkbox"/> Created </div>			
<p>16. General description and/or delineation for the area of impact of the project within the watershed. This work will take place in the riparian corridor along both sides of the Colorado River from Glen Canyon Dam to Diamond Creek. Most Ravenna and Pampas grass is found within 50 meters of the rivers' edge.</p> <p>17. Provide directions to the project site from the nearest city or town. List any special access requirements: The site can be access from Lees Ferry, AZ and travel upriver via boat to the base of Glen Canyon dam and then down river where the next access point is Diamond Creek Road.</p>			
Environmental Contaminant Location Information			
<p>1. Does your project site contain known environmental contaminants? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants:</p> <p>2. Are there known environmental contaminants in the project vicinity? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants:</p> <p>3. Are you asking for Arizona Water Protection Fund monies to identify whether or not environmental contaminants are present? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO</p>			

Ravenna & Pampas Grass Control along the Colorado River from Glen Canyon Dam to Diamond Creek

Scope of Work

TASK # 1

Map and treat Ravenna and pampas grass from Glen Canyon Dam to Lees Ferry

Task Title

Map and treat Ravenna and pampas grass from Glen Canyon Dam to Lees Ferry in the Fall of 2022 - Four day up-river trip

Task Description

Crews will map and treat any Ravenna or pampas grass from Glen Canyon Dam down the Colorado River to Lees Ferry. Crews will take a motor boat up river and then work down the 15 miles to Lees Ferry. Crews will have four days to complete the work and will camp along the river for efficiency.

Task Purpose/Objective

To map and treat all Ravenna and pampas grass from Glen Canyon Dam to Lees Ferry.

Responsible Personnel

RiversEdge West
Mariposa Ecological and Botanical Consulting
Glen Canyon National Recreation Area
Grand Canyon National Park

Deliverable Description

A Glen Canyon National Recreation Area Exotic Plant Management field datasheet will be completed for each mapped and/or treated population. Data collections will include species name, location name, GPS coordinates, number of plants mapped and/or treated, and native species growing adjacent to treated area/s. After all field work is completed, a final report will be completed which will include the following sections: abstract, introduction, methods, results, discussion, maps, and photos.

Deliverable Due Date

December 15, 2022

Task Cost (rounded to the nearest dollar)

\$8,816

TASK # 2

Map and treat Ravenna and pampas grass from Lees Ferry to Diamond Creek

Task Title

Map and treat Ravenna and pampas grass from Lees Ferry to Diamond Creek in the Fall of 2022 - 16 day River Trip

Task Description

Crews will embark on a 16-day river trip from Lees Ferry to Diamond Creek to map and treat all Ravenna and pampas grass plants.

Task Purpose/Objective

To map and treat all Ravenna and pampas grass along the Colorado River from Lees Ferry to Diamond Creek (250 miles)

Responsible Personnel

RiversEdge West
Mariposa Ecological and Botanical Consulting
Grand Canyon National Park

Deliverable Description

A Grand Canyon National Park Exotic Plant Management field datasheet will be completed for each mapped and/or treated population. Data collections will include species name, location name, GPS coordinates, number of plants mapped and/or treated, and native species growing adjacent to treated area/s. After all field work is completed, a final report will be completed which will include the following sections: abstract, introduction, methods, results, discussion, maps, and photos.

Deliverable Due Date

December 15, 2022

Task Cost (rounded to the nearest dollar)

\$32,980

Task 3: Final Report and Oral Presentation

Task Description

The Grantee shall prepare and present a final report in accordance with the guidelines and policies provided by the Arizona Water Protection Fund. The report will include a summary of all activities, all invasive plant removal data, and all restoration data, the methodologies employed for each plan, a discussion of success and challenges, a discussion and suggestions of lessons learned for moving forward, an evaluation of the success of the project. The Grantee shall also provide all data and photos unless otherwise specified.

Task Purpose/Objective

To provide a comprehensive final report that will be available to the public and can be used to better inform future restoration activities and demonstrate the value of these projects for State of Arizona.
To provide an oral presentation to the AWPf Committee

Responsible personnel

Mariposa Consulting
RiversEdge West

Deliverable Description

A final report and an oral presentation to the Committee.

Deliverable Due Date

January 2023

Task Cost (rounded to the nearest dollar)

\$1,382

[Add additional Tasks as necessary]

AWPF Fund Request

NOTE: This table is provided as a guide to help develop your project budget and AWPF fund grant request. Feel free to modify this table as needed to accurately describe your proposed budget details.

Arizona Water Protection Fund Grant Application Detailed Budget

Task 1: Map and treat Ravenna and pampas grass from Glen Canyon Dam to Lees Ferry in the Fall of 2022 - Four day up-river trip					
	Quantity	Unit	Unit Cost	Total (Requested)	Notes
Direct Labor Costs					
REW Executive Director (ED) to administer the grant and provide assistance	3	day	\$ 400.00	\$ 1,200.00	
REW Restoration Coordinator	3	day	\$ 220.00	\$ 660.00	
Direct Labor Subtotal				\$ 1,860.00	
Outside Service Costs					
GRCA Vegetation Program Manager	20	hours	\$ 56.00		
GLCA Natural Resource Specialist	20	hours	\$ 48.00		
GRCA Invasive Plant Crew Lead	1	unit	\$ 625.00		
GRCA GIS Specialist	1	unit	\$ 693.00		
Biologist (field work and reporting)	8	day	\$ 260.00	\$ 2,080.00	\$32.50 per hour
Boatman (boat driver, field work)	6	day	\$ 240.00	\$ 1,440.00	\$30 per hour
Botanist (field work)	5	day	\$ 220.00	\$ 1,100.00	\$27.50 per hour
Outside Services Subtotal				\$4,620.00	
Other Direct Costs					
Other Direct Subtotal				\$ -	
Capital Outlay, Equipment, Supplies, Per Diem, Travel, etc.					
<i>(Note: mileage reimbursement is limited to \$0.445/mile)</i>					
Boat rental (includes gas and boat transport)	4	day	\$ 425.00	\$ 1,700.00	
Per Diem (4 people for 4 days)	4	day/person	\$ 35.00	\$ 560.00	
Travel (3 people from Flagstaff)	170	miles	\$ 0.45	\$ 75.65	
Travel for REW Restoration Coordinator	1	unit	\$ 250.00		
Tools and supplies	1	package	\$ 450.00		
Other Direct Subtotal				\$2,335.65	
Task Subtotal				\$8,815.65	

AWPF Fund Request

Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)					\$ -	
				Task 1 Total	\$8,815.65	
Task 2: Map and treat Ravenna and pampas grass from Lees Ferry to Diamond Creek in the Fall of 2022 - 16 day River Trip						
	Quantity	Unit	Unit Cost	Total (Requested)		Notes
Direct Labor Costs						
REW Executive Director (ED) to administer the grant and provide assistance	6	day	400	\$ 2,400		
REW Restoration Coordinator to participate in the trip	12	day	220	\$ 1,320.00		partial ask for funding, partial match
Direct Labor Subtotal				\$ 3,720.00		
Outside Service Costs						
GRCA Vegetation Program Manager	1	unit	1120			
GRCA Invasive Plant Crew Lead	1	unit	625			
GRCA GIS Specialist	1	unit	693			
Lead Biologist/Boatman- Project lead and river safety, reporting, data management	22	day	\$ 260	\$ 5,720		
Trip Leader/Boatman - trip logistics and safety, trip prep and clean up	20	day	\$ 240	\$ 4,800		
Botanist - Field ID skills	17	day	\$ 200	\$ 3,400		
Boatman - river safety	17	day	\$ 220	\$ 3,740		
Volunteer - crew	18	day	\$ 220			
Volunteer - crew	18	day	\$ 220			
Other Direct Costs						
Other Direct Subtotal				\$17,660.00		
Capital Outlay, Equipment, Supplies, Per Diem, Travel, etc.						
<i>(Note: mileage reimbursement is limited to \$0.445/mile)</i>						
Boat and gear rental- three boats, all kitchen, toilet, camp rental equipment	15	day	150	\$ 6,750.00		
Tools	1	package	500			
Shuttle to Lees Ferry and from Diamond Creek	1	package	1700	\$ 1,700.00		
REW Travel for Restoration Coordinator	1	unit	250			
Per diem (\$30 per person per day for)	15	day	30	\$ 3,150.00		
Permits for the river trip and take-out at Diamond Creek	1	unit	1580			

AWPF Fund Request

Other Direct Subtotal				\$ 11,600.00	
Task Subtotal				\$32,980.00	
Optional: AWPf Administrative Costs (not to exceed 5% of Task Subtotal)				\$ -	
			Task2 Total	\$32,980.00	
Task 3: Final Report and Oral Presentation					
	Quantity	Unit	Unit Cost	Total	Notes
Direct Labor Costs					
REW Executive Director (ED) to administer the grant and provide assistance	1	day	400	\$ 400	
Direct Labor Subtotal				\$400.00	
Outside Service Costs					
Project Coordinator- lead Biologist	12	hours	70	\$ 840	
GRCA GIS Specialist	1	unit	695		
Outside Services Subtotal				\$840.00	
Other Direct Costs					
Other Direct Subtotal					
Capital Outlay, Equipment, Supplies, Per Diem, Travel, etc. <i>(Note: mileage reimbursement is limited to \$0.445/mile)</i>					
Mileage for travel to give presentation	320	miles	\$ 0.45	\$ 142.40	
Other Direct Subtotal				\$142.40	
Task Subtotal				\$1,382.40	
Optional: AWPf Administrative Costs (not to exceed 5% of Task Subtotal)					
			Task 3 Total	\$1,382.40	
Total Ask				\$43,178.05	

AWPF Fund Request

Arizona Water Protection Fund Grant Application Fund Request						

Matching Funds - Cost Share

NOTE: This table is provided as a guide to help develop your project budget and matching funds / project cost share budget. Feel free to modify this table as needed to accurately describe your proposed budget details.					
Matching Funds / Cost Share Budget					
Task 1: Map and treat Ravenna and pampas grass from Glen Canyon Dam to Lees Ferry in the Fall of 2022 - Four c					
	Quantity	Unit	Unit Cost	MATCHING	Notes
Direct Labor Costs					
REW Executive Director (ED) to administ	3	day	\$ 400.00		
REW Restoration Coordinator	3	day	\$ 220.00	\$ 660.00	
Direct Labor Subtotal				\$ 660.00	
Outside Service Costs					
GRCA Vegetation Program Manager	20	hours	\$ 56.00	\$ 1,120.00	
GLCA Natural Resource Specialist	20	hours	\$ 48.00	\$ 960.00	
GRCA Invasive Plant Crew Lead	1	unit	\$ 625.00	\$ 625.00	
GRCA GIS Specialist	1	unit	\$ 693.00	\$ 693.00	
Biologist (field work and reporting)	8	day	\$ 260.00		
Boatman (boat driver, field work)	6	day	\$ 240.00		
Botanist (field work)	5	day	\$ 220.00		
Outside Services Subtotal				\$ 3,398.00	
Other Direct Costs					
Other Direct Subtotal				\$ -	

Matching Funds - Cost Share

Capital Outlay, Equipment, Supplies, Per Diem, Travel, etc. <i>(Note: mileage reimbursement is limited to \$0.445/mile)</i>					
Boat rental (includes gas and boat transport)	4	day	\$ 375.00		
Per Diem (4 people for 4 days)	4	day/person	\$ 50.00		
Travel (3 people from Flagstaff)	170	miles	\$ 0.45		
Travel for REW Restoration Coordinator	1	unit	\$ 250.00	\$ 250.00	
Tools and supplies GLCA and GRCA	1	package	\$ 450.00	\$ 450.00	
Other Direct Subtotal				\$ 700.00	
Task Subtotal				\$ 4,758.00	
Optional: AWPf Administrative Costs (not to exceed 5% of Task Subtotal)				\$ -	
			Task 1 Total	\$ 4,758.00	
Task 2: Map and treat Ravenna and pampas grass from Lees Ferry to Diamond Creek in the Fall of 2022 - 16 day R					
	Quantity	Unit	Unit Cost	MATCHING	Notes
Direct Labor Costs					
REW Executive Director (ED) to administer	6	day	400		
REW Restoration Coordinator to participate	12	day	220	\$ 2,640	
Direct Labor Subtotal				\$ 2,640	
Outside Service Costs					
GRCA Vegetation Program Manager	1	unit	1120	\$ 1,120.00	

Matching Funds - Cost Share

GRCA Invasive Plant Crew Lead	1	unit	625	\$ 625.00	
GRCA GIS Specialist	1	unit	693	\$ 693.00	
Lead Biologist/Boatman- Project lead and	22	day	\$ 260		
Trip Leader/Boatman - trip logistics and sa	20	day	\$ 240		
Botanist - Filed ID skills	17	day	\$ 200		
Boatman - river safety	17	day	\$ 220		
Volunteer REW	18	day	\$ 220	\$ 3,960.00	
Volunteer REW	18	day	\$ 220	\$ 3,960.00	
Other Direct Costs					
Other Direct Subtotal				\$ 10,358	
Capital Outlay, Equipment, Supplies, Per Diem, Travel, etc. <i>(Note: mileage reimbursement is limited to \$0.445/mile)</i>					
Boat and gear rental- three boats, all kitch	15	day	150		
Tools GRCA	1	package	500	\$ 500.00	
Shuttle to Lees Ferry and from Diamond C	1	package	1700		
REW Travel for Restoration Coordinator	1	unit	250	\$ 250.00	
Per diem (\$30 per person per day for)	15	day	30		
Permits for the river trip and take-out at	1	unit	1580	\$ 1,580.00	
Other Direct Subtotal				\$ 2,330.00	
Task Subtotal				\$ 15,328.00	
Optional: AWPf Administrative Costs (not to exceed 5% of Task Subtotal)				\$ -	

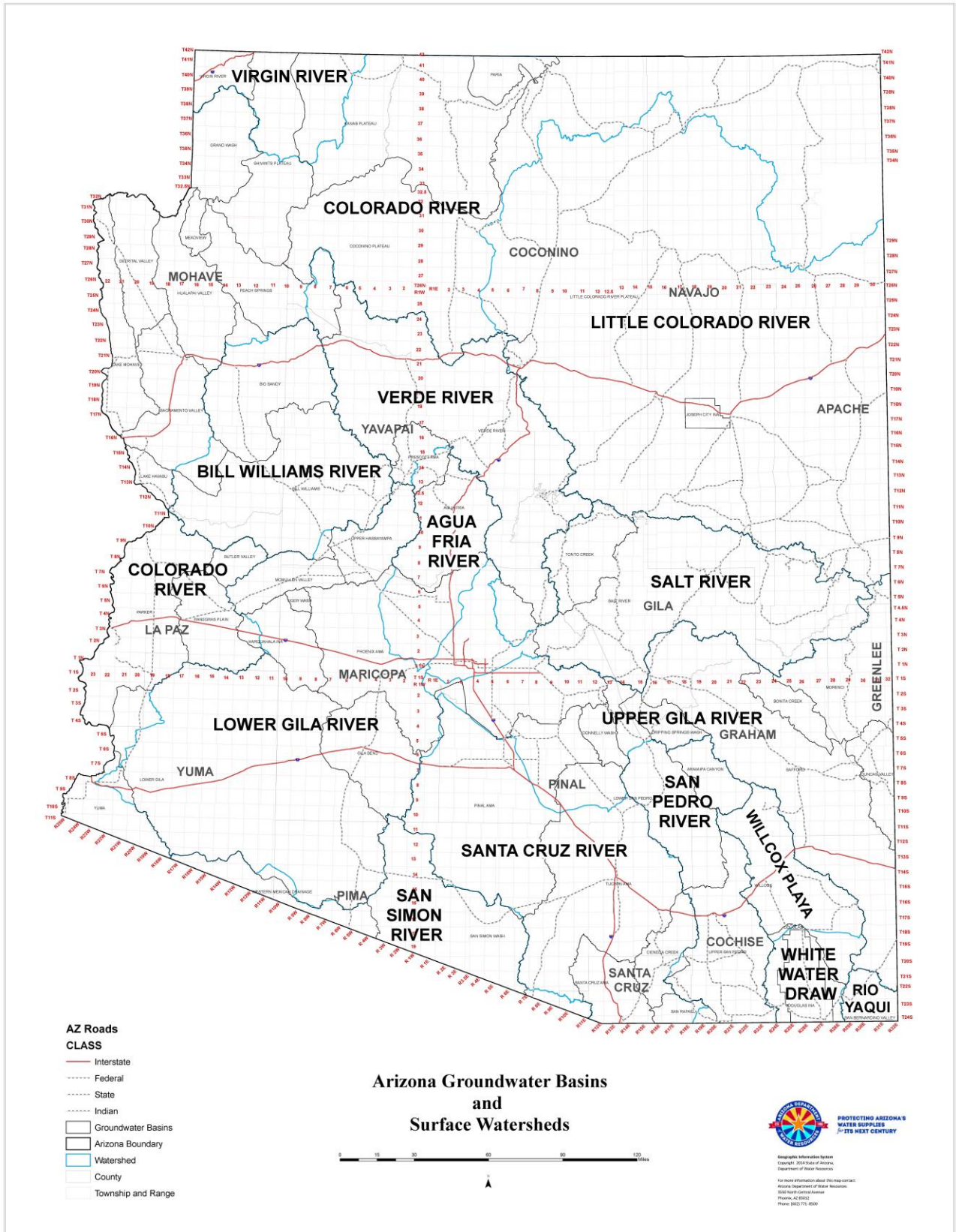
Matching Funds - Cost Share

			Task2 Total	\$15,328.00	
Task 3: Final Report and Oral Presentation					
	Quantity	Unit	Unit Cost		Notes
Direct Labor Costs					
REW Executive Director (ED) to administer	1	day	400		
Direct Labor Subtotal					
Outside Service Costs					
Project Coordinator- lead Biologist	10	hours	70		
GRCA GIS Specialist	1	unit		\$ 695.00	
Outside Services Subtotal					
Other Direct Costs					
Other Direct Subtotal					
Capital Outlay, Equipment, Supplies, Per Diem, Travel, etc. <i>(Note: mileage reimbursement is limited to \$0.445/mile)</i>					
Mileage for travel to give presentation		miles			
Other Direct Subtotal					
Task Subtotal				\$ 695.00	
Optional: AWP Administrative Costs (not to exceed 5% of Task Subtotal)					

Matching Funds - Cost Share

			Task 3 Total	\$ 695.00	
Total Match				\$ 20,781.00	
REW				\$ 11,720.00	
GRCA				\$ 8,101.00	
GLCA				\$ 960.00	
				\$ 20,781.00	

Arizona Watershed Map FY 2022



Title of Project: Ravenna & Pampas Grass Control Along the Colorado River from Glen Canyon Dam to Pearce Ferry

Location: (include UTM's & Township/Range/Section):
 Glen Canyon Dam/Township 41 North/Range 8 East/Section 24
 Glen Canyon Dam UTM's/12S 456861/4088049

Pearce Ferry/Township 32 North/Range 16 West/Section 34

Pearce Ferry UTM/ 12 S 230720/4000192

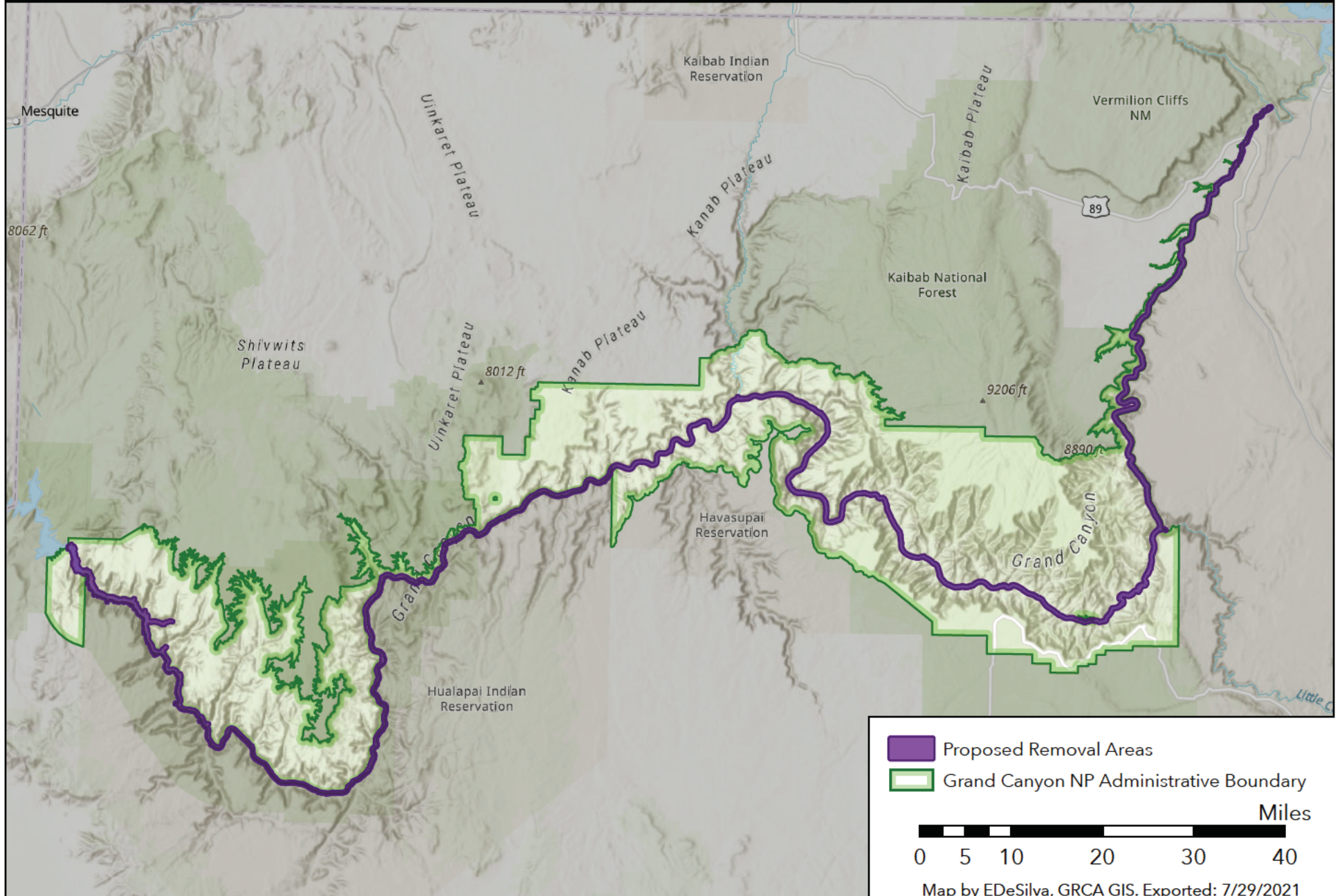
Diamond Creek/Township 27.5 North/Range 10 West/Section 32

Diamond Creek UTMS/ 12S 290412/3958078

The project will be completed in the riparian corridor along the Colorado River from the base of Glen Canyon Dam to Diamond Creek (240 river miles)

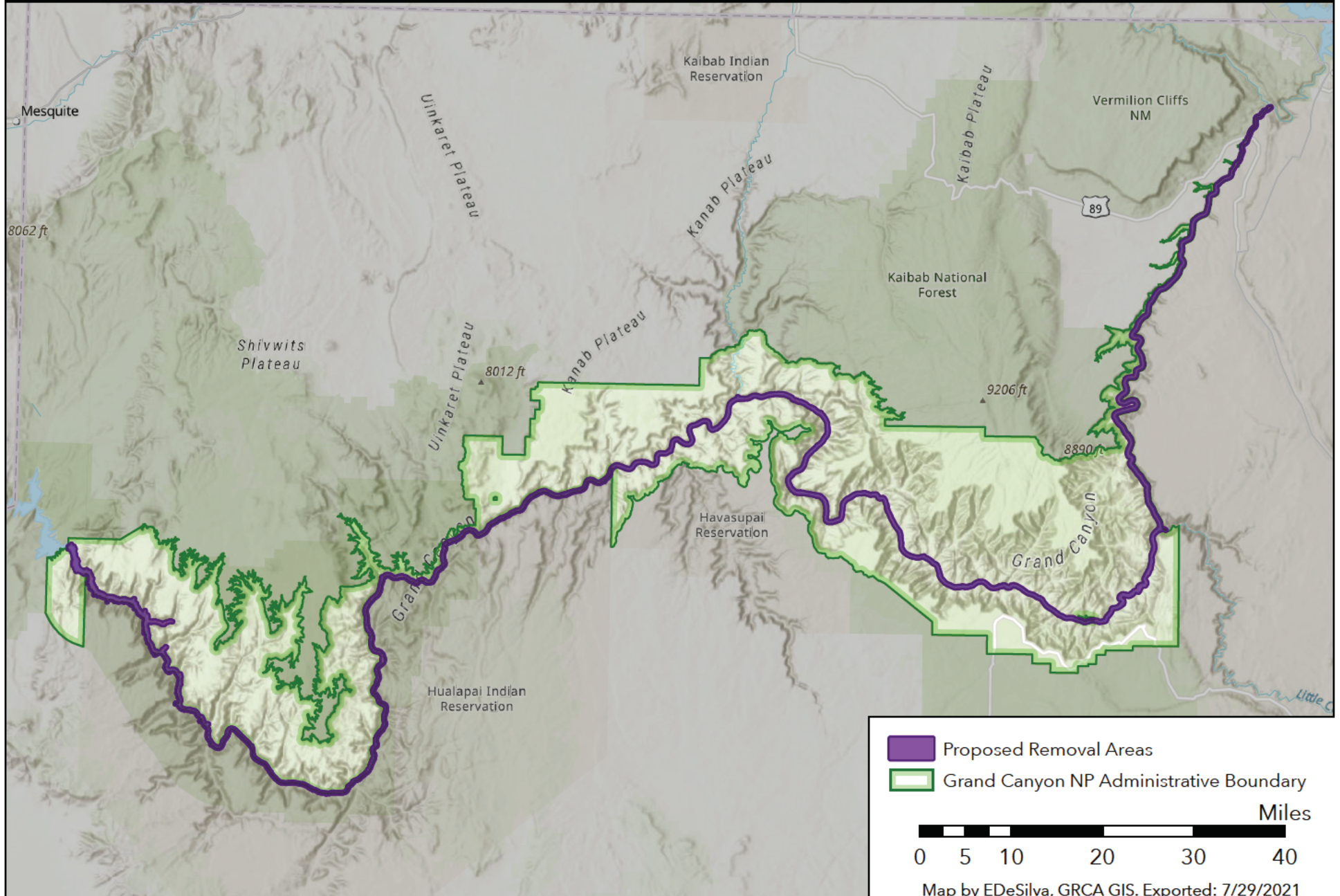
Ravenna Grass Control Along the Colorado River in Grand Canyon National Park
Vegetation Program
Grand Canyon National Park

National Park Service
U.S. Department of the Interior



Ravenna Grass Control Along the Colorado River in Grand Canyon National Park
Vegetation Program
Grand Canyon National Park

National Park Service
U.S. Department of the Interior



STATE HISTORIC PRESERVATION OFFICE

Review Form

In accordance with the State Historic Preservation Act (SHPO), A.R.S. 41-861 *et seq.*, effective July 24, 1982, each State agency must consider the potential of activities or projects to impact significant cultural resources. Also, each State agency is required to consult with the State Historic Preservation Officer with regard to those activities or projects that may impact cultural resources. Therefore, it is understood that **recipients of state funds are required to comply with this law** throughout the project period. All projects that affect the ground-surface that are funded by AWPf require SHPO clearance, **including those on private and federal lands.**

The State Historic Preservation Office (SHPO) must review each grant application recommended for funding in order to determine the effect, if any, a proposed project may have on archaeological or cultural resources. To assist the SHPO in this review, the following information **MUST** be submitted with each application for funding assistance:

- A completed copy of this form, and
 - A United States Geological Survey (USGS) 7.5-minute map
 - A copy of the cultural resources survey report if a survey of the property has been conducted, and
 - A copy of any comments of the land managing agency/landowner (i.e., state, federal, county, municipal) on potential impacts of the project on historic properties.
- NOTE: If a federal agency is involved, the agency must consult with SHPO pursuant to the National Historic Preservation Act (NHPA); a state agency must consult with SHPO pursuant to the State Historic Preservation Act (SHPA),
- OR**
- A copy of SHPO comments if the survey report has already been reviewed by SHPO.

Please answer the following questions:

1. Grant Program: Arizona Water Protection Fund
2. Project Title: Ravenna and Pampas Grass Control along the Colorado River from Glen Canyon Dam to Diamond Creek, Arizona
3. Applicant Name and Address: RiversEdge West, PO Box 1907, Grand Junction, CO 81502
4. Current Land Owner/Manager(s): National Park Service
5. Project Location, including Township, Range, Section: Glen Canyon Dam (Township 41 North/Range 8 East/Section 24) to Diamond Creek (Township 27.5 North/Range 10 West/Section 32), Arizona
6. Total Project Area in Acres (or total miles if trail, fence line, etc.): 241 river miles 19,000 acres
7. Does the proposed project have the potential to disturb the surface and/or subsurface of the ground?
 YES NO
8. Please provide a brief description of the proposed project and specifically identify any surface or subsurface impacts that are expected: Project consists of: 1) mapping all Ravenna and pampas grass populations along the Colorado River from Glen Canyon Dam to Diamond Creek through Glen Canyon National Recreation Area and Grand Canyon National Park, and 2) manually controlling (i.e., clipping and bagging seed heads, digging up plants) all Ravenna and pampas grass plants found along the river. Surface and subsurface impacts will consist of ≤ 1.5 square meters of surface disturbance per treated plant.

9. Describe the condition of the current ground surface within the entire project boundary area (for example, is the ground in a natural undisturbed condition, or has it been bladed, paved, graded, etc.). Estimate horizontal and vertical extent of existing disturbance. Also, attach photographs of project area to document condition: Glen Canyon Dam has fundamentally altered disturbance regimes in the downstream Colorado River ecosystem below Glen Canyon Dam. Fluctuating flows result in varying levels of disturbance within riparian habitats occupied by Ravenna and pampas grass. Ravenna and pampas typically grow in moist areas directly adjacent to the Colorado River. General dam operations result in flows of < 45,000 ft³/second.
10. Are there any known prehistoric and/or historic archaeological sites in or near the project area? YES
 NO
11. Has the project area been previously surveyed for cultural resources by a qualified archaeologist? YES
 NO UNKOWN

If YES, submit a copy of the survey report. Please attach any comments on the survey report made by the managing agency and/or SHPO. On 03/05/2021, Jennifer Dierker (GRCA Archaeologist) provided the following comment on an experimental vegetation treatment project of similar scope occurring along the Colorado River within GRCA. "The proposed work is within the New Highwater Zone (NHW) on sediment deposits adjacent to the river. There are no documented archaeological sites within this zone. No plant removal or ground disturbance should occur in the terrace deposits above this line without additional discussions with Cultural Resource staff. Staff with be mindful that archaeological sites exist throughout the river corridor and in proximity to camp and work locations. This materials, features, and deposits are to be avoided."

12. Are there any buildings or structures (including mines, bridges, dams, canals, etc.), which are 50-years or older in or adjacent to the project area? YES NO

If YES, complete an Arizona Historic Property Inventory Form for each building or structure, attach it to this form and submit it with your application.

13. Is your project area within or near a historic district? YES NO

If YES, name of the district: Lees Ferry Historic District

Please sign on the line below certifying all information provided for this application is accurate to the best of your knowledge.



_____/ 8/31/21
Applicant Signature /Date

Applicant Printed Name

FOR SHPO USE ONLY

SHPO Finding:

- Funding this project will not affect historic properties.
 Survey necessary – further GRANTS/SHPO consultation required (*grant funds will not be released until consultation has been completed*)
 Cultural resources present – further GRANTS/SHPO consultation required (*grant funds will not be released until consultation has been completed*)

SHPO Comments:

For State Historic Preservation Office:

Date:

**STATE OF ARIZONA
HISTORIC PROPERTY INVENTORY FORM**

Please type or print clearly. Fill out each applicable space accurately and with as much information as is known about the property.

PROPERTY IDENTIFICATION

For properties identified through survey: Site No. _____ Survey Area: _____

Historic Names (enter the name(s), if any that best reflect the property's historic importance): _____

Address: _____

City or Town: _____ Vicinity County: _____ Tax Parcel No.: _____

Township: _____ Range: _____ Section: _____ Quarters: _____ Acreage: _____

Block: _____ Lot(s): _____ Plat (Addition): _____ Year of plat (addition): _____

UTM Reference – Zone: _____ Easting: _____ Northing: _____

USGS 7.5' quadrangle map: _____

ARCHITECT: _____ not determined known Source: _____

BUILDER: _____ not determined known Source: _____

CONSTRUCTION DATE: _____ known estimated Source: _____

STRUCTURAL CONDITION

- Good (well maintained; no serious problems apparent)
- Fair (some problems apparent) Describe: _____
- Poor (major problems; imminent threat) Describe: _____
- Ruin/Uninhabitable

USES/FUNCTIONS

Describe how the property has been used over time, beginning with the original use: _____

Sources: _____

Attach a recent photograph of property in this space. Additional photographs may be appended.

PHOTO INFORMATION

Date of photo: _____
View Direction (looking towards): _____

SIGNIFICANCE

To be eligible for the National Register, a property must represent an important part of the history or architecture of an area. The significance of a property is evaluated within its historic context, which are those patterns, themes, or trends in history by which a property occurred or gained importance. Describe the historic and architectural contexts of the property that may make it worthy of preservation.

A. HISTORIC EVENTS/TRENDS – Describe any historic events/trends associated with the property: _____

B. PERSONS – *List and describe persons with an important association with the building:* _____

C. ARCHITECTURE – Style: _____ no style

Stories: _____ Basement Roof Form: _____

Describe other character-defining features of its massing, size and scale: _____

INTEGRITY

To be eligible for the National Register, a property must have integrity (i.e. it must be able to visually convey its importance). The outline below lists some important aspects of integrity. Fill in the blanks with as detailed a description of the property as possible.

Location - Original Site Moved: Date: _____ Original Site: _____

DESIGN

Describe alterations from the original design, including dates: _____

MATERIALS

Describe the materials used in the following elements of the property:

Walls (structure): _____

Walls (sheathing): _____

Windows: _____

Roof: _____

Foundation: _____

SETTING

Describe the natural and/or built environment around the property: _____

How has the environment changed since the property was constructed? _____

WORKMANSHIP

Describe the distinctive elements, if any, of craftsmanship or method of construction: _____

NATIONAL REGISTER STATUS (if listed, check the appropriate box)

Individually Listed; Contributor; Non-contributor to _____ Historic District

Date Listed: _____ Determined eligible by Keeper of National Register (date: _____)

RECOMMENDATIONS ON NATIONAL REGISTER ELIGIBILITY (opinion of SHPO staff or survey consultant)

Property is is not eligible individually.

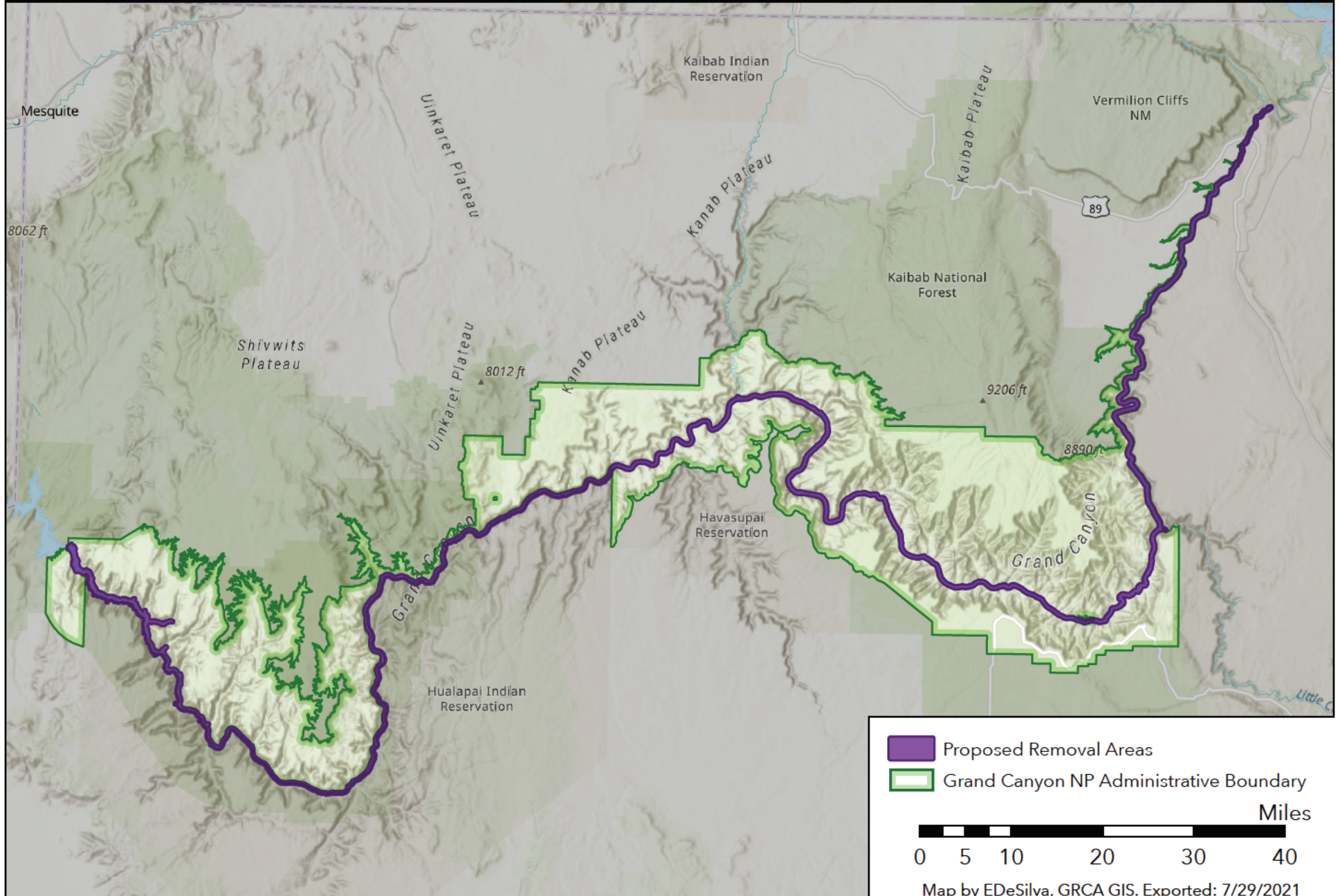
Property is is not eligible as a contributor to a listed or potential historic district.

More information needed to evaluate.

If not considered eligible, state reason: _____

Ravenna Grass Control Along the Colorado River in Grand Canyon National Park
Vegetation Program
Grand Canyon National Park

National Park Service
U.S. Department of the Interior



Melissa Anne McMaster

melissa@mariposaeco.com

114 N San Francisco

Suite 3

Flagstaff, AZ 86001

928.814.6373

SKILLS AND EXPERIENCE SUMMARY

Professional plant biologist conducting applied research informing conservation and management with areas of expertise in planning, implementing and managing projects involving, biological assessment surveys, invasive plant management, vegetation mapping, riparian restoration and rare plant monitoring; watershed partnership coordination and facilitation; ability to write research and project summaries for managers as well as scientific journal articles and funding proposals; others areas of expertise include taxonomic identification of plants, public speaking and presentations, workshop development and execution, contract management, volunteer coordination, and an enthusiasm and love for all things botanical in the southwest.

EDUCATION

Master of Science in Forestry, Northern Arizona University, Flagstaff, AZ, 2010

Bachelor of Science in Biology and Secondary Education, Utah State University, Logan, Utah, 2001

PROFESSIONAL EXPERIENCE

Principal/Lead Biologist, Mariposa Ecological and Botanical Consulting LLC, July 2014-current

- Hwal'bay Ba:j Enterprises, Inc. DBA Grand Canyon Resort Corporation, Peach Springs, AZ. August 2015-current.
 - Consultant surveying for and writing biological assessments and environmental assessments for numerous projects at the Resort including the Zipline, airport expansion, trail construction, Visitor Center, etc.
- Hualapai Tribal Nation, Peach Springs, AZ. May 2015-May 2019.
 - Consultant for riparian restoration/rehabilitation on Hualapai Tribal Lands adjacent to and in conjunction with federal lands in Grand Canyon National Park. Included site identification, selection and work plan development and implementation.
- Fort McDowell Yavapai Nation, Fountain Hills, AZ. March 2015-current.
 - Working with the Tribe to develop and implement a comprehensive vegetation management and river restoration program. Surveyed and inventoried plants throughout the entire reservation and created a vegetation map using NVCS classification systems. Developed and implemented an Invasive Plant Management Plan. Currently developing and implementing a Restoration Plan for a ten-mile stretch of the Verde River.

- Successfully wrote a grant to the AZ Water Protection Fund for the Tribe to continue implementing river restoration and invasive plant management treatments along the river.
- The Arboretum in Flagstaff, Flagstaff, AZ. August 2017- June 2020.
 - Consultant for riparian restoration/rehabilitation in Grand Canyon National Park along the Colorado River. Creating habitat for T & E Species, community outreach, work plan development and implementation, and long-term restoration planning.
- The Nature Conservancy, Escalante, UT. July 2014-current.
 - Working with Glen Canyon National Recreation Area, The Nature Conservancy, and Escalante River Watershed Partnership to implement a project to map and inventory legacy riparian trees along the Escalante River. Protocol development, data collection, photo-documentation, data synthesis, map creation to spatially represent tree data, reporting and documentation for the entire Escalante River watershed.
- Greater Grand Canyon Landscape Assessment, Flagstaff, AZ. August 2015-October 2015
 - Co-author on the chapter “Riparian Assessment” from a Management Plan for Grand Canyon National Park

Restoration Coordinator, RiversEdge West (formerly Tamarisk Coalition), April 2016-September 2019

- Through coordination, collaboration, and facilitation provide support to watershed partnership groups in AZ and UT who are working to restore and revitalize riparian systems
- Provide technical and scientific assistance and guidance to these partnership on all aspects of riparian restoration including invasive plant treatments, best restoration practices, stakeholder collaboration, and fundraising,
- Stakeholder meeting organization and facilitation and assisting new partnerships with organizing.
- Strategizing and collaborating with multiple stakeholders on politically, socially and ecologically sensitive subjects and projects.
- Steering Committee member of the Cross-watershed Network (XWN) and member of the planning committee for the developing AZ XWN.
- Developed and executed a workshop series on riparian restoration and the tamarisk beetle.

Plant Biologist (GS-9), Grand Canyon National Park, Flagstaff, AZ, August 2011- July 2014

- Directed and managed the daily operations of all activities related to vegetation management in remote backcountry areas in Grand Canyon including the following:
 - Riparian restoration/rehabilitation and habitat assessments along the Colorado River
 - Invasive plant mapping, monitoring and removal along the river, in side canyons and in all other backcountry areas of the park
 - Rare plant surveys, monitoring, mapping and collection
 - Vegetation monitoring and data analysis for several large projects
 - Developed a restoration plan including invasive plant removal and native plant replacement
 - Developed and implemented a scientifically rigorous pre- and post-work vegetation monitoring protocol
 - Implemented and refined restoration procedures including collecting seeds and live cuttings, nursery propagation and out-planting

Research Assistant (successful completion of a M.S. in Forestry), Northern Arizona University, Flagstaff, AZ, September 2007- Aug. 2010

- Developed and implemented a vegetation monitoring program on the North Kaibab Plateau, Kaibab National Forest, to ascertain the effects of fire and post-fire seeding on the ecosystem
 - Understory vegetation monitoring, overstory tree monitoring, fire effects and fire severity, herbaceous biomass sampling
 - Conducted in-depth data analysis using JMP, PC-ORD and Sigma Plot
 - Developed a database and electronic field data collection protocols and created maps and conducted spatial data analysis using ArcGIS
 - Collaboration with NAU, Grand Canyon Trust and the Kaibab National Forest employees for project development, implementation and management

JOB RELATED TRAINING

- Wetland Delineation Workshop, Richard Chinn, 4 day workshop, January 2015
 - Restoration Workshop by Natural Channel Design, 2 day workshop, April 2014
 - Restoration Workshop by Fred Phillips Consulting, 3 day workshop, February 2011
 - Operational Leadership Supervisors Training, April 2014
 - Yellow-billed cuckoo identification training, May 2014
 - Southwestern willow flycatcher identification training, May 2012
 - Wilderness First Responder exp. 2019
 - American Red Cross CPR exp. 2020
 - Food Managers Certification exp. 2019
 - Arizona Certified Herbicide Applicator
 - Secondary Education Certificate-Utah
-

























LTEMP Non-Flow Vegetation Treatment Actions to Mitigate Glen Canyon Dam Operation Impacts on Riparian Vegetation along the Colorado River in Grand Canyon National Park

FY2020 Annual Report to the Bureau of Reclamation

Interagency Agreement R18PG00066



LTEMP Non-Flow Vegetation Treatment Actions to Mitigate Glen Canyon Dam Operation Impacts on Riparian Vegetation along the Colorado River in Grand Canyon National Park

FY2020 Annual Report to the Bureau of Reclamation

Interagency Agreement R18PG00066

Lonnie H. Pilkington¹, Daniel L. Boughter¹, Cameron C. Prophet¹, Ahsa I. Hakanson¹

¹National Park Service
Grand Canyon National Park
17 South Entrance Road
Grand Canyon, Arizona 86023

ON THE COVER

A GRCA Biological Science Technician removing vegetation to assist with cultural site protection at Basalt (RM 70.1 R). NPS Photo.

List of Acronyms

NPS: National Park Service

GRCA: Grand Canyon National Park

GLCA: Glen Canyon National Recreation Area

GCMRC: Grand Canyon Monitoring and Research Center

AZCC: Arizona Conservation Corps

LTEMP EIS: Glen Canyon Dam Long Term Experimental and Management Plan Environmental Impact Statement

TWP: Triennial Work Plan

ACRE3: *Acroptilon repens* (Russian knapweed)

ALMA12: *Alhagi maurorum* (camelthorn)

COJU2: *Cortaderia jubata* (Uruguayan pampas grass)

CORTA: *Cortaderia* spp. (Pampas grass)

ELAN: *Elaeagnus angustifolia* (Russian olive)

LELA2: *Lepidium latifolium* (perennial pepperweed)

LEPID: *Lepidium species* (pepperweed)

PLSE: *Pluchea sericea* (arrowweed)

POFR2: *Populus fremontii* (Fremont cottonwood)

SAGO: *Salix gooddingii* (Goodding's willow)

SARA3: *Saccharum ravennae* (Ravenna grass)

SATR12: *Salsola tragus* (Russian thistle)

TARA: *Tamarix ramosissima* (tamarisk)

TRTE: *Tribulus terrestris* (puncturevine)

Introduction

Research conducted by Glen Canyon Environmental Studies and Grand Canyon Monitoring and Research Center over the last 30 years has shown that vegetation in the Colorado River Corridor below Glen Canyon Dam is directly affected by dam operations. Daily, weekly, and longer-term fluctuations in water levels as well as high-flow experiments (HFEs) affect colonization, survivorship rates, and growth of riparian plant species. Steady high and low flows also effect species, through dewatering, scouring, and drowning. Of particular concern, dam operations have been linked directly to establishment and spread of numerous invasive nonnative species, such as tamarisk (*Tamarix ramosissima*), Russian olive (*Elaeagnus angustifolia*) and Ravenna grass (*Saccharum ravennae*). These dam-vegetation response linkages were modeled as part of the Glen Canyon Dam Long Term Experimental and Management Plan Environmental Impact Statement (LTEMP EIS – U.S. Department of Interior, 2016a) process.

The LTEMP EIS evaluated dam operations on riparian vegetation health along the river corridor, with modeling results suggesting long-term declines, particularly in native plant communities. These long-term effects are also likely to have significant impacts at higher trophic levels such as wildlife communities and species, as well as numerous ecosystem processes. With operational flows limited to less than 45,000 cubic feet per second (CFS), the overall extent and health of the riparian areas in Grand Canyon National Park (GRCA) has and will continue to be altered, and non-native vegetation and monoculture species are predicted to increase.

The Grand Canyon Protection Act (U.S. Department of the Interior, 1992) states that the federal agencies must protect, mitigate, and improve conditions, including riparian vegetation, within GRCA and Glen Canyon National Recreation Area (GLCA) affected by dam operations. The experimental vegetation treatments addressed in this annual report will fulfill a meaningful part of these requirements.

This annual report summarizes the LTEMP Non-Flow Vegetation Treatment Actions to Mitigate Glen Canyon Dam Operation Impacts that were implemented by GRCA and partners along the Colorado River in GRCA in FY2020. The Glen Canyon Dam Adaptive Management Program Triennial Budget and Work Plan – Fiscal Years 2018 – 2020 Project Number and Element addressed by this project is C.7 Experimental Vegetation Treatment, and the LTEMP Resource Goal addressed by this project is Riparian Vegetation. This project is conducted under Interagency Agreement (IA) R18PG00066.

Objectives

The five major objectives of this project as it was originally conceived and as it was codified in Section 6.4 of the LTEMP ROD (U.S. Department of Interior, 2016b) are:

1. Control non-native plant species affected by dam operations, including tamarisk and other highly invasive species;
2. Develop native plant materials for replanting through partnerships and the use of regional greenhouses;
3. Replant native plant species to priority sites along the river corridor, including native species of interest to Tribes;
4. Remove vegetation encroaching on campsites; and
5. Manage vegetation to assist with cultural site protection.

Methods

Project Area

The project area within GRCA occurs along the Colorado River from the Paria Riffle (RM 0.9) to Pearce Ferry (RM 279.5 L). All experimental vegetation treatments were implemented within the Colorado River Ecosystem area influenced and affected by dam operations. Table 1 lists the experimental vegetation treatments implemented organized by project objective. In FY2020, project objectives were addressed at 51 sites. The Results section summarizes trip accomplishments by project objective.

Site Selection Process

The site selection process, which varies by project objective, is further described below.

1. Control non-native plant species affected by dam operations
 - a) Priority treatment sites contain non-native plant species affected by dam operations (e.g. tamarisk, Russian olive, ravennagrass, camelthorn [*Alhagi maurorum*], etc.) that are also listed as “high priorities” for control in the GRCA Exotic Plant Management Plan (NPS 2009). Site selection also considers the presence of high resource values (for example habitat for southwestern willow flycatcher, northern leopard frog, etc.) and potential for native plant restoration.
2. Develop native plant materials for replanting through partnerships and the use of regional greenhouses
 - a) Restoration of Goodding’s willow (*Salix gooddingii*) and several other native species including culturally significant plant species will be used in native plant restoration actions.
3. Replant native plant species to priority sites along the river corridor, including native species of interest to Tribes
 - a) Potential restoration sites may build on past native replanting efforts, include sites/areas that benefit federally listed species, and/or include sites where tamarisk is significantly declining due to tamarisk leaf beetle (*Diorhabda* spp.) impacts. Accessibility (e.g. reachable by foot) is another criterion important for restoration sites.
4. Remove vegetation encroaching on campsites
 - a) The park maintains a list of known campsites that identifies those that have encroachment where treatment would result in reclaiming campable area. In addition, the park consults with river guides on recommendations for additional sites.
5. Manage vegetation to assist with cultural site protection
 - a) GCMRC recommends sites to the National Park Service (NPS) based on a review of the known archaeological sites combined with historical information about vegetation encroachment, beach building potential, site specific wind direction information and availability of existing monitoring data.

Table 1. Experimental Vegetation Treatments Implemented in FY2020

Project Objective	Treatment Type	Treatment Type Description
1. Control Non-Native Plant Species Affected by Dam Operations	Cultural	Prevention (e.g., education/outreach)
	Mechanical/Manual	Prune, cut, pull, dig (e.g., using hand tools); dispose (e.g., scatter and/or dump in river)
	Chemical	Herbicide applications (e.g., spot spray, treat cut stumps, snip and drip); herbicide mixture: 9.4% imazapyr was used to treat camelthorn, Russian olive, Russian knapweed, and perennial pepperweed
	Biological	Biological control agents (i.e., already established for tamarisk). The tamarisk leaf beetle was first detected in GRCA in 2009. The tamarisk leaf beetle and its larvae feed on the leaves of tamarisk and can significantly weaken the plant.
2. Develop Native Plant Materials	Cultural, Mechanical/Manual	Propagule collection, storage, propagation, and transportation (i.e. cuttings collection)
3. Replant Native Plant Species at Priority Sites	Cultural, Mechanical/Manual	GRCA staff identified five potential riparian restoration sites. No planting, seeding, mulching, etc. occurred
4. Remove Vegetation Encroaching on Campsites	Cultural	Prevention (e.g., education/outreach)
	Mechanical/Manual	Prune, cut, pull, dig (e.g., using hand tools); dispose (e.g., scatter and/or dump in river)
	Chemical	Herbicide applications (e.g., spot spray, treat cut stumps, snip and drip); herbicide mixture: 9.4% imazapyr was used to treat arrowweed and camelthorn
	Biological	Biological control agents (i.e., already established for tamarisk). The tamarisk leaf beetle was first detected in GRCA in 2009. The tamarisk leaf beetle and its larvae feed on the leaves of tamarisk and can significantly weaken the plant.
5. Manage Vegetation to Assist with Cultural Site Protection	Cultural	Prevention (e.g., education/outreach), smother (e.g. plastic), mulch, spot burn, plant natives (e.g. to form dense cover, see below)
	Mechanical/Manual	Prune, cut, pull, winch, dig, hoe (e.g., using hand or power tools); dispose (e.g., scatter, pile, burn, dump in river) (may include removal of live/dying/dead tamarisk)
	Chemical	Herbicide applications (e.g., spot spray, basal bark application, treat cut stumps, hack and squirt methods)
	Biological	Biological control agents (i.e., already established for tamarisk). The tamarisk leaf beetle was first detected in GRCA in 2009. The tamarisk leaf beetle and its larvae feed on the leaves of tamarisk and can significantly weaken the plant.

Monitoring

Monitoring for this project has been partially formal and partially informal and is still in development; however, NPS and GCMRC are committed to formalizing monitoring for this project during the FY2021-2023 triennial workplan period.

Control Non-Native Plant Species Affected by Dam Operations

Evaluating non-native plant treatment success includes species cover estimates, and surveys to detect the presence of new invasive species. Recommended monitoring timelines often vary by species. For example, for camelthorn at least three years of consistent treatment is required before results can be measured. If monitoring reveals that treatments were not effective additional invasive plant treatments will be implemented. Treatment success is described in Table 2. In FY2021, the sites listed in Table 2 will be revisited, retreated (if necessary), and treatment success will be re-evaluated.

Table 2. Success of Non-Native Plant Treatments (FY2019 – FY2020)

Location	Treatment Method/s	Species Treated	# Treated in FY2019	# Treated in FY2020	Measure of Success
Cardenas	Snip-and-drip or foliar herbicide application (9.4% imazapyr). The snip-and-drip treatment method combines cutting with herbicide application	Perennial pepperweed	2,076	460	81.9% reduction in population
Cardenas	Cut-stump treatment method combines cutting with herbicide application (9.4% imazapyr)	Tamarisk	170	8	95.5% reduction in population
Mohawk	Snip-and-drip (9.4% imazapyr)	Camelthorn	2,169	1,500	59.4% reduction in

					population
Truck Seat	Snip-and-drip (9.4% imazapyr)	Camelthorn	1,050	495	67.9% reduction in population

In FY2021, GCMRC and NPS may install study plots at one or more locations to evaluate the effectiveness of treatment methods (e.g. snip-and-drip vs. foliar application, involving multiple herbicide formulations) for controlling camelthorn, arrowweed (*Pluchea sericea*), and/or Russian knapweed (*Acroptilon repens*).

Remove Vegetation Encroaching on Campsites

The success of vegetation treatments to increase campable areas is evaluated annually through pre- and post-treatment data collections. At each target campsite (10 sites on FY2020), 16 transects radiating from the geographic center of the primary common area of the campsite were installed at compass bearings of 0, 23, 45, 68, 90, 113, 135, 158, 180, 203, 225, 248, 270, 293, 315, and 338 degrees (Cameron, 2014). GPS coordinates were recorded for the center point. The following data was recorded along each transect line pre- and post-treatment: distance to the first significant occurrence of vegetation that established the edge of the campable open space, rock obstructions limiting the campable barren core, or the 25K CFS flow line of the river (Cole and Hall, 1992). The center point previously used for establishing transects will be relocated during subsequent visits for monitoring. Treatment success will be evaluated annually for 2 years post-treatment and the need for additional treatments will be assessed based on these results. Prior to the 2021 field season, the 2019 and 2020 pre- and post-treatment data will be analyzed and summarized.

Manage Vegetation to Assist with Cultural Site Protection

GCMRC used repeat ground-based light detection and ranging (lidar) surveys to measure changes in geomorphic condition of archaeological sites (Kasprak and others, 2017; Collins and others, 2008, 2009, 2012, 2014, 2016; East and others, 2016, 2017; Sankey and others, 2018a, b). GCMRC selected sites for lidar measurements from the entire population of river corridor sites using two site classification systems (East and others, 2016; 2017) that characterize the extent to which each site is: i) degraded by gully erosion, and ii) optimally positioned within the landscape to be resupplied with sand transferred from adjacent sandbars.

At the completion of the Glen Canyon Dam Adaptive Management Program Triennial Budget and Work Plan – Fiscal Years 2018-2020, the sample size of sites where lidar surveys have been conducted is ~30 sites (Caster and others, *in review*). During the FY2021-23 TWP, GCMRC will revisit all 30 sites, conduct lidar surveys, quantify changes in geomorphic condition, and relate any changes that are detected to dam operations; specifically, GCMRC will relate changes to the occurrence and timing of HFEs. These monitoring data will also be leveraged, as described below, to evaluate vegetation management implemented by NPS under the LTEMP.

In 2019 and 2020, the NPS implemented experimental vegetation removal treatments on sandbars adjacent to five archaeological sites (i.e. RM 24.5 L, Basalt [RM 70.1 R] , RM 122 R, Mohawk [RM 172.0 L], and RM 223.5 R). The treatments were intended to increase the supply of sand from the sandbars to the archaeological sites. In 2020, the NPS conducted maintenance at the sandbars to remove any vegetation regrowth. The NPS will revisit the sites to remove any vegetation regrowth in each year of the Glen Canyon Dam Adaptive Management Program Triennial Budget and Work Plan – Fiscal Years 2021 – 2023 under Reclamation Project C.7.-C.8. GRCA and GLCA Experimental Vegetation Treatment.

In this project, in addition to monitoring the geomorphic condition of archaeological sites, GCMRC will quantitatively evaluate the outcome and effectiveness of those vegetation management treatments. Lidar surveys acquired before and after the vegetation removal treatments, and after each annual site maintenance visit by the NPS, provide datasets for geomorphic change detection (Kasprak and others, 2017; Sankey and others, 2018b; Caster and others, *in review*) from which GCMRC will determine whether sediment transfer occurs and increases at the sites as a function of the vegetation removals. In addition to quantifying sediment transfer, GCMRC will use the lidar surveys and field observations, as well as remote monitoring cameras that exist at some of the sites, to quantify the vegetation that is removed and regrows during each year of the experiment. Figure 1 shows examples of photos and lidar data acquired before and after the removal of vegetation in 2019 at one of the sites.

GCMRC will evaluate the effects of vegetation removal for sediment transfer in several ways at the experiment sites. At many of the sites, multiple years of lidar surveys exist during the decade preceding the vegetation removal treatments. Thus, GCMRC can use those data to evaluate sediment transfer before and after the vegetation treatments, including years during which HFEs were and were not conducted. As described above, GCMRC will have comparable lidar survey datasets for a sample of 30 sites which can be used as experimental controls to measure sediment transfer at sites where vegetation has not been removed. GCMRC hypothesizes that sediment transfer at the experiment sites will be greater under the combined effects of vegetation removal followed by an annual HFE. No HFE was conducted in 2019 or 2020 and thus the first two years of the experiment will provide insight to the effects of removing vegetation on sandbars that were not resupplied with sediment from an HFE. Future HFEs that may be conducted in 2021-2022 and provide insight concerning effects of vegetation removal followed by an annual HFE. In FY2023, the last year of this TWP, GCMRC plans to report on the outcome of the experiment, and effectiveness of the vegetation removal treatments implemented through FY2022.

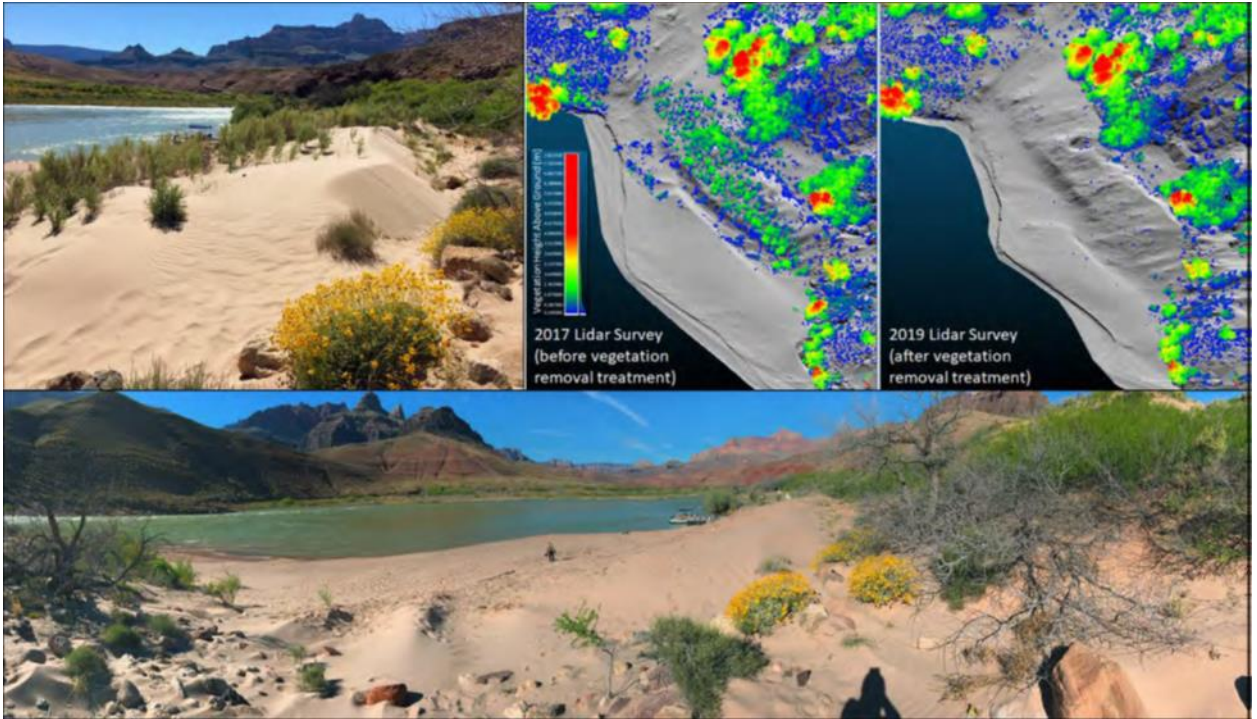


Figure 1. Photos illustrating vegetation removal implemented at one of the sites by NPS in 2019, and examples of lidar data that will be used to evaluate treatment effects. Top left panel shows the sandbar and dune immediately prior to vegetation removal in April 2019. Bottom panel shows the sandbar, dune, and surrounding landscape immediately after the vegetation removal in April 2019. Top middle and right panels show lidar-derived digital elevation models (DEM; gray surface) and vegetation canopy height models (CHM; blue-green-red surface) acquired before and after the vegetation removal.

Results

The site selection process for each project objective is described under the Methods section.

Control Non-Native Plant Species Affected by Dam Operations

GRCA and partners treated invasive non-native plant species affected by dam operations on two river missions (i.e. 08/29/2020 – 09/05/2020 and 09/12/2020 – 09/27/2020). Table 2 provides a brief summary of river mission accomplishments, and additional accomplishments are highlighted in Appendix B, Tables 5 and 6. In FY2021, the sites treated in FY2020 will be revisited and retreated (if necessary).

Due to time constraints, at 12 locations, we mapped, but did not treat, 3 Russian olive, 14,553 camelthorn, 1,650 pepperweed (*Lepidium* spp.), and 400 Russian knapweed. These documented infestations will be incorporated into future treatment plans (FY2021 – FY2023).

Table 3. Control Non-Native Plant Species Affected by Dam Operations – Summary by Trip

Mission Dates	Treatment Method/s	# of Sites Treated	Species Treated	# of Plants Treated	Area Treated (Square Meters)
08/29/2020 – 09/05/2020	Cut-stump and snip-and-drip treatment methods combine cutting with herbicide application (9.4% imazapyr)	17	Russian olive and camelthorn	958	4,841.9
09/12/2020 – 09/27/2020	Cut-stump or snip-and-drip treatment methods combine cutting with herbicide application (9.4% imazapyr)	7	Tamarisk, camelthorn, Russian knapweed	3,128	22,828
09/12/2020 – 09/27/2020	Foliar herbicide application (9.4% imazapyr)	1	Perennial pepperweed	460	938
09/12/2020 – 09/27/2020	Mechanical (i.e. digging, pulling)	2	Ravenna grass, Pampas grass	2	6

Develop Native Plant Materials for Replanting

Over the course of two river missions, GRCA, GCMRC, and GLCA staff collected native plant materials (see Appendix B, Tables 4 and 7) at 6 sites (i.e. RM 71.4, RM 93.8, RM 248.7, RM 269.9, RM 274.3, RM 275.2) for future riparian restoration actions. All cuttings (i.e. 166 Goodding’s willow and 10 Fremont cottonwood) were 30 cm to 60 cm long, approximately 0.64 cm in diameter, and relatively freshly grown branches. The cuttings are currently housed in the GRCA Greenhouse. Future native plant material collection and propagation actions will be described in detail in upcoming revegetation plans.

Replant Native Plant Species to Priority Sites along the River Corridor, Including Native Species of Interest to Tribes

In FY2020, no out-planting occurred, but GRCA did identify the following five potential native plant restoration sites: Cardenas (RM 71.7 L), Granite (RM 93.8 L), 243.2 Mile (RM 243.2 R), Surprise Canyon (RM 248.7 R), and GCY (RM 274.3 L). In the past, GRCA staff and partners conducted riparian restoration actions at Cardenas and Granite, and the park is considering expanding restoration efforts at these two sites. During the restoration site selection process, GRCA and partners are evaluating the number of LTEMP priorities and other resource management factors that are relevant at each potential restoration site.

On 02/10/2020, GRCA, GLCA, and GCMRC staff met with a Hualapai Tribe Cultural Resource Specialist and discussed site selection (e.g. invasive plant treatment, revegetation, cultural resource protection, etc.), culturally significant plant species for native plant restoration efforts, and engaging tribal youth in project implementation.

In FY2021, revegetation plans will be developed for one or more locations. On-the-ground native plant restoration actions (i.e. out-planting, seeding, mulching, fencing, etc.) will likely begin in FY2023.

Remove Vegetation Encroaching on Campsites

GRCA and GCMRC staff utilized mechanical and chemical control methods to treat vegetation (i.e. arrowweed, camelthorn, Russian thistle, puncturevine, and tamarisk) encroaching on campable areas (see Appendix B, Table 6) at 10 sites (i.e. RM 37.9 L, RM 72.7 L, RM 76.1 L, RM 77.1 L, RM 108.4 L, RM 202.4 R, RM 243.2 R, RM 243.2 R, RM 248.7 R, and RM 274.3 L). At each encroachment mitigation site, pre- and post-treatment data was collected to evaluate treatment success. In FY2021, the FY 2019 and FY 2020 pre- and post-treatment data will be analyzed, summarized, and included in the next annual report. In FY2021, the sites treated in FY2020 will be revisited, monitored, and retreated (if necessary).

Manage Vegetation to Assist with Cultural Site Protection

GRCA and GCMRC staff implemented experimental vegetation removal treatments intended to increase the aeolian transport of Colorado River sediment, deposited by HFEs, to archaeological sites. At the following five sites (see Appendix B, Table 6 for additional details), we utilized mechanical and chemical methods to treat invasive plant species (i.e. arrowweed, camelthorn, and tamarisk) to assist with cultural site protection: RM 25.0 L, RM 70.1 R, RM 122.8 R, RM 172.0 L, and RM 223.5 R.

Tribal Youth Involvement

GRCA and Arizona Conservation Corps (AZCC) entered into a Task Agreement (P19AC00942) to engage tribal youth in project implementation. Due to the COVID-19 pandemic, GRCA made the difficult decision to cancel AZCC involvement in this project in FY2020. Engaging Tribal youth in natural resource stewardship and environmental education is very important to GRCA and we look forward to providing these experiences when the pandemic subsides.

Supplemental Funding Contributions

GRCA continues to seek additional funding to support additional vegetation work through various NPS fund sources. In FY2022, NPS funding (\$74,944.80) has been secured to engage Veterans (35 years of age or under) in LTEMP experimental vegetation treatments .

Partnerships

GRCA continued to seek and develop partnerships to foster adult and youth involvement in this project. Grand Canyon Youth, Catena Foundation, and GRCA entered into discussions focused on increasing project involvement from underserved and underrepresented youth groups. River guides and GRCA discussed partnering on an Adopt-a-Camp program that would engage river guides and the public in experimental vegetation treatment actions such as invasive non-native plant control.

2021 River Mission Proposals

In August of 2020, the GRCA Vegetation Program submitted seven GRCA Administrative River Mission Proposals for consideration. If approved, these missions will engage multiple partners in LTEMP experimental vegetation treatments as outlined in Interagency Agreement R18PG00066.

Conclusions

Collaboration between governmental entities enabled the collective to address four of the five major objectives of this project. Replanting native plant materials at priority sites (IA Task 4.1) did not occur, but native plant materials were collected and are propagating in the GRCA greenhouse.

This project is ripe for public engagement and multiple partnerships between governmental and non-governmental organizations are necessary to accelerate project objective accomplishments and advance towards GRCA Desired Conditions (Appendix C, Table 8). Potential future project sites are addressed in Appendix D.

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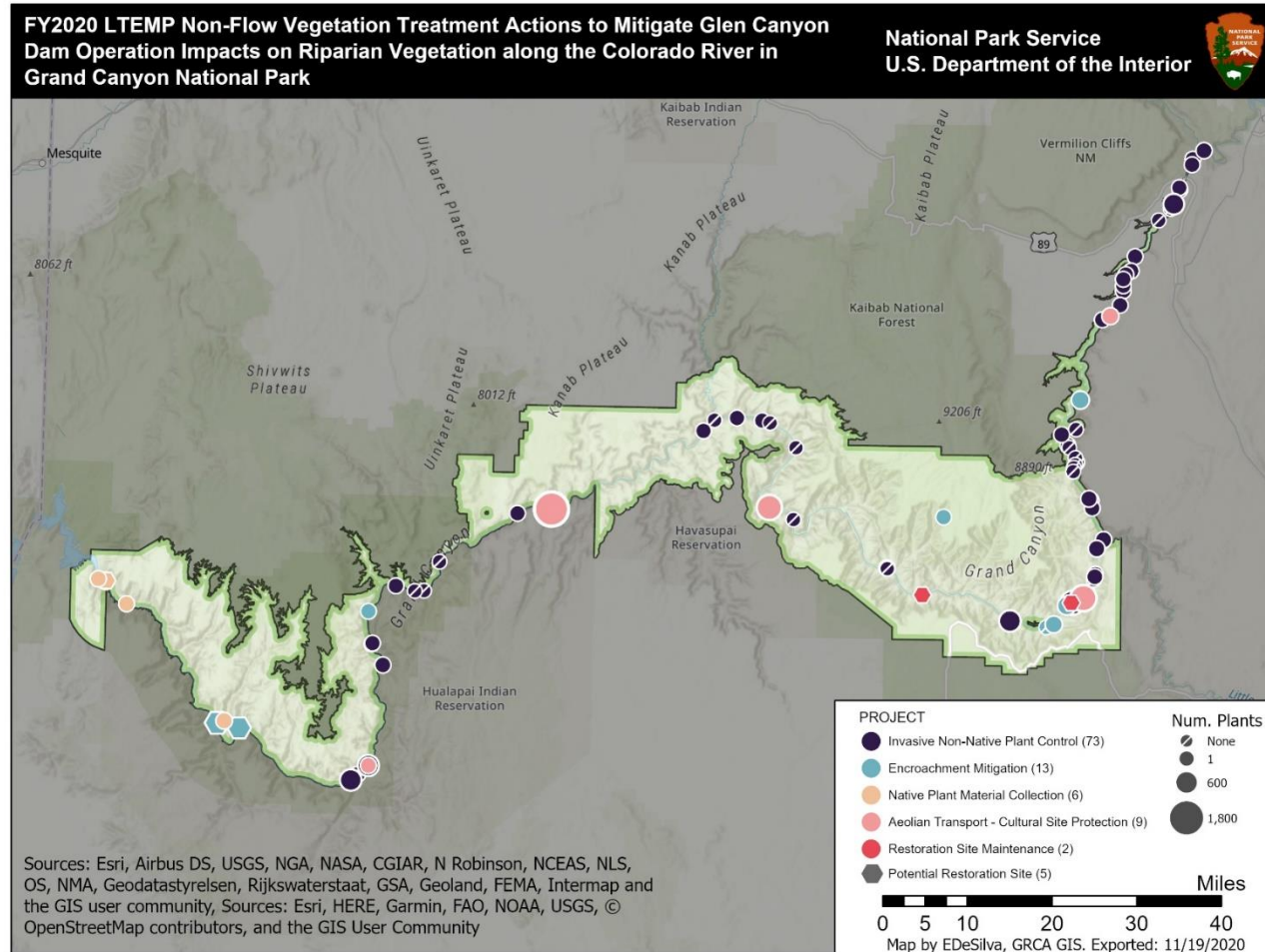
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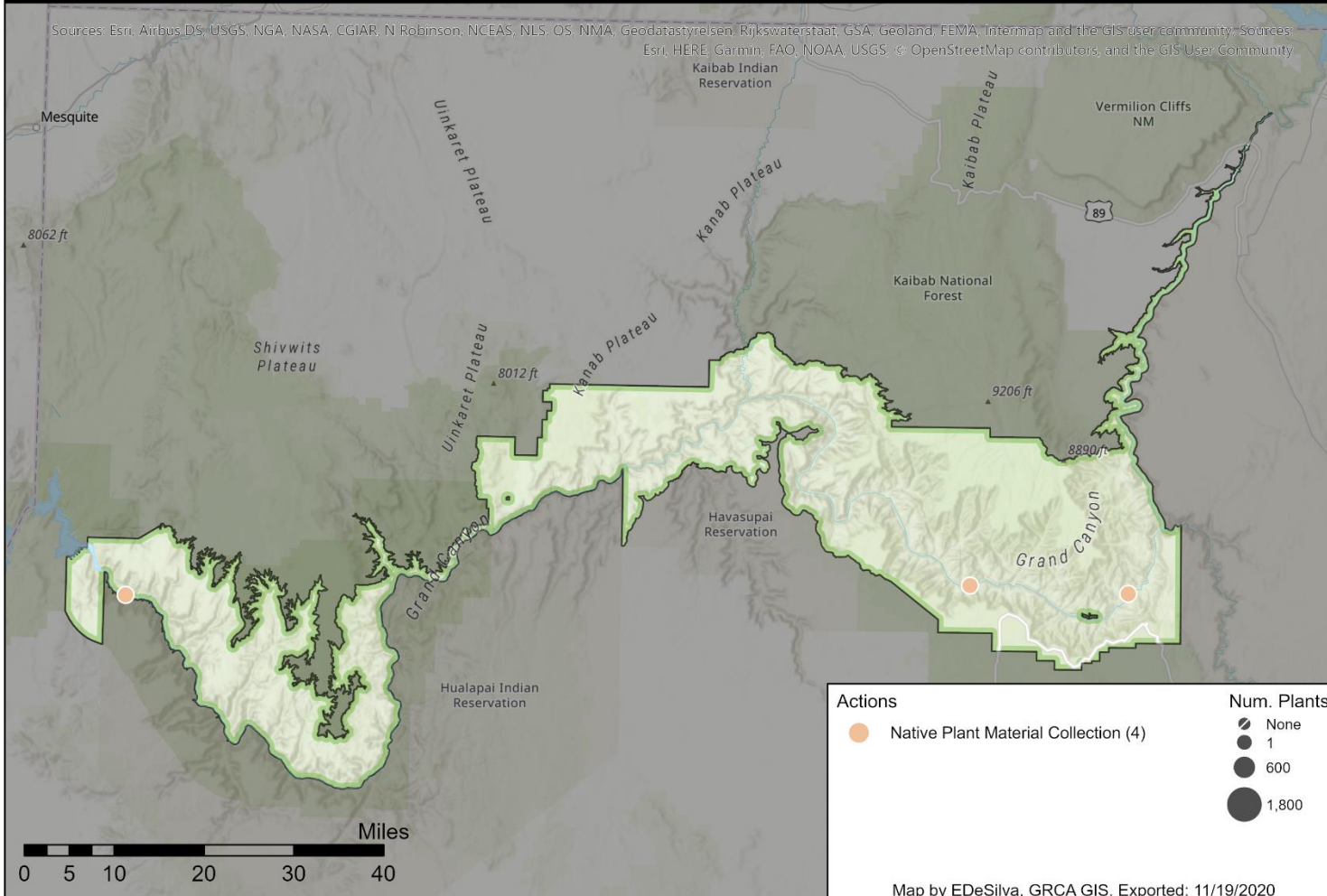
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Appendix A: Site Maps



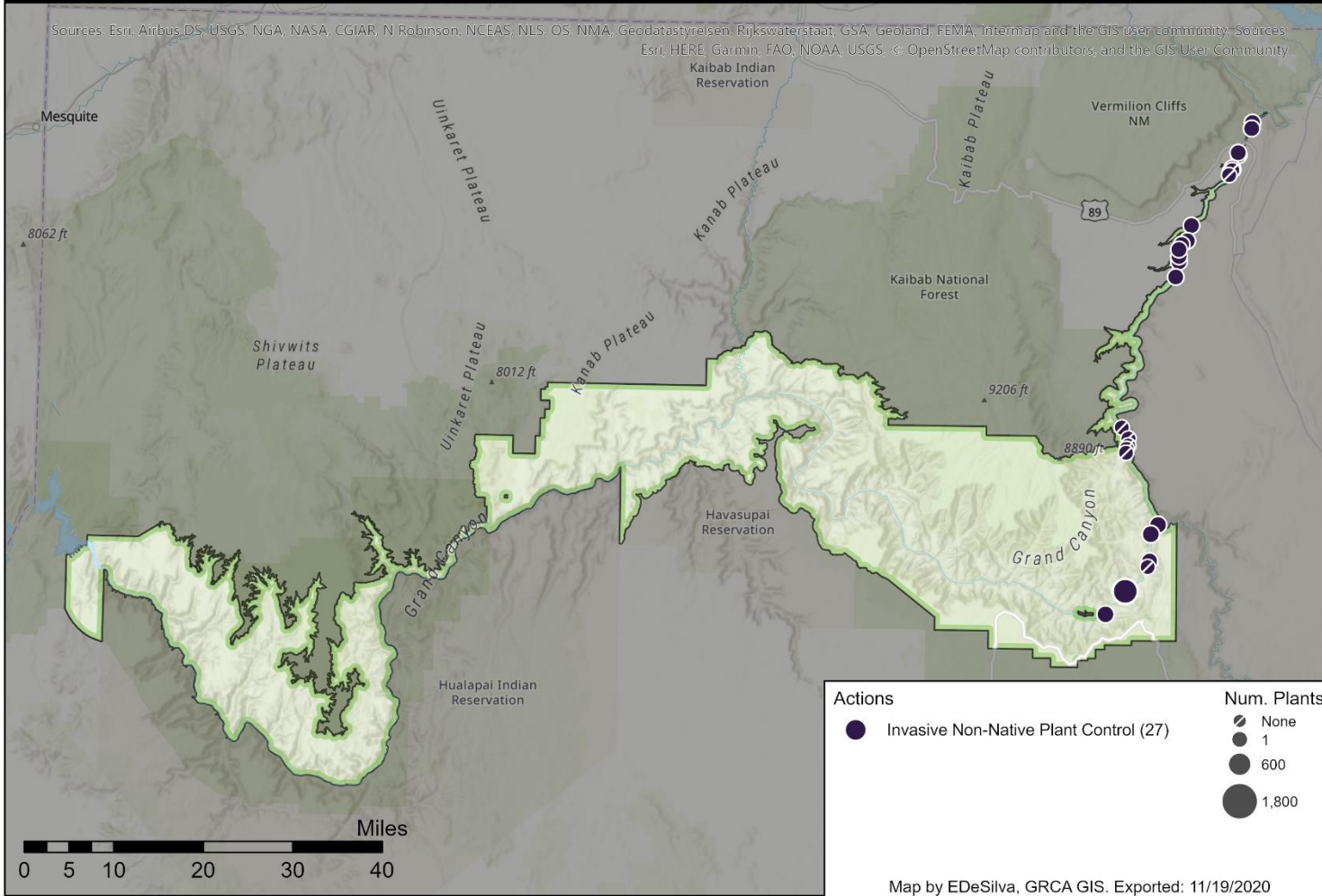
LTEMP Non-Flow Vegetation Treatment Actions to Mitigate Glen Canyon Dam Operation Impacts on Riparian Vegetation along the Colorado River in Grand Canyon National Park
River Mission Dates: 20200826-20200911

National Park Service
U.S. Department of the Interior



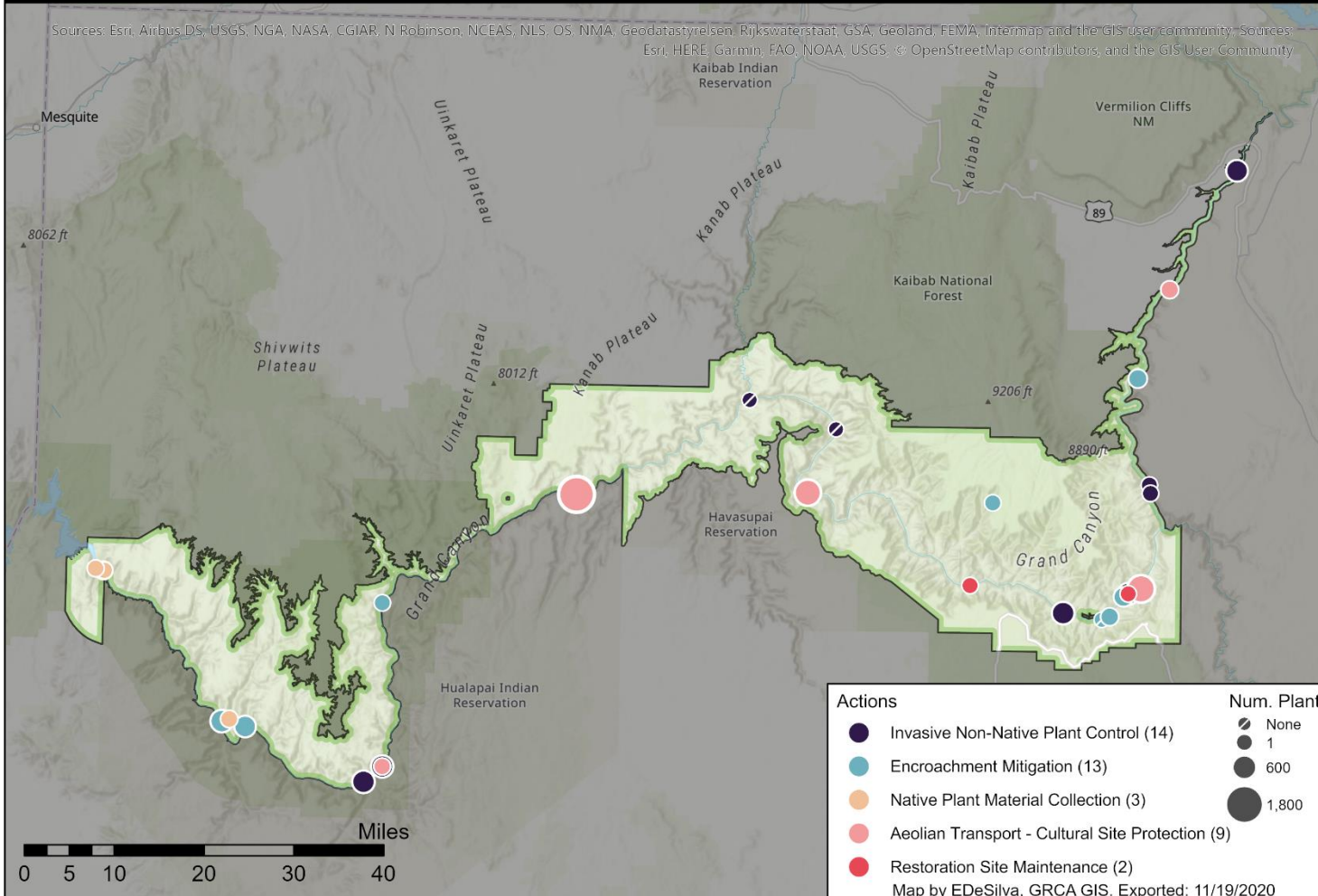
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River Mission Dates: 20200829-20200905

National Park Service
U.S. Department of the Interior



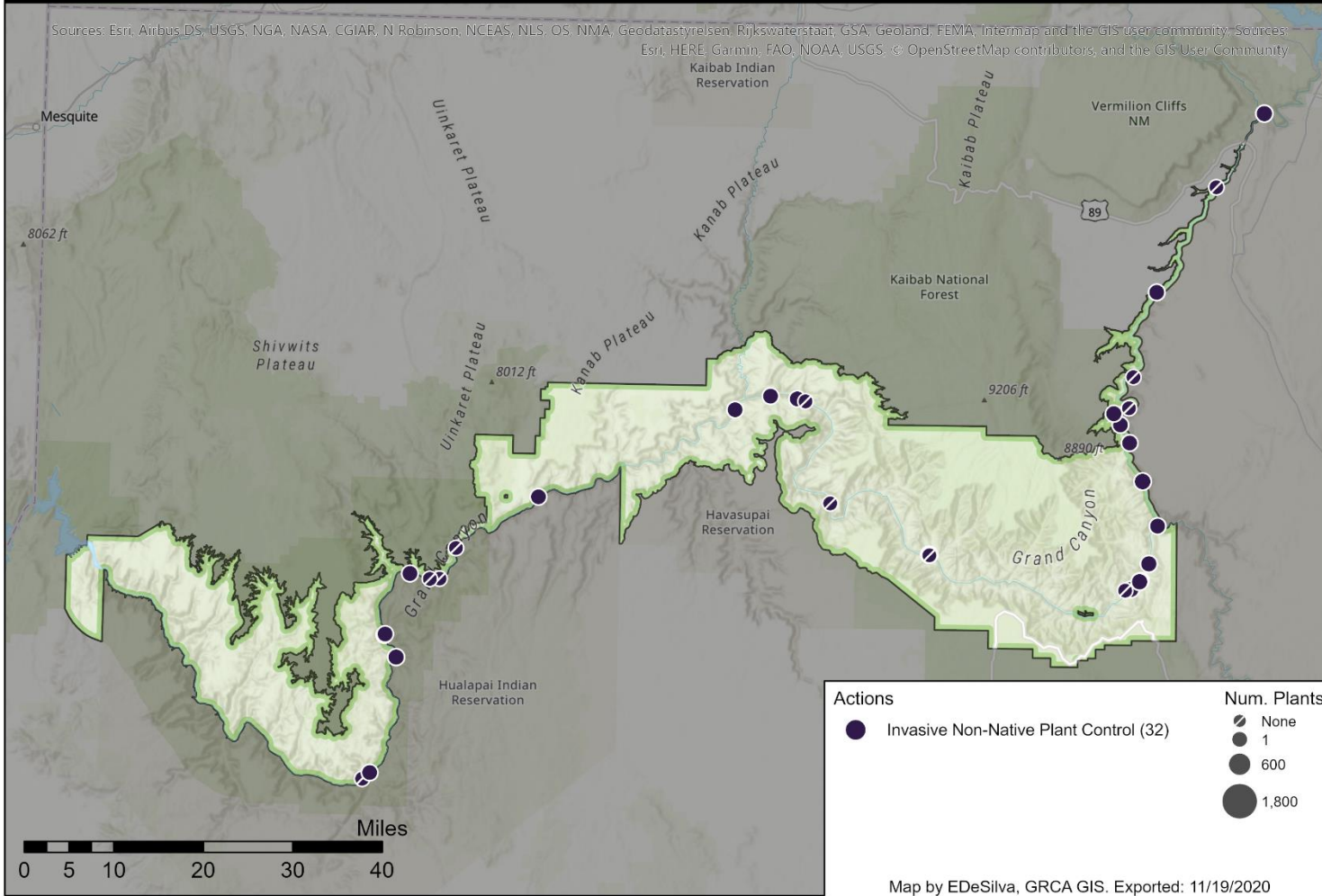
LTEMP Non-Flow Vegetation Treatment Actions to Mitigate Glen Canyon Dam Operation Impacts on Riparian Vegetation along the Colorado River in Grand Canyon National Park
 River Mission Dates: 20200912-20200927

National Park Service
 U.S. Department of the Interior



LTEMP Non-Flow Vegetation Treatment Actions to Mitigate Glen Canyon Dam Operation Impacts on Riparian Vegetation along the Colorado River in Grand Canyon National Park
River Mission Dates: 20201004-20201016

National Park Service
U.S. Department of the Interior





Status of Riparian Restoration Out-Plantings at Granite Camp (RM 93.8 L)
Date of Assessment: 09/18/2020
Grand Canyon National Park

National Park Service
U.S. Department of the Interior



Appendix B: Experimental Vegetation Treatment Logs

**Table 4. Trip Name: Grand Canyon Monitoring and Research Center (GCMRC) Terrestrial Vegetation Monitoring
Trip Dates: 08/26/2020 – 09/11/2020**

DATE	TASK	LOCATION	UTM EASTING	UTM NORTHING	RIVER MILE	RIVER SIDE	USDA SPECIES CODE	# OF CUTTINGS COLLECTED
8/30/2020	Native Plant Material Collection	Cardenas Marsh	421959	3993909	71.4	L	SAGO	12
9/2/2020	Native Plant Material Collection	Granite	393612	3995398	93.8	L	SAGO	10
9/2/2020	Native Plant Material Collection	Granite	393612	3995398	93.8	L	POFR2	10
9/10/2020	Native Plant Material Collection	Travertine Grotto	242341	3993736	269.9	R	SAGO	12

Table 5. Trip Name: LTEMP Vegetation Mitigation
Trip Dates: 08/29/2020 – 09/05/2020

DATE	TASK	LOCATION	UTM EASTING	UTM NORTHING	RIVER MILE	RIVER SIDE	SPECIES CODE	CONTROL METHOD	# OF PLANTS TREATED	# OF PLANTS MAPPED
8/29/2020	Invasive Non-Native Plant Control	ELAANG 2.0R	445072	4078304	2.0	R	ELAN	Chemical	1	
8/29/2020	Invasive Non-Native Plant Control	Cathedral Wash	444918	4077246	2.8	R	ELAN	Chemical	5	
8/29/2020	Invasive Non-Native Plant Control	6 Mile	442504	4072887	5.9	R	ELAN	Chemical	3	
8/29/2020	Invasive Non-Native Plant Control	6 Mile River Right	442588	4072469	6.2	R	ELAN	Chemical	1	
8/29/2020	Invasive Non-Native Plant Control	Badger	441450	4070080	7.9	R	ELAN	Chemical	4	
8/29/2020	Invasive Non-Native Plant Control	Jackass Canyon	441504	4069894	8.0	L	ELAN	Chemical	3	
8/29/2020	Invasive Non-Native	Jackass Canyon	441444	4069754	8.1	L	ACRE3	Untreated		

	Plant Control									400
8/29/2020	Invasive Non-Native Plant Control	8.3 Mile River Right	441086	4069406	8.4	R	ELAN	Chemical	2	
8/29/2020	Invasive Non-Native Plant Control	8.4 Mile River L	440859	4068856	8.4	L	ELAN	Untreated		3
8/30/2020	Invasive Non-Native Plant Control	Across from Hot Na Na	434095	4059783	16.6	R	ELAN	Chemical	1	
8/30/2020	Invasive Non-Native Plant Control	ELAANG 18.4R	433353	4057032	18.4	R	ELAN	Chemical	1	
8/30/2020	Invasive Non-Native Plant Control	ELAANG 19.1L	432329	4056360	19.1	L	ELAN	Chemical	1	
8/30/2020	Invasive Non-Native Plant Control	ELAANG 19.9R	431842	4055460	19.9	R	ELAN	Chemical	3	
8/30/2020	Invasive Non-Native Plant Control	Above North Canyon	431850	4054222	20.5	R	ELAN	Chemical	2	

8/30/2020	Invasive Non-Native Plant Control	ELAANG 21.4R	431857	4053252	21.4	R	ELAN	Chemical	1	
8/30/2020	Invasive Non-Native Plant Control	ELAANG 23.2L	431263	4050516	23.2	L	ELAN	Chemical	1	
9/2/2020	Invasive Non-Native Plant Control	48.8 Mile Right	421562	4023429	48.8	R	LEPID	Untreated		300
9/2/2020	Invasive Non-Native Plant Control	Below Dinosaur	422764	4021450	50.3	R	LEPID	Untreated		>1,000
9/2/2020	Invasive Non-Native Plant Control	51.2 Mile Right	422724	4020177	51.2	R	LEPID	Untreated		200
9/2/2020	Invasive Non-Native Plant Control	51.6 Mile Right	422433	4019597	51.6	R	LEPID	Untreated		50
9/2/2020	Invasive Non-Native Plant Control	Above Little Nankoweap	422322	4018876	52.0	R	LEPID	Untreated		100
9/3/2020	Invasive Non-Native	Above LCR	428092	4005907	61.6	R	ALMA12	Chemical	61	

	Plant Control									
9/3/2020	Invasive Non-Native Plant Control	Crash Canyon	426780	4004217	62.7	R	ALMA12	Chemical	84	
9/3/2020	Invasive Non-Native Plant Control	Palisades	426562	3999385	66.1	R	ALMA12	Untreated		1,500
9/3/2020	Invasive Non-Native Plant Control	Above Espejo	426218	3998309	66.8	L	ALMA12	Untreated		2,500
9/3/2020	Invasive Non-Native Plant Control	Cardenas	422180	3993936	71.6	L	ALMA12	Chemical	713	787
9/3/2020	Invasive Non-Native Plant Control	Nevills	418630	3989801	76.1	L	ALMA12	Chemical	71	

Table 6. Trip Name: LTEMP Vegetation Mitigation

Trip Dates: 09/12/2020 – 09/27/2020

DATE	TASK	LOCATION	UTM EASTING	UTM NORTHING	RIVER MILE	RIVER SIDE	SPECIES CODE	CONTROL METHOD	# OF PLANTS TREATED	# OF PLANTS MAPPED
9/12/2020	Invasive Non-Native Plant Control	Jackass Canyon	441444	4069754	8.1	L	ACRE3	Chemical	423	
9/13/2020	Aeolian Transport - Cultural Site Protection	24.5 Mile	429382	4048439	25.0	L	TARA	Chemical	107	
9/13/2020	Encroachment Mitigation - Campsites	Tatahatso	423675	4032486	37.9	L	SATR12	Mechanical	186	
9/14/2020	Invasive Non-Native Plant Control	Kwagunt	425743	4013410	56.5	R	SARA3	Mechanical	1	
9/14/2020	Invasive Non-Native Plant Control	57.6L	425939	4011917	57.6	L	COJU2	Mechanical (removed seed heads)	1	
9/14/2020	Aeolian Transport - Cultural Site Protection	Basalt	424247	3994807	70.1	R	PLSE	Chemical	481	
9/15/2020	Aeolian Transport - Cultural Site Protection	Basalt	424247	3994807	70.1	R	PLSE	Mechanical	900	

9/15/2020	Aeolian Transport - Cultural Site Protection	Basalt	424247	3994807	70.1	R	TARA	Chemical	266	
9/15/2020	Invasive Non-Native Plant Control	Cardenas	422047	3993920	71.6	L	TARA	Chemical	8	
9/15/2020	Invasive Non-Native Plant Control	Cardenas	422180	3993936	71.6	L	ALMA12	Chemical	26	
9/15/2020	Invasive Non-Native Plant Control	Cardenas	421959	3993909	71.7	L	LELA2	Chemical	460	
9/15/2020	Restoration Site Maintenance	Cardenas	421959	3993909	71.7	L	PLSE	Mechanical	Unknown	
9/16/2020	Encroachment Mitigation - Campsites	Unkar Left	421091	3993359	72.7	L	ALMA12	Chemical	245	
9/16/2020	Encroachment Mitigation - Campsites	Nevills	418630	3989801	76.1	L	ALMA12	Chemical	124	
9/17/2020	Encroachment Mitigation - Campsites	Hance	417205	3989261	77.1	L	PLSE	Mechanical	Unknown	
9/17/2020	Invasive Non-Native Plant Control	Grapevine	410293	3990457	81.7	L	ALMA12	Chemical	500	
9/17/2020	Invasive Non-Native Plant Control	Grapevine	410230	3990482	81.7	L	ALMA12	Chemical	175	

9/18/2020	Restoration Site Maintenance	Granite	393612	3995398	93.8	L	PLSE	Mechanical	Unknown	
9/18/2020	Invasive Non-Native Plant Control	Granite	393612	3995398	93.8	L	PLSE	Mechanical	Unknown	
9/19/2020	Encroachment Mitigation - Campsites	Ross Wheeler	397687	4010218	108.4	L	PLSE	Mechanical	Unknown	
9/19/2020	Aeolian Transport - Cultural Site Protection	122 Mile Canyon	364516	4012118	122.8	R	ALMA12	Chemical	115	
9/19/2020	Aeolian Transport - Cultural Site Protection	122 Mile Canyon	364550	4012054	122.8	R	PLSE	Chemical	800	
9/20/2020	Invasive Non-Native Plant Control	Stone Creek 1	369615	4023421	132.0	R	ALMA12	Untreated		1000
9/20/2020	Invasive Non-Native Plant Control	Kanab Camps East	354136	4028667	143.8	R	ALMA12	Untreated		8766
9/21/2020	Aeolian Transport - Cultural Site Protection	Mohawk	323121	4011749	172.0	L	PLSE	Chemical	221	
9/21/2020	Aeolian Transport - Cultural Site Protection	Mohawk	323121	4011749	172.0	L	PLSE	Mechanical	1579	

9/21/2020	Invasive Non-Native Plant Control	Mohawk	323121	4011749	172.0	L	ALMA12	Chemical	1024	
9/22/2020	Encroachment Mitigation - Campsites	Two Hundred and Two Mile	288329	3992303	202.4	R	PLSE	Mechanical	Unknown	
9/23/2020	Invasive Non-Native Plant Control	223.5 Mile Right	288306	3962972	223.5	R	ALMA12	Chemical	477	
9/23/2020	Aeolian Transport - Cultural Site Protection	223.5 Mile Right	288306	3962972	223.5	R	TARA	Chemical	34	
9/24/2020	Invasive Non-Native Plant Control	Truckseat	284955	3960219	226.3	R	ALMA12	Chemical	495	
9/24/2020	Encroachment Mitigation - Campsites	243 Mile	263990	3970386	243.0	R	TRTE	Mechanical	8	
9/24/2020	Encroachment Mitigation - Campsites	243.2 Mile	263752	3970135	243.2	R	ALMA12	Chemical	418	220
9/24/2020	Encroachment Mitigation - Campsites	243.2 Mile	263743	3970121	243.2	R	TARA	Chemical	5	
9/25/2020	Encroachment Mitigation - Campsites	Surprise Canyon	259565	3971108	248.7	R	SATR12	Mechanical	500	

9/26/2020	Encroachment Mitigation - Campsites	GCY	238370	3998112	274.3	L	TRTE	Mechanical	2	
9/26/2020	Encroachment Mitigation - Campsites	GCY	238396	3998115	274.3	L	TRTE	Mechanical	4	
9/26/2020	Encroachment Mitigation - Campsites	GCY	238380	3998111	274.3	L	TARA	Chemical	153	

Table 7. Trip Name: LTEMP Vegetation Mitigation

Trip Dates: 09/12/2020 – 09/27/2020

DATE	TASK	LOCATION	UTM EASTING	UTM NORTHING	RIVER MILE	RIVER SIDE	USDA SPECIES CODE	# OF CUTTINGS COLLECTED
9/26/2020	Native Plant Material Collection	Surprise Canyon	260897	3971484	248.7	R	SAGO	69
9/26/2020	Native Plant Material Collection	GCY	238517	3998143	274.3	L	SAGO	29
9/26/2020	Native Plant Material Collection	Columbine Falls	236980	3998491	275.2	L	SAGO	34

Appendix C. GRCA Desired Conditions

Table 8. All work for GRCA will be consistent with moving toward this desired condition from the GRCA Desired Conditions planning framework.

Indicator	Reference Condition	Target
Areal extent of vegetation	Tamarisk: 600 acres; Other / native: 1900 acres (Kearsley et al., 2015)	Tamarisk: 300 acres (decreasing); Other / native: 2000 acres (increasing)
Cover of native and non-native species (native vegetation types) (%)	71% native; 29% non-native (Kearsley et al., 2001-2005)	90% native 10% non-native
Richness of native species (%)	70% richness of native species (Kearsley et al., 2001-2005)	At least 85% richness of native species
Populations and areal extent (target only) of key rare plant species (#)	TBD (Phillips et al., 1987; herbarium collection through 2011)	# of populations and areal extent, by key species, are stable or increasing

Appendix D

Table 9. Potential LTEMP Experimental Vegetation Treatment Sites For FY 2021 – FY 2025

**Sites proposed for treatment in FY2021 are highlighted in teal.*

River Mile	River Side	Site Name	Tasks	River Mile	River Side	Site Name	Tasks
0.2	R	Below Lees Ferry	IP	54.9	R	No Name 54.8	IP
0.3	R	Lees Ferry Riverfront	IP	55.4	R	RM 55.4R	IP
0.3	L	RM 0.3L	IP	55.9	R	Kwagunt Marsh	IP
0.4	R	Fly Fisherman's Beach	IP	56.2 - 56.6	R	Kwagunt	EM/IP
0.8	R	Paria River Mouth	IP	57.6	L	RM 57.6L	IP
0.9	R	Paria Parking	IP	58.1	L	Opposite Malgosa	O
0.9	R	Paria River 1	IP	60.2	R	RM 60.0R	O
1.1	R	Paria Beach	IP	60.6	L	RM 60.6L	IP
1.7	R	Secret Beach	IP	TBD	TBD	Old Fish	IP
1.8	L	RM 1.6L	IP	61.1	R	RM 61.1R	IP
2.0	R	RM 2.0R	IP	61.6	R	Above LCR	IP
2.1	R	RM 2.1R	IP	61.8	L	LCR Day Use Area	IP
2.4	R	RM 2.2R	IP	61.8	L	Confluence Island	IP
2.4	L	RM 2.2L	IP	62.2	R	Below Little Colorado River	IP
2.8	R	Cathedral Wash	IP	62.6	R	Above Crash Canyon	IP
3.3	L	3.1 Mile Left Bar	IP	62.7	R	Crash Canyon	IP
3.3	L	3.1 Mile Left Bar	IP	65.9	R	Lava Canyon	O
4.0	R	RM 4.0R	IP	66.1	L	Palisades	EM/IP
4.4	R	Navajo Bridge River Right	IP	66.6	L	Below Palisades	IP
4.5	L	Navajo Bridge River Left	IP	66.8	L	Above Espejo	IP
4.7	L	RM 4.6L	IP	67.0	L	Espejo Island	IP
5.0	L	RM 4.9L	IP	69.0	R	Tanner Rapids Right	IP
5.0	R	RM 5.0R	IP	69.0	L	Tanner Rapid Left	IP
5.3	R	RM 5.3R	IP	69.3	L	Below Tanner Rapid	IP
5.4	L	RM 5.4L	IP	70.0	R	Basalt	EM/CRAT
5.9	R	RM 6.0R	EM/IP	70.8	R	Above Cardenas	IP
6.1	R	RM 6.0R	EM/IP	71.0	TBD	No Name 71.0	IP

6.1	L	RM 6.1L	IP	71.4	R	No Name 71.0 (Cardenas Marsh)	IP
6.5	R	RM 6.5R	IP	71.6	L	Cardenas	R/IP/RSM/ NPC
6.9	L	RM 6.9L	IP	71.6	R	Across from Cardenas	IP
7.5	L	RM 7.5L	IP	72.3	R	Unkar Delta	IP
7.5	R	RM 7.5R	IP	72.4	R	Upper Unkar	EM/IP
8.1	L	Jackass Canyon	EM/IP	72.7	L	Above Unkar	IP
8.1	R	Badger	EM/IP	72.7	L	Unkar Left	EM/IP
8.3	R	RM 8.3R	IP	73.1	L	RM 73.1L	IP
8.4	L	RM 8.4L	IP	73.9	UNK	No Name 73.9	IP
8.9	L	Below Jackass	EM/IP	74.2	R	Below Granary	IP
10.5	R	RM 10.5R	IP	76.1	L	Nevills	EM/IP
10.9	L	RM 10.9L	IP	76.5	L	Papago	EM/IP
11.3	R	Soap Creek	R/EM/IP	77.1	L	Hance	EM
11.7	R	RM 11.7R	IP	78.0	R	RM 78.0R	IP
12.1	L	Brown's Inscription	EM/IP	81.7	L	Grapevine	IP
12.4	L	RM 12.4L	EM/IP	87.9	R	Roys Beach	IP
12.6	R	RM 12.6R	IP	89.4	L	Pipe Creek Delta	IP
12.8	L	RM 12.8L	IP	93.2	L	Salt Creek	EM
16.5	R	RM 16.5R	IP	93.8	L	Granite	R/IP/RSM/ NPC
16.6	L	Hot Na	EM/IP	97.2	L	Boucher	EM
16.6	R	Across from Hot Na	IP	98.7	R	Crystal	EM/IP
17.7	R	RM 17.7R	IP	99.6	R	Above Tuna Creek	IP
18.4	L	18 Mile Wash	EM/IP	99.6	L	Above Tuna Rapid	IP
18.4	R	RM 18.4R	IP	99.7	R	Tuna Creek	IP
19.1	L	RM 19.1L	IP	99.8	L	Tuna	IP
19.2	R	RM 19.2.0R	IP	103.7	R	RM 103.0R (New Shady Grove)	EM/IP
19.4	R	RM 19.4R	IP	108.1	R	Hotauta	EM
19.9	R	RM 19.9R	IP	108.3	L	Ross Wheeler	EM
20.2	L	RM 20.0L	O	110.0	R	RM 110.0	EM/IP
20.5	R	RM 20.0R	O	118.5	R	RM 118.5R	EM
20.7	R	North Canyon	EM/IP	119.0	R	RM 119.0R	EM
21.2	L	RM 21.2L	IP	119.1	L	Across from Big Dune	IP
21.4	R	RM 21.4R	IP	121.2	L	RM 121.2L	O

23.2	L	RM 23.2L	IP	122.8	R	RM 122.0R	CRAT/EM/ IP
23.3	R	RM 23.3-1R	IP	125.4	L	Fossil	O
23.5	L	Lone Cedar	IP	127.0	R	Randy's Rock	R
24.2	L	RM 24.2L	IP	132.0	R	Stone Creek 1	IP
24.5	L	RM 24.5L	CRAT/E M/IP	133.7	L	Talking Heads	IP
24.6	R	RM 24.6R	IP	134.2	R	Racetrack	EM
24.8	L	RM 24.8L	CRAT/IP	134.5	R	Lower Tapeats	IP
25.2	R	Twenty-five Mile Rapid Right	IP	134.8	L	Above Owl Eyes	IP
25.3	L	RM 25.3L	IP	135.1	L	Owl Eyes	EM
25.7	R	RM 25.7R	IP	136.8	L	Across from Deer Creek	EM/O
25.9	R	RM 25.9R	IP	136.9	R	Deer Creek Falls	IP
26.0	R	Below Cave Springs Rapid	IP	137.6	L	Pancho's Kitchen	EM
26.9	L	Tiger Wash	IP	137.7	L	Football Field	IP
28.4	R	RM 28.4R	IP	137.8	L	Backeddy	EM/IP
30.6	R	Fence Fault	O	137.9	L	Backeddy	IP
31.9	R	South Canyon	EM/IP	141.1	L	Below Keyhole	IP
32.7	R	RM 32.7R	IP	143.8 144.8	L + R	Kanab	IP
33.8	L	Below Redwall	IP	145.9	L	Above Olo	O
35.0	L	Nautiloid	IP	150.7	L	Upset Hotel	EM/O
35.4	L	RM 35.0L	IP	152.1	R	Ledges	IP
36.3	L	RM 36.0L	IP	158.7	R	RM 158.7R	O
36.8	L	RM 36.7L	IP	172.0	L	Mohawk	CRAT/EM/ IP
37.9	L	Tatahatso	EM/IP	172.6	L	RM 172.6L	IP
38.7	L	Marthas	IP	176.5	R	Below Redslide	IP
39.5	L	RM 39.5L	IP	183.0	R	Lower Chevron	EM
39.9	R	RM 39.9R	IP	185.9	R	Upper 185 Mile	EM
40.0	R	RM 40.0R	IP	186.0	R	Lower 185 Mile	EM
40.1	L	MCD Site	IP	188.8	L	Below Lower Whitmore	IP
40.3	L	RM 40.3L	IP	192.1	Island	RM 192.1	IP
40.6	R	RM 40.6R	IP	192.3	L	Fat City	O
41.2	R	Buck Farm (lower)	EM/IP	193.3	L	RM 193.3L	IP
41.4	L	RM 41.4L	IP	194.0	TBD	RM 194.0	R

42.0	L	RM 42.0L	IP	194.6	L	Hualapai Acres	R/EM
42.3	R	RM 42.3R	IP	195.6	TBD	No Name 195.6	IP
44.1	R	P. Harding	EM/IP	197.0	R	Froggy Fault	IP
44.5	L	Eminence	EM/IP	197.0	L	RM 197.0L	IP
45	L	Willie Taylor	EM/IP	198.9	R	Parashant	O
45.1	L	Lower End of Willie Necktie	IP	202.4	R	RM 202.0R	EM
45.5	L	RM 45.5L	IP	204.9	R	Spring	IP
46.1	TBD	No Name 46.1	IP	205.9	R	Kolb	IP
46.9	R	Above Saddle	IP	206.0	I	206 Mile Isle	IP
48.5	L	Below Saddle	IP				
47.1	R	Triple Alcoves	IP	206.4	L	Above Indian Canyon	IP
				206.5	R	Above Indian Canyon Right	IP
47.2	L	Duck N Quack	EM/IP	206.5	L	RM 206.5L	IP
47.5	R	Upper Saddle	R/EM	207.0	R	Indian Canyon	EM/IP
48.5	L	Above Saddle	IP	208.3	TBD	No Name 208.3	IP
48.6	L	RM 48.6	IP	209.6	L	RM 209.6L	IP
48.7	R	No Name 48.7	IP	209.7	L	Below Granite Park	IP
48.8	R	RM 48.8R	IP	214.5	R	RM 214.0R	EM
50.3	R	RM 50.3R	IP	216.1	R	Opposite 3 Springs	O
50.7	L	RM 50.7L	IP	218.0	L	217 Mile Rapid	EM/IP
51.2	R	RM 51.2R	IP	223.5	R	RM 223.0R	CRAT/IP
51.4	R	RM 51.4R	IP	225.2	L	Above Diamond	IP
51.5	R	RM 51.5R	R	226.4	R	Truck Seat	IP
51.6	R	RM 51.6R	IP	239.6	L	RM 239.6L	IP
52.0	R	Above Little Nankoweap	IP	239.8	R	Separation Canyon	O
52.1	R	Little Nankoweap	EM/R/IP	242.6	R	RM 242.0R	EM
52.4	R	Nankoweap Delta Upper	EM/IP	243.0	R	RM 243.0R – RM 243.2R	EM/R
52.8	R	Nankoweap Delta Lower	EM/IP	243.2	R	RM 243.5R	EM/R
53.0	L	Nankoweap	EM/IP	248.7	R	Surprise Canyon	EM/IP/R/ NPC
53.1	R	Upper Nankoweap	EM/IP	269.9	R	Travertine Grotto	NPC/EM
53.4	R	Main Nankoweap	EM/R/IP	274.3	L	Grand Canyon Youth	EM/IP/R/ NPC

53.5	R	Lower Nankoweap	EM/IP	275.2	L	Columbine Falls	NPC
53.8	L	No Name 53 Mile Left	IP				

IP = Control non-native plant species affected by dam operations; NPC = Develop native plant materials, native plant material collection site; R = Replant native plant species at priority sites, potential restoration site; EM = Remove vegetation encroaching on campsites; CRAT = Manage vegetation to assist with cultural site protection; O = Site with other valued resources, RSM = Restoration site maintenance (Cardenas and Granite)





RIVER TRIP REPORT

Agreement #	R18PG00066
Agency/Division	NPS/GRCA/SRM/VEGETATION
Trip Coordinator	Dan Hall and Lonnie Pilkington
Trip Name	LTEMP Vegetation Mitigation Mission
Trip Dates	10/04/2020-10/16/2020

TRIP OBJECTIVES:

The National Park Service (NPS) proposed a 20 year experimental riparian restoration project as part of the Glen Canyon Dam Long Term Experimental and Management Plan Environmental Impact Statement (LTEMP EIS). This project is designated in the environmental commitments in the LTEMP Record of Decision (ROD) as specific mitigation of the impacts of dam operation to the condition of the vegetation communities within the Colorado River Ecosystem. The objective of this river mission was to implement the following “non-flow mitigation” in support of the LTEMP ROD.

- Survey for and control non-native plant species affected by dam operations, including Ravenna grass (*Saccharum ravennae*) and Pampas grass (*Cortaderia* spp.).

RESULTS & OBSERVATIONS

See table below for the details of sites, number of plants and number of seed heads. Ravenna plants were dug up with shovels and seed heads were clipped, bagged and removed from the site.

Date	Day	Details of Work Performed (electrofishing/ equipment installation / vegetation removed/ cultural resources monitored, etc)	# of hours worked (# of people x # of hours worked)	Camp Name	Camp RM
10/4/20	1	Ravenna grass removed from Lees Ferry 0.20 R; 43 plants, 22 seed heads	40	8 Mile	8
10/5/20	2	Ravenna grass removed from Below Cave Springs 25.98R; 3 plants	40	Tatahatso	32
10/6/20	3	Removed Ravenna grass from the known populations just above Saddle Canyon 46.94R, 18 plants, 2 seed heads; Below	40	Opposite Malgosa	56

		saddle 48.54L; 1 plant 20 seed heads at Below 50 miles Camp 50.89 L; 7 pants 2 seed heads, Kwagunt Marsh (Lower end of hidden science camp), 56.15R 65plants and 27 seed heads			
10/7/20	4	Removed Ravenna grass from Island at LCR 61.75 Island; 5 plants, 10 seed heads, Below Palisades 66.56L, 35 plants, 7 seed heads, Tanner Rapid 68.97, 45 plants, 88 seed heads	40	Tanner	69
10/8/20	5	Removed Ravenna grass from Above Cardenas 70.78R, 15 plants, 23 seed heads	40	Zoraster	83
10/9/20	6	Removed Ravenna grass from Tuna Creek 99.71 R 49 plants, 11 seed heads site. Melissa and Peter hiked out.	40	Ruby	105
10/10/20	7	Boated, scanned	20	Talking Heads	133
10/11/20	8	Removed Ravenna grass from Backeddy 137.89L, 1 plant, 1 seed head, Below Keyhole 141.10L, 1 plant, 9 seed heads	20	Below Kanab	145
10/12/20	9	Removed Ravenna grass from Above Olo (Corndog) 145.93L, 1 plant, 1 seed head,	20	Small sand camp	160
10/13/20	10	Removed Ravenna grass from Below Redslide 176.48R 1 plant 31 seed heads	20	Lava	180
10/14/20	11	Boated and scanned	20	Hualapai Acres	196
10/15/20	12	Removed Ravenna grass from Across Froggy Fault 196.86R, 9 plants, 7 seed heads, Above Indian Canyon Camp 206.36L L 1plant, 5 seed heads, Above Indian Canyon Camp 206.46R, 1plant 3 seed heads, Below 209 209.65L, Island 34 plants, 5 seed heads	20	221 Camp	221
10/16/20	13	Removed Ravenna grass from Above Diamond 225.18L, 1 plant 3 seed heads. Take out.	20		

BRIEF SUMMARY OF TRIP ACCOMPLISHMENTS:

We removed 337 Ravenna plants and 177 seed heads at 22 sites. We found 12 new populations of Ravenna grass. We did note plants at Hualapai Acres and at Truck Seat Camp, but were unable to remove those plants on this trip. The number of both new and existing sites with Ravenna grass indicate a need to continue monitoring and eradication efforts.

TRIP PARTICIPANTS:

Name	Affiliation	Job Title/Position
Dan Hall	Dan Hall's Manly Services	Boatman/biologist
Melissa McMaster	Mariposa Ecological and Botanical Consulting	Biologist
Chris McIntosh	Mariposa Ecological and Botanical Consulting	Boatman
Peter	Mariposa Ecological and Botanical Consulting	Volunteer

COMMENTS:

Michael Scott

[REDACTED]
Fort Collins, CO 80521

Email: [REDACTED]

Phone: [REDACTED]

November 17th, 2017

Rhonda Newton
River Permit Allocation
Grand Canyon National Park

Dear Ms. Newton:

I am writing this letter in support of an administrative access application to the river corridor in Grand Canyon National Park, for the purpose of eradicating invasive Ravenna grass from the Park. I have deep personal and professional interests in Grand Canyon. Briefly, I am a retired riparian plant ecologist from the US Geological Survey and currently adjunct faculty at Utah State University. I have worked in Grand Canyon with Larry Stevens and Bob Webb. Currently, I am involved in a project interpreting riparian vegetation change with Grand Canyon Monitoring and Research Center.

On a work trip with GCMRC this past August, I noticed a number of non-native species, including Russian olive, establishing in the newly vegetating low water zone. This zone is forming as a result of changes to the flow regime that began in 2000. Whereas there is little that can be done to control some widely established non-native riparian plants, like tamarisk and camelthorn, the Park has been doing a good job of tracking and controlling species like Russian olive and Ravenna grass by continual removal throughout the corridor. The efforts at controlling Ravenna have been especially effective and there is a possibility that this species can be eradicated from the river corridor if the remaining sites of invasion and source populations can be removed.

During my recent work trip, I also got to know Dan Hall, who along with Melissa McMaster, are spearheading an effort to eliminate Ravenna from Grand Canyon. Dan is an accomplished botanist and well knows the history of Ravenna in the canyon. He has been instrumental in previous efforts to control this species in Grand Canyon and is passionate about its removal. Dan estimates that with two small oar trips in the Fall, over the next three to four years, Ravenna could be eliminated from the canyon. I understand that the Park faces a difficult challenge in managing human use of the river corridor, but the opportunity to eliminate a troublesome, non-native plant like Ravenna, by knowledgeable, experienced and dedicated people, represents a valuable resource management opportunity for the Park. I highly recommend the granting of administrative access for this meritorious project. Please do not hesitate to contact me if you have any questions about my recommendation.

Sincerely,

Michael L. Scott

This grant proposal is a collaborative effort between Grand Canyon National Park, Glen Canyon National Recreation Area and RiversEdge West. All entities agree to collaborate and fulfill their obligations upon receiving funding for this project.

This grant proposal is a collaborative effort between Grand Canyon National Park, Glen Canyon National Recreation Area and RiversEdge West. All entities agree to collaborate and fulfill their obligations upon receiving funding for this project. All work will take place in GRCA or GLCA and the collaborators have the permission to conduct this work.

This grant proposal is a collaborative effort between Grand Canyon National Park, Glen Canyon National Recreation Area and RiversEdge West. All entities agree to collaborate and fulfill their obligations upon receiving funding for this project. This project does not involve a need for water other than to use as transportation. All river access permits will be granted by the National Park Service.