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TASK MEMORANDUM

DATE:	November 4, 2023
TO:	TAC and Board of Directors, CCBWQA Jane Clary, Wright Water Engineers, CCBWQA Technical Manager
CC:	Cherry Creek State Park (CCSP) Park Manager
FROM:	Ricardo Gonçalves, PE
SUBJECT:	2023 Annual Inspection of Pollution Reduction Facilities (PRFs) at CCSP

Introduction

The CCBWQA has a contractural agreement with RG and Associates, LLC to perform a Field Observation annually of the PRFs constructed by the CCBWQA at CCSP, and to perform observations on those PRFs after a storm event of more than 1" per hour of intensity or reported visible damage to PRF facilities in the CCSP.

The purpose of the annual Field Observation is to assess whether the PRFs are functioning as designed and to identify routine restorative and rehabilitative maintenance requirements. The TAC of the CCBWQA will use this report to provide recommendations to the board for the following fiscal year's budgeting of maintenance activities. Restorative and rehabilitative maintenance are the responsibility of the CCBWQA. Routine maintenance is the responsibility of the CCSP. Other items, such as educational/interpretive sign replacement and weed control, as outlined in the Agreement are shared 50/50 by CCSP and CCBWQA. The West Boat Ramp PRF's routine, restorative and rehabilitative maintenance responsibility is 100% the responsibility of the CCSP and/or the Marina.

As defined in the Agreement, the term "Restorative and Rehabilitative Maintenance"shall mean all maintenance and repair reasonably necessary to keep the structural and other essential components or portions of a PRF in good working order and functioning as designed, including but not limited to the repair of walls, embankments, pipes, gates, monitoring facilities, erosion and riprap, the removal of sediment, and the replacement of vegetation within the disturbed area of a PRF as needed to maintain or restore the PRFs function."Routine Maintenance" shall mean any and all maintenance that is necessary (other than Restorative and Rehabilitative Maintenance) to keep a PRF in a clean, visually appealing and safe condition, free from

debris and rubbish, and protected from vandalism and malicious mischief to the same extent as any other public facility located within the CCSP.

The PRFs that are part of the Stream and Drainage System are observed at least annually and after storm events since they are more likely to have changes in their condition. The PRFs that are Shoreline Stabilization are observed on an as needed basis, or as the CCBWQA, CCSP and or United States Army Corps of Engineers personnel identify issues or concerns during the year. This year, because of the unusual flooding that occurred in May and June, the Shoreline Stabilization PRFs were inspected for maintenance and repair needs.

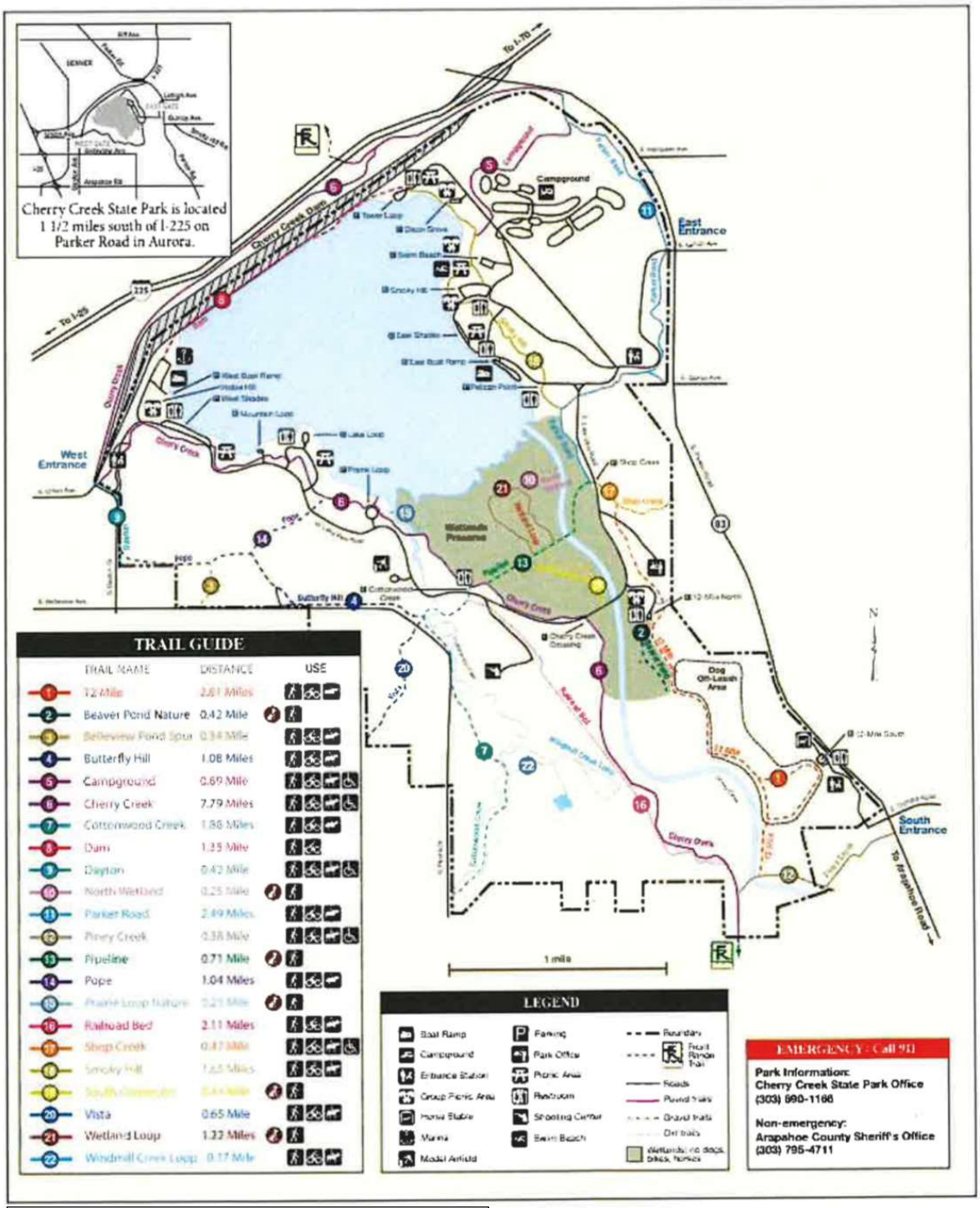
A map of the park from the CCSP brochure is shown on the following page to show the general vicinity of the In-Park PRFs.

The following facilities are included in the In-Park PRFs:

Stream and Drainage System
Shop Creek
Cherry Creek 12 mile Park (All Phases)
Cottonwood Wetlands
Cottonwood Stream Reclamation
Quincy Drainage
West Boat Ramp

Shoreline Stabilization
Tower Loop
Dixon Grove
East Shade Shelters
East Boat Ramp
Mountain and Lake Loop

All the PRFs were observed. The field observation was conducted on September 26, 27, 28, 29 and October 3rd. Parks officials did not accompany the inspections as they were too busy and requested a walkthrough later in the fall.



CCSP Brochure Map

General Assessments

The general assessments for the Annual Field Observation and photos are provided on the following pages.

Cottonwood Wetlands: Some aquatic vegetation and cattail debris was observed on the surface of the water. The water level was down significantly from the month before, but still high enough that water was overflowing the access trail. The educational signs were in good shape and did not appear to have been damaged in any way by the storm. Compaction from last year's harvesting activities was observed, but otherwise, there was no plant stress observed from this year's floods. Some compaction was noticed from this year's harvesting activities. Maintenance for consideration is decompaction and reseeding of the area along the trail and cleaning out of the outlet structure grate.

Outlet structure

Compaction from last year's harvesting activities

Compaction and wheel-tracking from this year's harvesting activities

Cottonwood Creek Stream Reclamation: This PRF is highly functional, with the vegetation striving all the way to the water's edge, and the riffle drops operating well. Evidence of high-water debris was observed, and the only apparent damage from the May and June storms was to the approach slab of the bridge on Lakeview Dr. No other damage was observed at any of the drop structures or crossing structures. Over-bank flooding only caused one minor eroded area in the fields, indicating that the low design velocities were successful in retaining the floodplain vegetation. Damage from the recent floods was observed to the gravel trails and access roads by the over-bank flooding. Some noxious weeds in the form of Russian Olives and Common Reed were observed and two active beaver dams were noted. Evidence of this year's harvesting activities was noted with some wheel-tracking compaction evident. No maintenance activities were specifically identified, however, monitoring and coordination with CCSP staff regarding noxious weeds is recommended. Monitoring of the wheel-tracking should be done next spring to determine to what extent any decompaction and re-seeding might be required. Also, CCSP will need to do some significant trail maintenance.

Thriving vegetation

Thriving vegetation

Erosion on access road

Riffle structure at lower trail crossing

Riffle structure near old Cottonwood alignment and shooting center

Riffle structure near confluence of Lone Tree Creek

Crossing east of S Cherry Creek Drive and Peoria St.

Beaver Dam north of above crossing

High-water debris but little plant stress and no evidence of erosion was typical

Cherry Creek 12-mile Park-All Phases:

All three phases of the project were examined from upstream to downstream, beginning at the first access point. Overall, the storms this last May and June accelerated the erosion from behind the boulder edging and washed out some of the boulder edging. Backfill in some of the erosion areas at the base of the access stairs would classify as needing maintenance attention, for pedestrian safety, the height from the bottom timber step to the ground surface being greater than the height from timber step to timber step. This would be a CCSP cost.The erosion behind the boulder edging where the concrete trail abuts the boulder edging is severe enough that the trail undercut areas should grouted to protect the trail. The rest of the damage will need to be rectified in near-future stabilization projects. The displacement of the "breakout" area is, perhaps, the most significant area needing stabilization attention, as well as the lost boulder edging downstream of Access Number 4. The entire area upstream of the grade control structure has suffered extreme bed erosion to such an extent that tree islands 2-3 feet high have been created. It also appears that the main channel has deviated from previous years. Of additional concern is whether stabilization of the east bank of Cherry Creek with the boulder edging is actually creating an off-set destabilization of the stream bottom and even of the west bank. All of this indicates that a serious re-evaluation of the original design concepts should be done to determine their functionality and applicability to stabilizing or reclaiming a stream that is constantly changing its course and if some alterations of those original design concepts should be effected prior to simply repairing the damaged areas back to the way they were before. Also, what should be addressed is the appropriateness of the design storms that should be utilized in examining the hydraulic design of the stream system. Due to the re-evaluation, no repairs are recommended, and CCSP will have some maintenance on the access stairways. All of the repair work should be part of a Capital Improvements Project, once a direction is established. It recommended that an outside consultant should be contracted to perform the re-evaluation.

Behind-the-boulder edging erosion at third access point

Behind the boulder edging erosion

Behind-the-boulder edging erosion at the Fourth Access Point

Boulder edging erosion just below Fourth Access Point

Boulder edging erosion below Access 4. Also note in-stream sediment deposition almost to the level of the original boulders.

Boulder erosion at Access 6

Tree islands caused by extreme bed scour

Beginning of beach area- severe erosion behind the boulder edging and of the beach itself, starting a second channel behind the boulder edging

Severe erosion behind boulder edging just before the beach area.

The boulder edging is now a spine, away from the water and the high point of the bank, with beach on both sides, not an "edge" of anything.

Erosion behind boulders undercutting trail.

Erosion behind boulders undercutting trail.

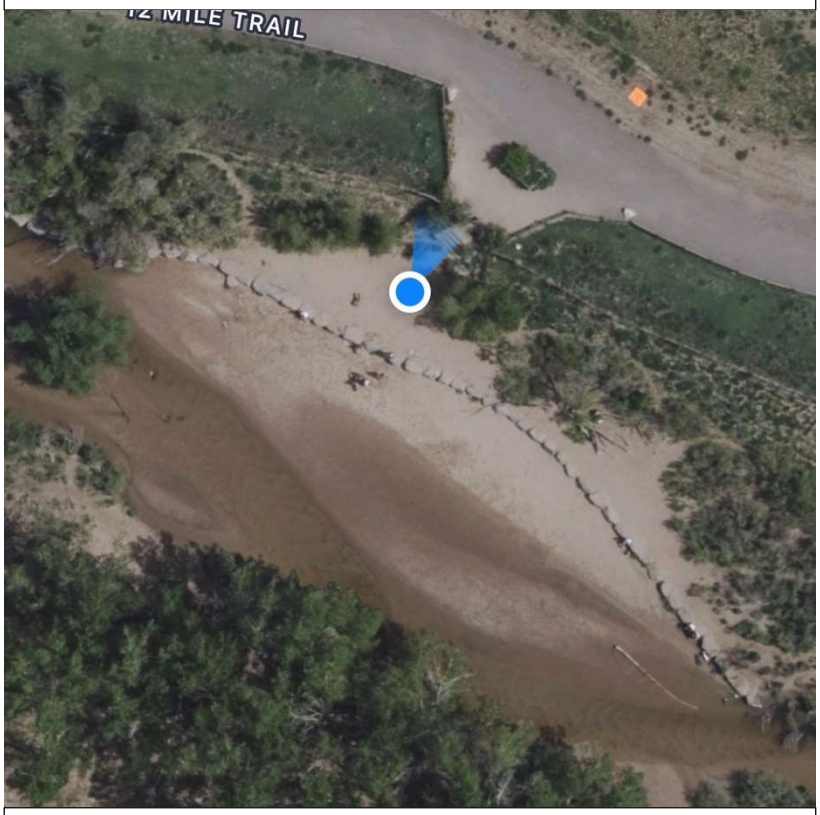
Grade control structure continued to work well

Severe erosion at breakout area

Severe erosion at breakout area

Severe bank and bed erosion downstream of the breakout area

Downstream of the breakout area



Satellite photo of DOLA beach showing how the creek doesn't follow the path that was used for the boulder edging design.

Shop Creek: There are 5 drop structures within CCSP numbered 1 through 5 from upstream to downstream, and an additional drop structure outside of the CCSP Boundary. All of the drops have the same basic problems with spalling concrete along their crests, seepage between layers of roller-compacted concrete on some, vegetation growing on downstream faces, and severe erosion and spalling around their outlet structures. The recent floods did not appear to have created any of the damage, most of it being created through general wear and tear. Repair of the concrete around the outlet structures, herbicide application, one tree removal is recommended for maintenance and repair. The information signs were in good repair and not in any need of attention.

Drop No.1

Drop No. 1 outlet structure overtopped and clogged with weeds

Drop No. 2

Drop No. 2 Outlet

Drop No.3

Drop No. 3 Outlet

Drop No. 4

Drop No. 4 Outlet

Drop No.5

Drop No. 5 Outlet

Shop Creek Informational Sign

Shop Creek Informational Sign

Quincy Drainage: Debris clogging was observed at the outlet structure, as were numerous plants growing in the energy dissipators of the outlet structure at the Lakeview Dr. crossing. These plants may need to be eradicated in the next couple of years. CCSP staff will take care of debris removal. At this time, no maintenance or repair needs were identified, except for weed control, although a capital project for stream reclamation may be needed in the future.

Debris clogging of the outlet structure

Outlet of the outlet structure

Outlet at Lakeview Dr. becoming clogged with plants

Outlet at Lakeview Dr. becoming clogged with plants.

Tower Loop: Reservoir elevation on this day September 27, was 5550.04. This PRF consists of boulders and riprap stabilization of the shoreline. While there was some minor subsidence of the boulders due to the floods, and the minor loss of some backfill behind the boulders, the only maintenance and repair item identified was minor backfill of the boulder edging. The floods created some bank erosion areas above the normal reservoir operating level and away from the older boulder stabilization area that could be included in a current capital stabilization project that is being designed. Some boulders were displaced but probably by human hands for seating purposes. The informational sign was in good shape and in no need of attention.

Informational sign in good condition

Human-displaced boulders

Boulder backfill material washed away from sidewalk

Eroded material from behind the grout at the fishing points

Backfill behind boulders washed away

Backfill washed away

Dixon Grove: Reservoir elevation this day, September 27, 2023, was 5550.04. Boulders and riprap serve as protection of shoreline for this PRF. There is a water quality capture area that treats runoff from the parking lot. No maintenance needs were identified. An area of shoreline south of the west shoreline stabilization area could be a good candidate for a future shoreline stabilization capital project. Various dead trees and debris from the floods was identified for CCSP maintenance.

East Shore of Stabilized area

Vibrant water quality capture area

Area south as candidate for future Shore Stabilization CIP project

Area south as candidate for future Shore Stabilization CIP project

East Shade Shelters: Reservoir elevation at the time of inspection, September 28, 2023 was 5550.05 feet.The north section was not inspected as it is currently part of a capital project to stabilize the shoreline. The south section inspection showed some shifting of the boulders, some trail undermining and bank erosion above the 5552-elevation due to the high flood elevations. As these erosive areas are above the shore stabilization levels they would be good candidates for CCSP reseeding and stabilization projects. A discussion should be held to decide whether the Shore Stabilization philosophy should extend to shore stabilization above the normal reservoir operating level that the current projects are designed for. Maintenance needs are only minor boulder edging backfill and some weed control. The shoreline generally appeared to be stable from earlier stabilization projects, even with the minor boulder displacement and some erosion areas. A separate planning effort should be done, that would identify more specifically the work needed, priority and costs.

Flood caused above stabilization level erosion

Bank erosion above operating level caused by flood not previously riprapped.

Above flood level bank erosion

Vertical bank erosion caused by flood overtopping curb and fisherman access.

Trail edge erosion

Old riprap displacement judging from moss-laden riprap rocks in the water.

East Boat Ramp: Reservoir water level on this day of inspection, September 28, 2023 was 5550.05. Boulders and riprap serve as protection of the shoreline. The maintenance identified for this area is revegetation of the maintenance project that was completed in October of last year, where the seeding and mulch were washed out of the riprap by the flood, and for weed control.

Reseed and mulch 2022 maintenance project, eroded by the floods of 2023-Remove weeds from observation deck.

Reseed and mulch 2022 maintenance project.

Mountain and Lake Loops: Reservoir water surface elevation on this inspection date, September 28, 2023 was 5550.05. Boulders and riprap serve as protection of the shoreline for these facilities. About 100 feet of shoreline has been eroding up to and is exposing the tree roots. As such, there is a maintenance project in place to stabilize this portion of shoreline. Bank erosion above the normal high-water line and trail material erosion was caused by overland flow from the floods running to the reservoir. The bank erosion should be monitored and CCSP should regrade the trails. No maintenance needs were identified.

100-foot eroding shoreline that will be stabilized by current maintenance project.

Access steps need CCSP maintenance

Current condition of shoreline stabilization

West Boat Ramp: All maintenance for this PRF is the responsibility of the CCSP. Maintenance identified for CCSP was cutting and clearing of all the vegetation inside the bounds of the pond, especially at the outlet.

Outlet clogged with plant material

Plant-clogged inlet

Total facility clogged with plants

Conclusions:

1. All the In-Park PRFs appear to be performing their functions well, with the exception of, possibly, the 12-mile Park projects.
2. The field observation general assessments include thoughts on maintenance, monitoring and planning efforts for future capital projects.
3. The summary of the maintenance work identified for consideration and budget estimates is shown in Appendix A of this report. The operations and maintenance costs developed from this 2023 Annual Field Inspection are $143,296 for Restorative and Rehabilitation work, and 12,500 for weed control.
4. Concerns and issues that were located outside limits of the original PRF or require additional analysis and study beyond the engineering already done on the original PRF were suggested as planning efforts. These planning efforts should include identification of the capital project, the priority, identification of the water quality benefits, and estimated costs. The identified planning efforts include:
    a. Cherry Creek 12 Mile Park-continued planning on Cherry Creek from Lakeview Dr. to CCSP Boundary, and an analysis of the goals and objectives of the original design concepts of the 12-mile park area as to the functionality and applicability of stabilizing and reclaiming a stream that is constantly changing its course in spite of all the control measures that have been applied to it, all to determine how restorative and rehabilitative measures should be applied.
    b. Dixon Grove and all shoreline stabilization projects- a planning effort to address new areas for shore stabilization, like the one to the south of the existing stabilized area at Dixon Grove, and all other areas from and including Tower Loop to Mountain and Lake Loops, and the appropriateness of the original design concepts, and how those concepts might need to change, especially in light of the effects of the two floods that occurred this year and what restorative and rehabilitative measures should be taken.
    c. Quincy Drainage-Planning for stream reclamation on Quincy Drainage from Lake View Dr. to the PRF.

Appendix A

Cherry Creek Basin Water Quality Authority
Summary of 2024 Operation & Maintenance (O&M) Costs
Prepared / Updated: October 24, 2022

Project	Quantity			CCSP Work	CCBWQA Purchases Seed with CCSP Installation	CCBWQA Work					Comments	
	Each	Hours	Acres	Herbicide Application[1]	Tractor Reseeding (Seed Cost Only)[2]	Weed Control[1]	Tree Planting[3]	Shrub Planting[3]	Misc.	Restorative / Rehabilitation work[4]		
Shop Creek	1					$ 3,000					Herbicide treatment of vegetation growing on faces of drops at 100% CCBWQA, since it isn't weed control related.	
	1									$ 17,244	Project carryover from 2023 to 2024, Concrete Repair at Crests of 3 drop structures.	
Cottonwood Wetlands	1			$ 1,000		$ 1,000				$ 30,550	PRF Routine, Decompaction and revegetation of access along embankment. Cleaning of outlet grate.	
Cottonwood Stream Reclamation				$ 2,000		$ 2,000				$ -		
Tower Loop				$ 1,000		$ 1,000				$ 2,950		
Dixon Grove				$ 1,000		$ 1,000						
East Shade Shelter				$ 1,000		$ 1,000				$ 2,950		
East Boat Ramp				$ 500		$ 500				$ 15,970		
Mountain/Lake Loop Shoreline	1			$ 1,000		$ 1,000				$ 65,282	Project carryover from 2023 to 2024, stabilize shoreline area.	
Cherry Creek 12-mile All Phases	1			$ 2,000		$ 2,000				$ 8,350	Weed Control for noxious weeds at 100% CCBWQA, since within 5 years of PRF construction.	
Subtotal				$ 9,500	$ -	$ 12,500	$ -	$ -	$ -	$ 143,296		

Totals

CCSP =	**$ 9,500**
CCBWQA =	**$ 155,796**
Combined =	**$ 165,296**

Note 1. CCBWQA performs weed control (mechanical until native grasses mature, then herbicide) for first 5 years after PRF construction; afterwards 50/50 split between CCBWQA and CCSP.
Note 2. Reseeding Rate = $3,250/acre. CCBWQA purchases seed CCSP installs it with their tractor and the seed attachment purchased by CCBWQA.
Note 3. Tree Replacement = $1,300/ea. Shrub Replacement =$65/ea.. CCBWQA Participation @ 100%.
Note 4. PRF Function Repair/Maintenace. Project Specific Estimate. CCBWQA Participation @ 100%.

2023 PRF Inspection

Cherry Creek 12-Mile Park 2024 Repair

Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	EA	$ 500.00	$ 500.00
2	Boulder edging backfill/grout	10	CY	$ 250.00	$ 2,500.00
3	Material removal from operating pool	10	CY	$ 250.00	$ 2,500.00

Subtotal		$	5,500.00	
Contingency	20%	$	1,100.00	
Subtotal		$	6,600.00	
Surveying				
Engineering, Permitting & Const Svs	30%	$	1,750.00	USACOE permit
Total Estimated Construction Cost		**$**	**8,350.00**	

2023 PRF Field Observation
Cottonwood Wetlands 2024 Repair

Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	LS	$ 500.00	$ 500.00
2	Decompaction	0.2	AC	$ 6,500.00	$ 1,300.00
3	Reseeding and Mulch	0.2	AC	$ 6,500.00	$ 1,300.00
4	Clean out Outlet Structure	1	LS	$ 650.00	$ 650.00
5	Remove material from flood storage pool per USACOE	81	CY	$250	$ 20,250.00

Subtotal		$	24,000.00
Contingency	20%	$	4,800.00
Subtotal		$	28,800.00
Surveying			
Engineering, Permitting & Const Svs		$	1,750.00
Total Estimated Construction Cost		**$**	**30,550.00**

2022 PRF Inspection
East Boat Ramp 2024 Repair
Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	EA	$ 1,200.00	$ 1,200.00
3	Seed	0.1	AC	$ 3,250.00	$ 325.00
4	Mulch	0.1	AC	$ 3,250.00	$ 325.00
5	Remove material from flood storage pool per USACOE	40	CY	$ 250.00	$ 10,000.00

Subtotal		$ 11,850.00	
Contingency	20%	$ 2,370.00	
Subtotal		$ 14,220.00	
Surveying			
Engineering, Permitting & Const Svs	30%	$ 1,750.00	USACOE Permit
Total Estimated Construction Cost		**$ 15,970.00**	

2023 PRF Inspection
East Shade Shelter 2024 Repair

Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	EA	$ 500.00	$ 500.00
2	Boulder Edging Backfill	1	CY	$ 250.00	$ 250.00
3	Remove material from flood storage pool per USACOE	1	CY	$ 250.00	$ 250.00

Subtotal		$	1,000.00
Contingency	20%	$	200.00
Subtotal		$	1,200.00
Surveying			
Engineering, Permitting & Const Svs	30%	$	1,750.00
Total Estimated Construction Cost		**$**	**2,950.00**

2023 PRF Inspection

Mountain and Lake Loop 2024 Repair

Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	EA	$ 1,560.00	$ 1,560.00
2	Construction Fence	800	LF	$ 5.85	$ 4,680.00
3	Erosion Control Log	80	LF	$ 3.90	$ 312.00
4	Type M Soil Riprap	85	CY	$ 250.00	$ 21,250.00
5	Seed	0.5	AC	$ 3,250.00	$ 1,625.00
6	Mulch	0.5	AC	$ 3,250.00	$ 1,625.00
7	Remove and Reset Fence for Access	50	LF	$ 42.00	$ 2,100.00
8	Remove material from flood storage pool per USACOE	85	CY	$ 250.00	$ 21,250.00

Subtotal		$	54,402.00
Contingency	20%	$	10,880.40
Subtotal		$	65,282.40
Surveying			
Engineering, Permitting & Const Svs	30%		
Total Estimated Construction Cost		**$**	**65,282.40**

Permitting will be done in 2023

2023 PRF Field Observation
Shop Creek 2024 Repair

Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	LS	$ 1,000.00	$ 1,000.00
2	Concrete Repair at Crests	1	LS	$ 6,500.00	$ 6,500.00
3	Water Control	1	LS	$ 1,300.00	$ 1,300.00
4	Concrete Washout	1	EA	$ 975.00	$ 975.00
5	Tree Removal	1	LS	$ 1,137.00	$ 1,137.00
6	Remove material from flood storage pool per USACOE	2	CY	$ 1,000.00	$ 2,000.00

Subtotal		$ 12,912.00
Contingency	20%	$ 2,582.40
Subtotal		$ 15,494.40
Surveying		
Engineering, Permitting & Const Svs		$ 1,750.00
Total Estimated Construction Cost		**$ 17,244.40**

2023 PRF Inspection
Tower Loop 2024 Repair

Date: 10/24/2023

No.	Item	Quantity	Unit	Unit Price	Extension
1	Mobilization	1	EA	$ 500.00	$ 500.00
2	Boulder void backfill	1	CY	$ 250.00	$ 250.00
3	Remove material from flood storage pool per USACOE	1	CY	$ 250.00	$ 250.00

Subtotal		$	1,000.00
Contingency	20%	$	200.00
Subtotal		$	1,200.00
Surveying			
Engineering, Permitting & Const Svs	30%	$	1,750.00
Total Estimated Construction Cost		**$**	**2,950.00**