CHERRY CREEK BASIN WATER QUALITY AUTHORITY

2024-2033 CAPITAL IMPROVEMENT PROGRAM SUPPORTING DATA

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TAC Recommendation – November 2, 2023
Board Review Version – October 19, 2023
Board Final Version – November 16, 2023

2024-2033 CAPITAL IMPROVEMENT PROGRAM

This document presents the details of the 2024-2033 Capital Improvement Program (2024-2033 CIP), as reviewed by the Board with the 2024 funding included in the Budget that is adopted by the Board, and it includes the following information.

Table 1 – Summary of Potential Pollutant Reduction Facilities, Revision for 2024-2033 CIP.

This table lists all the Pollutant Reduction Facilities (PRFs) that have been considered for implementation by the Authority since 2000 and shows their status. The "blue" font represents completed projects, the "green" font represents projects that are included in the 2024-2033 CIP, and projects in "black" font have been considered but haven't been included in the CIP.

Prior to 2010, Cherry Creek Reservoir was under a total maximum annual load (TMAL) limitation for phosphorus. Since PRFs originally focused on reduction of phosphorus loads discharged into the reservoir, Table 1 was developed to provide a brief summary of the design basis, projected loads and treatment, estimated PRF costs, and costs per pound of phosphorus immobilized. Currently there is no TMAL; instead, the control strategy identified in Regulation No. 72 is to minimize nutrient (phosphorus and nitrogen) concentrations. Therefore, PRFs are still evaluated, in part, on their costs per pound of phosphorus for consistency between all potential PRFs. Additional information on how PRFs are evaluated, particularly stream reclamation type projects, is presented in the Authority's report dated June 17, 2011 titled *Stream Reclamation Water Quality Benefit Evaluation Interim Status Report*.

The Cottonwood Creek Cattail Harvesting Pilot Project (CCB-13.3.1 A and B) included phosphorus reduction and removed (59-60 pounds per year) from the system based on 2020 Cattail Harvesting Pilot Project Memo for a unit cost $1,000-1,017 per pound of phosphorus removed.

New for the 2024-2033 CIP, ten of the completed projects (see blue text) were selected based on the best available accounting information on total project costs of design, construction, and permit clearance. Other information such as stream length and project participation were adjusted based on best available information, with the source included in comments which can viewed in of the spreadsheet itself. The Stream Reclamation O&M costs were adjusted to be similar cost baseline of $6,000 per mile with a minimum of $1,000 for projects within Cherry Creek State Park (higher cost accounts for higher public use in the park) and $2,000 per mile with of minimum of $1,000 for remaining stream reclamation projects. The original project information was retained, and the updated and revised project information was delineated by adding an asterisk (*) in the project designation and both were highlighted to facilitate comparison between the two.

New for the 2024-2033 CIP, the projects included in the CIP (see green text) the budget estimates of project costs were updated, based on similar projects that were bid in 2023 or updated engineer's opinions of construction costs, in an effort capture inflationary pressures and current market conditions.

Table 2 – Summary of Recommended Pollutant Reduction Facilities 2024 – 2033 CIP

This table lists the PRFs that are in the current 10-year CIP with more detail provided for the projects in the current budget year. Since the Authority partners with other governmental agencies to design and construct some of the PRFs, the Authority's portion of total project costs is also shown. The total cost is included along with the Authority's portion. Previous funding contributed by the Authority is deducted from the Authority's portion to get the Residual PRF Costs for the Authority, the Residual PRF Costs for the Authority are then budgeted through the 10-year CIP, since most projects take several years from concept through construction.

Some highlights of the projects included in the 2024 Budget are described below.

The East Shade Shelter Shoreline Stabilization Phase III (CCB-17.5.1) project includes funding participation from the latest Engineer's opinion of probable cost of 86% Authority and 14% is CPW to cover their participation in amenities. The actual costs and participation split will need to be determined through final design and construction and further coordination between parties.

The Tower Loop Shoreline Stabilization Phase II (CCB-17.7) project has been moved back to final design in 2032 and construction in 2033 based on value engineering effort done in 2023. The actual costs and schedule will need to be monitored and evaluated with future CIP updates.

The Cherry Creek Stream Reclamation at Arapahoe Rd., Reaches 3 and 4 (CCB-5.14C) project includes CCBWQA's funding at 16% (not the typical 25% partner project) to match the average of $1,016 per pound of phosphorus immobilized from Table 3. Project costs and participation may be better defined through the upcoming design and evaluated further with future CIP updates.

The Cherry Creek – Reservoir to Lake View Drive Alternatives Analysis and Development of Preferred Alternative (CCB-5.16A) project includes CCBWQA's funding of 100%.

The Cherry Creek all Reached in CCSP (CCB-5.16A, B, C) line includes CCBWQA funding $7,650,000 over 10-years. It represents a funding stream that can be applied to projects as their costs and priorities and further identified and refined through current and upcoming design efforts. Currently, the Cherry Creek – Reservoir to Lake View Drive is considered the top priority; after the development of the preferred alternative and its associated costs will determine how far this funding will go. Additional project partners and funding from others will likely be needed in order to complete all of the stream reclamation on Cherry Creek within Cherry Creek State Park (CCSP).

The Piney Creek Reaches 1 to 2 (CCB-6.5) project includes CCBWQA's funding at 23% (not the typical 25% partner project) to match the average of $1,016 per pound of phosphorus immobilized from Table 3. Project costs and participation may be better defined through upcoming design and evaluated further with future CIP updates.

The Piney Creek Reaches 4 to 5 (CCB-6.6) project includes CCBWQA's funding at 23% (not the typical 25% partner project) to match the average of $1,016 per pound of phosphorus immobilized from Table 3. Project costs and participation may be better defined through upcoming design and evaluated further with future CIP updates.

The McMurdo Gulch Reclamation (CCB-7.4) includes CCBWQA's funding of 25% as it is a partner project and is for priority 3 stream reclamation. As requested by Castle Rock, it includes $1,121,000 of CCBWQA for 2024, of which $869,000 is new funding included in CCBWQA's 2024 budget, and $252,000 of CCBWQA's unspent funding that was left over after the completion of priorities 1 and 2 stream reclamation. This information will need to be evaluated by CCBWQA when drafting the Intergovernmental Agreement between the parties, and when it is considered for action by CCBWQA's Board.

The Lone Tree Creek in CCSP downstream of Pond, CCBWQA only (CCB-21.1) project includes CCBWQA funding of 100%. This funding is only for the stream reclamation portion downstream of the pond and embankment only. The scope and cost of the project will need to be reevaluated based on completion of the Major Drainageway Planning Study that is currently underway. Additional improvements and partner funding may be needed as a result of this study.

The Lone Tree Creek in CCSP upstream of Pond, Centennial Trail Portion (CCB-21.3) project is done in conjunction with Centennial Trail Project. CCBWQA's funding is at 25% (not the typical 100% for projects within CCSP) and is for the stream reclamation portion of the larger trail project. The trail portion advanced the stream reclamation portion ahead of its water quality priority, limiting the funds available for the project. CCBWQA's Board has previously taken action to confirm the $112k commitment to Centennial so it has been included in the 2024 Budget.

CCBWQA's funding on Happy Canyon Creek at Jordan Rd/ (CCB-22.1) is at 25% and continues the funding that was previously requested by SEMSWA.

CCBWQA's funding on PRF Preservation, Acquisition, Lease of Land or Water is budgeted for $100k and CCBWQA's percentage is not known as no project and costs have been identified.

All other projects listed in the CIP were coordinated with project partners and adjusted based on input and direction received. Further evaluation and adjustments will likely be needed in future CIP updates when projects get closer to the current budget year.

2024 Operations and Maintenance Budget

The projects and costs from 2023 Annual Inspection of PRFs at CCSP Task Memorandum by RG and Associates were included in the CIP for 2024. The RDS Utilities Costs were increased from $65,000 to $72,000, PRF Reseeding of $5,000, PRF Mowing of $5,000, Tree/Shrub Planting of $2,000, and Fence Repair of $8,000 were included at the direction of the Technical Manager and to match the 2024 Budget.

Table 3 – Summary of 10 Completed Pollutant Reduction Facilities for Consideration in 2024 – 2033 CIP

From Table 2, the ten completed projects with the updated and revised project information, delineated by adding an asterisk (*) in the project designation, were adjusted to 2023 costs using ENR's Building Cost Index. Three unit costs were developed for the stream reclamation cost per mile and the cost per pound of phosphorus immobilized (without or with cost sharing from

partners). Figure 1 shows the stream reclamation cost per mile and Figure 2 shows the cost per pound of phosphorus immobilized (without or with cost sharing from partners).

Summary statistics are included at the bottom of Table 2 of CIP and below. The mean of $4,064 per pound of phosphorus (without cost sharing) or $1,016 per pound of phosphorus (with cost sharing of 75% partner participation and 25% CCBWQA participation) were used to evaluate projects included in the 10-year CIP (see green text) in Table 1. When the calculated cost per pound of phosphorus exceeded these means then a more detailed method was used to calculate it, delineated with a pound sign (#) in the project designation, or CCBWQA's participation was adjusted down to get the cost per pound in alignment with the mean. As the projects move forward and more detailed costs and engineering information is available the projects that were adjusted can be further evaluated, to see whether additional funding from CCBWQA is warranted, and updated as needed in future CIPs.

Statistic	Stream Reclamation Cost per mile	$/pound of phosphorus (w/o cost sharing)	$/pound of phosphorus (w/ CCBWQA participation at historical limit of 25%)
Minimum =	$ 3,145	$ 1,890	$ 472
Maximum =	$ 13,840	$ 8,292	$ 2,073
Mean =	$ 6,771	$ 4,064	$ 1,016
Median =	$ 6,759	$ 4,053	$ 1,013
Standard Deviation =	$ 3,581	$ 2,137	$ 534

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

TABLE 1 - SUMMARY OF POTENTIAL POLLUTANT REDUCTION FACILITIES

REVISIONS FOR 2024 - 2033 CIP

Date: **November 2, 2023**

Color Code:
- Blue: Project Completed
- Green: Planned for design/construction within 10-year CIP (see Table 2)
- *: Project updated based on best available information. Projects have best accounting information that includes total project costs of design, construction, construction management, and permit clearance. Other information such as stream length was adjusted based on information noted in comments on spreadsheet. O&M costs were adjusted to be similar cost baseline. Projects that were bid/constructed in phases, were separated into those phases to facilitate adjustment to 2023 costs on PRFs for WQ Analysis.
- #: Site specific analysis used for project to support CCBWQA's funding level
- Projects highlighted so that original project information compared with updated project information (denoted with *).

Proj. Designation	Project Title	Status	Description	Design Basis				Projected Loads					Projected Treatment			Cost Estimate (1000$)								Unit Cost ($/pound)		Note
			PRF Type	Quantity	Unit	Rate	Volume	Rate		Total		Source	Removal	lbs Removed		Capital	Land Acquisition	Water Augment[8]	Capital Replace[9]	O&M	Annual Cost @ 4%	CCBWQA Share (%)	CCBWQA Share ($)	w/o cost sharing	w/cost sharing	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)			(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
CCR-1	Reservoir Destratification (mixing)	Officially start-up April 2008	Use inlake mixing to minimize algae blooms, therefore chlorophyll a	369	sq mi	n/a	n/a	n/a		n/a		n/a		810	lbs/season	$ 968				$ 28	$ 80	100%	$968	$ 99	$ 99	
CCB-1	CCSP Wetlands	Prelim design prepared in 2003 (Ref 1, 8)	Restore 60 Acres of wetlands in multiple phases	369	sq mi	3.5 cfs avg daily flow	1415 af/210 days	0.35	mg/l	1050	lbs/yr	Base flow		600	lbs/season	$ 1,928	$ -	$ -	$ -	$ 19	$ 123	100%	$1,928	$ 204	$ 204	18
CCB-5.2	Arapahoe/Douglas County Line Stream Stabilization	Project completed w/o Authority participation	Local stream stabilization (L = 2700 ft)	0.51	mi			100	lbs/mi	51	lbs/yr	Storm Flow	90%	46	lbs/year	$ 1,062	$ -	$ -	$ -	$ 1	$ 58	0%	$0	$ 1,258	$ -	2
CCB-5.3	Cottonwood Bridge Stream Stabilization	Project completed by Parker w/o Authority participation	Local stream stabilization (L = 2700 ft)	0.51	mi			100	lbs/mi	51	lbs/yr	Storm Flow	90%	46	lbs/year	$ 436	$ -	$ -	$ -	$ 2	$ 25	0%	$0	$ 551	$ -	2
CCB-5.5	Stroh Road Stream Stabilization	Project completed by Parker w/o Authority participation	Stream stabilization (L = 5000 ft)	0.95	mi			100	lbs/mi	95	lbs/yr	Storm Flow	90%	85	lbs/year	$ 218	$ -	$ -	$ -	$ 1	$ 13	0%	$0	$ 149	$ -	2
CCB-5.7	Cherry Creek Stream Stabilization at Eco-Park (SEMSWA)	IGA w/SEMSWA for design in 2010 and construction in 2011/2012	Local stream stabilization (L = 6850 ft)	1.30	mi			100	lbs/mi	130	lbs/yr	Storm Flow	90%	117	lbs/year	$ 4,756	$ -	$ -	$ -	$ 1	$ 256	24%	$1,155	$ 2,191	$ 532	2, 3
CCB-5.7*	Cherry Creek Stream Stabilization at Eco-Park (SEMSWA)	IGA w/SEMSWA for design in 2010 and construction in 2011/2012	Local stream stabilization (L = 4850 ft)	0.92	mi			100	lbs/mi	92	lbs/yr	Storm Flow	90%	83	lbs/year	$ 4,756	$ -	$ -	$ -	$ 2	$ 257	19%	$905	$ 3,106	$ 591	2, 3, 7
CCB-5.9.1	Cherry Creek Stream Stabilization at 12-Mile Park (CCSP) - Phase I	Design completed in 2011 for Phase I.	Local stream stabilization (L = 500 ft)	0.09	mi			100	lbs/mi	9	lbs/yr	Storm Flow	90%	9	lbs/year	$ 296	$ -	$ -	$ -	$ 1	$ 17	100%	$296	$ 1,979	$ 1,979	2, 20
CCB-5.9.2	Cherry Creek Stream Stabilization at 12-Mile Park (CCSP) - Phase II	Design completed in 2013 for Phase II.	Local stream stabilization (L = 2500 ft)	0.47	mi			100	lbs/mi	47	lbs/yr	Storm Flow	90%	43	lbs/year	$ 1,429	$ -	$ -	$ -	$ 1	$ 78	100%	$1,429	$ 1,820	$ 1,820	2, 20
CCB-5.10	Cherry Creek Stream Stabilization at PJCOS (Vermillion Creek, PJMD.)	Design completed by PJMD. Authority is funding partner in design	Local stream stabilization (L = 5100 ft)	0.97	mi			100	lbs/mi	97	lbs/yr	Storm Flow	90%	87	lbs/year	$ 3,017	$ -	$ -	$ -	$ 2	$ 164	21%	$643	$ 1,882	$ 401	2, 3
CCB-5.11	Cherry Creek Stream Stabilization at Norton Farms (Parker)	Conceptual design by UDFCD identified priority 3	Local stream stabilization (L = 2200 ft)	0.42	mi			100	lbs/mi	42	lbs/yr	Storm Flow	90%	38	lbs/year	$ 900	$ -	$ -	$ -	$ 1	$ 49	28%	$252	$ 1,313	$ 368	2, 3
CCB-5.11*	Cherry Creek Stream Stabilization at Norton Farms (Parker)	Conceptual design by UDFCD identified priority 3	Local stream stabilization (L = 2500 ft)	0.47	mi			100	lbs/mi	47	lbs/yr	Storm Flow	90%	43	lbs/year	$ 1,103	$ -	$ -	$ -	$ 1	$ 60	23%	$255	$ 1,410	$ 326	2, 3
CCB-5.12	Cherry Creek Stream Stabilization at Pine Lane	Project completed by Parker w/o Authority participation	Local stream stabilization (L = 1500 ft)	0.28	mi			100	lbs/mi	28	lbs/yr	Storm Flow	90%	26	lbs/year	$ 500	$ -	$ -	$ -	$ 1	$ 28	0%	$0	$ 1,087	$ -	
CCB-5.14	Cherry Creek Stream Reclamation - CCSP to Eco Park (Ph II to V)	IGA w/SEMSWA for design in 2010	Local stream stabilization (L = 11000 ft)	2.08	mi			100	lbs/mi	208	lbs/yr	Storm Flow	90%	188	lbs/year	$ 10,200	$ -	$ -	$ -	$ 1	$ 547	25%	$2,499	$ 2,920	$ 715	
CCB-5.14B	Cherry Creek Stream Reclamation - Valley Country Club	Projects with UDFCD, SEMSWA, and Aurora. Phases started in 2010.	Local stream stabilization (L = 2000 ft.=1400 ft on Cherry Creek and 600 ft. on Tributary)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 2,284	$ -	$ -	$ -	$ 1	$ 123	21%	$484	$ 3,607	$ 764	2, 3
CCB-5.15	Cherry Creek Stream Reclamation at Country Meadows (Hess Rd)	Project by Town of Parker and Douglas County	Local stream stabilization (L = 7700 ft)	1.46	mi			100	lbs/mi	146	lbs/yr	Storm Flow	90%	131	lbs/year	$ 2,170	$ -	$ -	$ -	$ 2	$ 118	24%	$520	$ 901	$ 216	2, 3
CCB-5.15*	Cherry Creek Stream Reclamation at Country Meadows (Hess Rd)	Project by Town of Parker and Douglas County	Local stream stabilization (L = 4200 ft)	0.80	mi			100	lbs/mi	80	lbs/yr	Storm Flow	90%	72	lbs/year	$ 2,788	$ -	$ -	$ -	$ 2	$ 151	25%	$695	$ 2,114	$ 527	2, 3, 7
CCB-5.16	Cherry Creek Stream Reclamation - 12 Mile Phase III	Project w/in CCSP identified as Reach 1 in Project CCB-5.14 work.	Local stream stabilization (L =30 ft,)	0.01	mi			100	lbs/mi	1	lbs/yr	Storm Flow	90%	1	lbs/year	$ 300	$ -	$ -	$ -	$ 3	$ 19	100%	$300	$ 37,299	$ 37,299	2, 20
CCB-5.17.1A	Cherry Creek Stream Reclamation at KOA	Preliminary design completed 2019, Extension Requested by UDFCD and Parker in 2019	Local stream stabilization (L =1400 ft original, L=2000 ft with 600 ft extension)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 2,035	$ -	$ -	$ -	20	$ 129	20%	$375	$ 3,795	$ 776	2, 3
CCB-5.17.1A*	Cherry Creek Stream Reclamation at KOA	Preliminary design completed 2019, Extension Requested by UDFCD and Parker in 2019	Local stream stabilization (L =1400 ft original, L=2000 ft with 600 ft extension)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 1,806	$ -	$ -	$ -	$ 1	$ 98	18%	$333	$ 2,868	$ 529	2, 3, 7
CCB-5.17.1B	Cherry Creek Stream Reclamation at Dransfeldt	Design in 2021, Construction in 2023	Local stream stabilization (L =2400 ft original)	0.45	mi			100	lbs/mi	45	lbs/yr	Storm Flow	90%	41	lbs/year	$ 7,274	$ -	$ -	$ -	$ 1	$ 391	12%	$837	$ 9,551	$ 1,099	2, 3
CCB-6.1	Piney Creek Stream Stabilization - Project 1	Authority funded $118,000 Arapahoe County in 2002.	Restore 5200 lf upstream of Parker Road	22.90	sq mi	n/a	n/a	100	lbs/mi	100	lbs/yr	Storm Flow	90%	90	lbs/year	$ 997	$ -	$ -	$ -	$ 10	$ 63	13%	$130	$ 705	$ 92	2, 3
CCB-6.2	Piney Creek Stream Stabilization - Project 2 U/S Buckley Rd	Project completed w/o Authority participation	Reclaim 1700 lf upstream of Buckley Road	0.32	mi			100	lbs/mi	32	lbs/mi	Storm Flow	90%	29	lbs/year	$ 998	$ -	$ -	$ -	$ 1	$ 54	12%	$120	$ 1,880	$ 226	2, 3
CCB-6.4	Piney Creek Stream Reclamation - Reachs 6 & 7	Request from UDFCD in 2014	Local stream stabilization (L = 6,000 ft)	1.14	mi			unk		365	lbs/yr	Storm Flow	90%	329	lbs/year	$ 11,000	$ -	$ -	$ -	$ 2	$ 591	25%	$2,750	$ 1,800	$ 450	12
CCB-6.4A *	Piney Creek Stream Reclamation - Reach 7	Request from UDFCD in 2014	Local stream stabilization (L = 2,340 ft)	0.44	mi			100	lbs/mi	44	lbs/mi	Storm Flow	90%	40	lbs/year	$ 3,765	$ -	$ -	$ -	$ 1	$ 203	14%	$512	$ 5,082	$ 691	2, 3, 7
CCB-6.4B.1 *	Piney Creek Stream Reclamation - Reach 6 upstream of Caley	Request from UDFCD in 2014	Local stream stabilization (L = 1,600 ft)	0.30	mi			100	lbs/mi	30	lbs/yr	Storm Flow	90%	27	lbs/year	$ 2,896	$ -	$ -	$ -	$ 1	$ 156	14%	$394	$ 5,726	$ 779	2, 3, 7
CCB-6.4B.2 *	Piney Creek Stream Reclamation - Reach 6 Phase 2	Request from UDFCD in 2014	Local stream stabilization (L = 2,580 ft)	0.49	mi			100	lbs/mi	49	lbs/yr	Storm Flow	90%	44	lbs/year	$ 2,659	$ -	$ -	$ -	$ 1	$ 143	14%	$361	$ 3,262	$ 443	2, 3, 7
CCB-7.1	McMurdo Gulch Reclamation (Castle Rock)	Project completed in 2011	Stream Reclamation (L = 15,000 lf)	2.84	mi			100	lbs/mi	284	lbs/yr	Storm Flow	90%	256	lbs/year	$ 1,470	$ -	$ -	$ -	$ 28	$ 107	43%	$630	$ 419	$ 180	
CCB-7.2	McMurdo Gulch Reclamation (Castle Rock) 19/20 Project	Design in 2019, Construction in 2020	Stream Reclamation (L = 2,000 lf)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 1,677	$ -	$ -	$ -	17	$ 107	25%	$420	$ 3,127	$ 783	2, 3
CCB-7.2 *	McMurdo Gulch Reclamation (Castle Rock) 19/20 Project	Design in 2019, Construction in 2020	Stream Reclamation (L = 2,000 lf)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 1,156	$ -	$ -	$ -	$ 1	$ 63	25%	$289	$ 1,846	$ 462	2, 3, 7

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Color Code: Blue: Project Completed

Green: Planned for design/construction within 10-year CIP (see Table 2)

* Project updated based on best available information. Projects have best accounting information that includes total project costs of design, construction, construction management, and permit clearance. Other information such as stream length was adjusted based on information noted in comments on spreadsheet. O&M costs were adjusted to be similar cost baseline. Projects that were bid/constructed in phases, were separated into those phases to facilitate adjustment to 2023 costs on PRFs for WQ Analysis.

\# Site specific analysis used for project to support CCBWQA's funding level

Projects highlighted so that original project information compared with updated project information (denoted with *).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
45	CCB-7.3	McMurdo Gulch Reclamation (Castle Rock) 20/21/22 Project	Design in 2020, Construction 2021	Stream Reclamation (L = 3,700 lf)	0.70	mi			100	lbs/mi	70	lbs/yr	Storm Flow	90%	63	lbs/year	$ 2,460	$ -	$ -	$ -	$ 25	$ 156	25%	$615	$ 2,480	$ 620	2, 3			
46	CCB-7.3 *	McMurdo Gulch Reclamation (Castle Rock) 20/21/22 Project	Design in 2020, Construction 2021	Stream Reclamation (L = 3,700 lf)	0.70	mi			100	lbs/mi	70	lbs/yr	Storm Flow	90%	63	lbs/year	$ 1,940	$ -	$ -	$ -	$ 1	$ 105	24%	$466	$ 1,664	$ 400	2, 3, 7			
47	CCB-12	Bowtie Property PRF	Purchase completed 2003	Stabilize confluence (Ph I) and construct sediment pond (Ph 2)	22	sq mi	2-year flood	300 af	500	mg/l/ton	85	lbs/yr	base flow and minor flood	70% pond 65% wetlands	235	lbs/year	$ 826	$ 300	$ 63	$ 1.8	$ 6	$ 70	100%	$826	$ 299	$ 299	2			
48	CCB-13.1	Cottonwood\Peoria Wetlands Pond	Completed 2003. Restorative maintenance required in 2009	Joint funded project with UDFCD, GWV, Arapahoe County	8.30	sq mi							base and flood flows	measured	363	lbs/year	$ 1,636	$ -	$ -	$ -	$ 5	$ 93	12%	$196	$ 255	$ 31	2			
49	CCB-13.2	Cottonwood Stream Reclamation in CCSP	Phase I completed in 2004. Phase II completed June 2008 (Ref 2)	11,600 lf of stream reclamation from Peoria to Perimeter Rd. Pond	2.20	mi			100	lbs/mi	220	lbs/yr	base and flood flows	see separate calcs	730	lbs/year	$ 2,200	$ -	$ -	$ -	$ 55	$ 173	100%	$2,200	$ 237	$ 237	2			
50	CCB-13.3	Cottonwood Creek Stream Stabilization at Easter Avenue	Authority contributed $338,000 for construction in 2010.	2,600 lf of stream reclamation from Easter Ave to Briarwood Ave	0.49	mi			100	lbs/mi	49	lbs/yr	Storm Flow	90%	44	lbs/year	$ 1,350	$ -	$ -	$ -	$ 1	$ 73	25%	$338	$ 1,655	$ 414	2			
51	CCB-13.4	Peoria Trib B/Airport East and West Pond (Outfall C-1)	Cottonwood Creek Master Planned Improvements. Ponds combined into one.	Combined existing detention ponds and provided EURV	0.35	sq mi			400	lbs/sq mi	140	lbs/yr	Base and storm flow	40%	56	lbs/yr	$ 523	$ -	$ -	$ -	$ -	$ 28	25%	$131	$ 500	$ 125				
52	CCB-17.2	Reservoir Shoreline Stabilization Mountain Loop Trail	Scheduled for construction beginning in 2012	CCSP Recreation sites: Mountain, Lake and Cottonwood Creek Loops (2,300 ft of shoreline)											54	lbs/yr	$ 1,131	$ -	$ -	$ -	$ 5	$ 66	100%	$1,131	$ 1,215	$ 1,215	1, 16			
53	CCB-17.3	West Boat Ramp Parking Lot WQ Improvements	Final design completed in 2012	Provide water quality treatment of parking lot runoff.	3.43	ac prkg lot					3	lbs/yr	parking lot	70%	2	lbs/yr	$ 330	$ -	$ -	$ -	$ 1	$ 19	100%	$330	$ 8,903	$ 8,903	1			
54	CCB-17.4	East Boat Ramp Shoreline Stabilization Phase II	Identified during 2012 annual PRF inspection	105 lf of bank stabilization	105	lf	0.1 cy/yr/ft		0.14	lbs/lf	14.7	lbs/yr	bank erosion	80%	12	lbs/yr	$ 91	$ -	$ -	$ -	$ 2	$ 7	100%	$91	$ 585	$ 585	1, 16			
55	CCB-17.5	East Shade Shelter Shoreline Stabilization Phase II	Identified during 2012 annual PRF inspection	20 lf of bank stabilization	20	lf	0.1 cy/yr/ft		0.14	lbs/lf	2.8	lbs/yr	bank erosion	80%	2	lbs/yr	$ 18	$ -	$ -	$ -	$ -	$ 1	100%	$18	$ 431	$ 431	1, 16			
56	CCB-20.1	Detention Pond Retrofit Program - McMurdo Gulch	Phase 1 - McMurdo Gulch	Modify existing ponds to meet current standards for WQ	1	Each			0.40	lbs/Trib Acre	0.4	lbs/yr	Residential		9	lbs/pond/yr	$ 60	$ -	$ -	$ -	$ 0	$ 4	100%	$60	$ 396	$ 396	1, 17			
57	CCB-22..2	Happy Canyon Creek Upstream of I-25 (MHFD)	Requested in 2020	3000 lf of stream reclamation	0.57	mi			100	lbs/mi	57	lbs/yr	Storm Flow	90%	51	lbs/year	$ 5,441	$ -	$ -	$ -	$ 54	$ 346	9%	$500	$ 6,765	$ 622	2, 3			
58	CCB-22..2*	Happy Canyon Creek Upstream of I-25 (MHFD)	Requested in 2020	3000 lf of stream reclamation	0.57	mi			100	lbs/mi	57	lbs/yr	Storm Flow	90%	51	lbs/year	$ 4,021	$ -	$ -	$ -	$ 1	$ 216	9%	$362	$ 4,232	$ 381	2, 3, 7			

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

TABLE 1 - SUMMARY OF POTENTIAL POLLUTANT REDUCTION FACILITIES

REVISIONS FOR 2024 - 2033 CIP

Date: **November 2, 2023**

Color Code: Blue: Project Completed

Green: Planned for design/construction within 10-year CIP (see Table 2)

* Project updated based on best available information. Projects have best accounting information that includes total project costs of design, construction, construction management, and permit clearance. Other information such as stream length was adjusted based on information noted in comments on spreadsheet. O&M costs were adjusted to be similar cost baseline. Projects that were bid/constructed in phases, were separated into those phases to facilitate adjustment to 2023 costs on PRFs for WQ Analysis.

\# Site specific analysis used for project to support CCBWQA's funding level

Projects highlighted so that original project information compared with updated project information (denoted with *).

Proj. Designation	Project Title	Status	Description	Design Basis				Projected Loads					Projected Treatment			Cost Estimate (1000$)											Unit Cost ($/pound)		Note
			PRF Type	Quantity	Unit	Rate	Volume	Rate		Total		Source	Removal	lbs Removed		Capital from 2023 to 2032 CIP	Total Project Cost update to 2023 $	Design in 2023 $	Capital in 2023 $	Land Acquisition	Water Augment[8]	Capital Replace[9]	O&M	Annual Cost @ 4%	CCBWQA Share (%)	CCBWQA Share ($)	w/o cost sharing	w/cost sharing	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)			(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
CCB-5.4	Cherry Creek Stream Stabilization at Main Street (Parker)	Conceptual design by UDFCD	Local stream stabilization (L = 4000 ft)	0.76	mi			100	lbs/mi	76	lbs/yr	Storm Flow	90%	68	lbs/year	$ 1,776	$ 5,600	$ 840	$ 4,760	$ -	$ -	$ -	$ 2	$ 302	23%	$1,280	$ 4,430	$ 1,013	2, 3, 7
CCB-5.6	Cherry Creek Stream Stabilization at Lincoln Avenue (Parker)	Conceptual design by UDFCD	Local stream stabilization (L = 2350 ft)	0.45	mi			100	lbs/mi	45	lbs/yr	Storm Flow	90%	40	lbs/year	$ 1,447	$ 3,290	$ 494	$ 2,797	$ -	$ -	$ -	$ 1	$ 177	23%	$755	$ 4,425	$ 1,016	2, 3, 7
CCB-5.14C	Cherry Creek Stream Reclamation at Arapahoe Rd. - Valley Country Club to Soccer Fields, Reaches 3 to 4	Projects with UDFCD, SEMSWA, and Aurora. Phases started in 2010.	Local stream stabilization (L = 5167 ft on Cherry Creek)	0.98	mi			100	lbs/mi	98	lbs/yr	Storm Flow	90%	88	lbs/year	$ 5,287	$ 10,600	$ 1,590	$ 9,010	$ -	$ -	$ -	$ 2	$ 570	16%	$1,665	$ 6,462	$ 1,015	2, 3, 7
CCB-5.16A	Cherry Creek Stream Reclamation - Reservoir to Lake View Drive (Reach 1 in Muller's 2022 Stream Assessment Report)	Project w/in CCSP	Local stream stabilization (L =5400 ft,)	1.02	mi			100	lbs/mi	102.3	lbs/yr	Storm Flow	90%	92	lbs/year	$ 6,842	$ 11,846	$ 1,777	$ 10,069	$ -	$ -	$ -	$ 6	$ 641	100%	$11,846	$ 6,960	$ 6,960	2, 3, 6
CCB-5.16A#	Cherry Creek Stream Reclamation - Reservoir to Lake View Drive (Reach 1 in Muller's 2022 Stream Assessment Report)	Project w/in CCSP	Local stream stabilization (L =5400 ft,)	1.02	mi									1684	lbs/year	$ 6,842	$ 11,846	$ 1,777	$ 10,069	$ -	$ -	$ -	$ 6	$ 641	100%	$11,846	$ 380	$ 380	2, 3, 6, 10
CCB-5.16B	Cherry Creek Stream Reclamation - Lake View Drive to North Side of DOLA (Reach 2 in Muller's 2022 Stream Assessment Report)	Project w/in CCSP	Local stream stabilization (L =4400 ft,)	0.83	mi			100	lbs/mi	83.3	lbs/yr	Storm Flow	90%	75	lbs/year	$ 5,612	$ 7,920	$ 1,188	$ 6,732	$ -	$ -	$ -	$ 6	$ 430	100%	$7,920	$ 5,738	$ 5,738	2, 3, 6
CCB-5.16C	Cherry Creek Stream Reclamation - (Reach 3 in Muller's 2022 Stream Assessment Report)	Projects with UDFCD, SEMSWA, and Aurora. Phases started in 2010.	Local stream stabilization (Cherry Creek Reach 3 L =6200 ft)	1.17	mi			100	lbs/mi	117	lbs/yr	Storm Flow	90%	106	lbs/year	$ 10,054	$ 11,160	$ 1,674	$ 9,486	$ -	$ -	$ -	$ 1	$ 599	100%	$11,160	$ 5,667	$ 5,667	2, 3, 6
CCB-5.16C #	Cherry Creek Stream Reclamation - (Reach 3 in Muller's 2022 Stream Assessment Report)	Projects with UDFCD, SEMSWA, and Aurora. Phases started in 2010.	Local stream stabilization (Cherry Creek Reach 3 L =6200 ft)	1.17	mi									1963	lbs/year	$ 10,054	$ 11,160	$ 1,674	$ 9,486	$ -	$ -	$ -	$ 1	$ 599	100%	$11,160	$ 305	$ 305	2, 3, 6, 10
CCB-5.17.2	Cherry Creek Stream Reclamation U/S Scott Road	Project requested by Douglas County and UDFCD in 2019	Local stream stabilization (L = 4300 ft)	0.81	mi			100	lbs/mi	81	lbs/yr	Storm Flow	90%	73	lbs/year	$ 5,477	$ 5,477	$ 822	$ 4,655	$ -	$ -	$ -	$ 2	$ 295	24%	$1,309	$ 4,031	$ 963	2, 3, 7
CCB-6.5	Piney Creek - Cherry Creek to Parker Road, Reaches 1 to 2 (SEMSWA)	Requested in 2020	2900 lf of stream reclamation	0.55	mi			100	lbs/mi	55	lbs/mi	Storm Flow	90%	49	lbs/year	$ 2,350	$ 4,060	$ 609	$ 3,451	$ -	$ -	$ -	$ 1	$ 219	23%	$930	$ 4,421	$ 1,013	2, 3, 7
CCB-6.6	Piney Creek south of Orchard Rd., Reaches 4 to 5 (SEMSWA)	Requested in 2020	3800 lf of stream reclamation	0.72	mi			100	lbs/mi	72	lbs/mi	Storm Flow	90%	65	lbs/year	$ 3,000	$ 5,320	$ 798	$ 4,522	$ -	$ -	$ -	$ 1	$ 286	23%	$1,220	$ 4,416	$ 1,013	2, 3, 7
CCB-7.4	McMurdo Gulch Reclamation (Castle Rock) 22/23/24/25 Project	Design in 2022- 2023, Construction in 2024	Stream Reclamation (L = 6,550 lf)	1.24	mi			100	lbs/mi	124	lbs/yr	Storm Flow	90%	112	lbs/year	$ 3,298	$ 5,162	$ 774	$ 4,388	$ -	$ -	$ -	$ 2	$ 279	25%	$1,292	$ 1,878	$ 470	2, 3, 7
CCB-13.3.1A	Cottonwood Creek Catail Harvesting from Reservoir to Peoria Street~	Pilot Project - Odd Years Harvest Left Bank	1.7 Acres of Cattail Harvesting	2.90	mi				lbs/mi	30	lbs/yr	Storm Flow	100%	59	lbs/year	$ 60	$ 90	$ -	$ 90	$ -	$ -	$ -	$ -	$ 5	100%	$90	$ 1,525	$ 1,525	4
CCB-13.3.1B	Cottonwood Creek Cattail Harvesting from Reservoir to Peoria Street~	Pilot Project - Even Years Harvest Right Bank	2.0 Acres of Cattail Harvesting	2.90	mi				lbs/mi	237	lbs/yr	Storm Flow	100%	60	lbs/year	$ 60	$ 90	$ -	$ 90	$ -	$ -	$ -	$ -	$ 5	100%	$90	$ 1,500	$ 1,500	4
CCB-13.5.3	Cottonwood Creek Tributary - Shooting Area Tributary (CCSP)	Requested in 2020	600 lf of stream reclamation	0.11	mi			100	lbs/mi	11	lbs/yr	Storm Flow	90%	10	lbs/year	$ 300	$ 720	$ 108	$ 612	$ -	$ -	$ -	1	$ 40	25%	$180	$ 3,870	$ 967	2, 3, 6
CCB-13.5.4	Cottonwood Creek and Tributary C (IWSD)	Requested in 2020	2080 lf of stream reclamation	0.39	mi			100	lbs/mi	39	lbs/yr	Storm Flow	90%	35	lbs/year	$ 1,664	$ 2,496	$ 374	$ 2,122	$ -	$ -	$ -	1	$ 135	25%	$624	$ 3,800	$ 950	2, 3, 7
CCB-16	Stream Corridor Preservation	No projects identified	Partner with others to purchase property or conservation easements along Cherry Creek													$ 100	$ 100	$ -	$ 100					$ 5	100%	$100			1
CCB-17.2.1	Mountain and Lake Loop - 2021 Shoreline Maintenance	Identified during 2020 annual PRF observation	45 lf of bank stabilization	45	lf	0.1 cy/yr/ft		0.14	lbs/lf	6.3	lbs/yr	bank erosion	80%	5.04	lbs/yr	$ 24	$ 65	$ -	$ 65	$ -	$ -	$ -	$ 1	$ 4	100%	$65	$ 889	$ 889	1, 16, 22
CCB-17.5.1	East Shade Shelter Shoreline Stabilization Phase III	Identified during 2014 annual PRF inspection	400 lf of bank stabilization	400	lf	0.1 cy/yr/ft		0.14	lbs/lf	56.0	lbs/yr	bank erosion	80%	44.8	lbs/yr	$ 906	$ 975	$ 184	$ 791	$ -	$ -	$ -	$ 1	$ 53	86%	$842	$ 1,188	$ 1,026	1, 16, 22
CCB-17.7	Tower Loop Shoreline Stabilization Phase II	Identified during 2014 annual PRF inspection	700 lf of bank stabilization	700	lf	0.1 cy/yr/ft		0.14	lbs/lf	98.0	lbs/yr	bank erosion	80%	78.4	lbs/yr	$ 1,076	$ 1,035	$ 155	$ 880	$ -	$ -	$ -	$ 1	$ 56	100%	$1,035	$ 720	$ 720	1, 16, 22
CCB-21.1	Lone Tree Creek in CCSP downstream of Pond (CCBWQA Only)	Identified in 2014. Request from Arapahoe County Open Space.	500 lf of stream reclamation from CCSP Boundary to Cottonwood Creek	0.09	mi			100	lbs/mi	9	lbs/yr	Storm Flow	90%	9	lbs/yr	$ 340	$ 600	$ 90	$ 510	$ -	$ -	$ -	$ 1	$ 33	100%	$600	$ 3,889.15	$ 3,889	2, 3, 6
CCB-21.3	Lone Tree Creek in CCSP upstream of Pond (Centennial Trail Portion)	Request from Centennial for Participation in Stream Reclamaation portion of Trail Project.	710 lf of stream reclamation between CCSP Boundary and Windmill Creek Loop Trail	0.13	mi			100	lbs/mi	13	lbs/yr	Storm Flow	90%	12	lbs/yr	$ 448	$ 448	$ -	$ 448	$ -	$ -	$ -	$ 1	$ 25	25%	$112	$ 2,065.93	$ 516	2, 3, 6
CCB-22.1	Happy Canyon Creek at Jordan Road (SEMSWA)	Requested in 2020	2,500 lf of stream reclamation, project extended another 2000 feet in 2022	0.85	mi			100	lbs/mi	85	lbs/yr	Storm Flow	90%	77	lbs/year	$ 2,731	$ 6,300	$ 945	$ 5,355	$ -	$ -	$ -	$ 2	$ 340	23%	$1,445	$ 4,427	$ 1,015	2, 3, 7
CCB-23.1	Dove Creek Otero Avenue to U/S of Pond D-1 (SEMSWA)	Requested in 2020	2700 lf of stream reclamation (broken into 2 phases, see 23.2A and 23.2 B)	0.51	mi			100	lbs/mi	51	lbs/yr	Storm Flow	90%	46	lbs/year		$ 4,960	$ -	$ 4,960	$ -	$ -	$ -	$ 1	$ 267	16%	$778	$ 5,796	$ 909	2, 3, 7

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

TABLE 1 - SUMMARY OF POTENTIAL POLLUTANT REDUCTION FACILITIES

REVISIONS FOR 2024 - 2033 CIP

Date: **November 2, 2023**

Color Code: Blue: Project Completed

Green: Planned for design/construction within 10-year CIP (see Table 2)

* Project updated based on best available information. Projects have best accounting information that includes total project costs of design, construction, construction management, and permit clearance. Other information such as stream length was adjusted based on information noted in comments on spreadsheet. O&M costs were adjusted to be similar cost baseline. Projects that were bid/constructed in phases, were separated into those phases to facilitate adjustment to 2023 costs on PRFs for WQ Analysis.

\# Site specific analysis used for project to support CCBWQA's funding level

Projects highlighted so that original project information compared with updated project information (denoted with *).

Proj. Designation	Project Title	Status	Description	Design Basis				Projected Loads				Projected Treatment			Cost Estimate (1000$)								Unit Cost ($/pound)		Note
			PRF Type	Quantity	Unit	Rate	Volume	Rate		Total		Source	Removal	lbs Removed		Capital	Land Acquisition	Water Augment[8]	Capital Replace[9]	O&M	Annual Cost @ 4%	CCBWQA Share (%)	CCBWQA Share ($)	w/o cost sharing	w/cost sharing	
(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)		(9)		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
The projects listed below are older and will likely need to be further evaluated and have costs updated in with future CIP efforts.																										
CCB-8	Limestone Filter Enhancement	Specific project not identified	Construct limestone filter bed downstream of retention pond	1.0	sq mi	n/a	10.7 af/year/sq mile	427	lbs/sq mi	427	lbs/yr	Base and storm flow	20%	85	lbs/year/mi^2	$ 943		$ -	$ 595	$ 1	$ 83	43%	$405	$ 977	$ 420	
CCB-11	Advanced Water Treatment Plant	Conceptual design prepared	Construct 2 MGD AWT plant on Cottonwood Creek to treat Cherry Creek and Cottonwood Creek flows (0.21-mg/ influent, 0.03 mg/l disch)	3	cfs	2-MGD	2260	0.21	mg/l	1272	lbs/yr	Base flow and groundwater	90%	1145	lbs/year	$ 4,593	unknown	unknown		$ 69		100%	$4,593	$ -	$ -	11
CCB-17.4.1	East Boat Ramp Shoreline Stabilization Phase III	Identified during 2012 annual PRF inspection	400 lf of bank stabilization	400	lf	0.1 cy/yr/ft		0.14	lbs/lf	56.0	lbs/yr	bank erosion	80%	44.8	lbs/yr	$ 350	$ -	$ -	$ -	$ 4	$ 23	100%	$350	$ 508	$ 508	1, 16
CCB-17.6	West Shade Shelter Shoreline Stabilization PRF[14]	Identified initially in 2006. UCD Student Project w/WPR in 2013	1,400 lf of bank stabilization	1400	lf	0.1 cy/yr/ft		0.14	lbs/lf	196.0	lbs/yr	bank erosion	80%	179	lbs/yr	$ 704	$ -	$ -	$ -	$ 2	$ 40	65%	$458	$ 222	$ 144	21, 22
CCB-17.8	Dixon Grove Shoreline Stabilization Phase II	Identified during 2019 annual PRF inspection	200 lf of bank stabilization	200	lf	0.1 cy/yr/ft		0.14	lbs/lf	28.0	lbs/yr	bank erosion	80%	22.4	lbs/yr	$ 235	$ -	$ -	$ -	$ 1	$ 14	100%	$235	$ 607	$ 607	1, 16, 22
CCB-18	OWTS Sewer Service	No action to date	Provide Sewer Service for OWTS Areas			To Be Determined		To Be Determined					To Be Determined				To Be Determined					100%	$0	To Be Determined		1
CCB-19	Non-point Pollutant Management	No action to date	Assist agricultural contributors to water quality impact			To Be Determined		To Be Determined					To Be Determined			$ 100	$ -	$ -	$ -	$ -	$ 5	100%	$100	To Be Determined		1

BASIS FOR ANALYSIS:

(A) Unit cost of phosphorus removal based on annualized cost of completed project over 35 years at 4% interest rate. CRF = 0.053577

(B) All projects identified provide for additional phosphorus immobilization beyond minimum requirements, unless noted otherwise.

2024 CIP NOTES:

1. Assumed that augmentation for consumptive use not required
2. Augmentation for naturally established wetlands not required (assumption)
3. Phosphorus Estimated based on Interim Stream Reclamation Paper
4. See 2020 Cattail Harvesting Pilot Project Memo. Phosphorus estimated based on SEMSWA 2020 Data.
5. Pond updates to bring up to current standards and to facilitate maintenance. No phosphorus calculation provided, since ponds already exist.
6. Updated O&M Cost to $6k per mile (increased cost to account for higher public use for projects in CCSP)with a minimum of $1k.
7. Updated O&M Cost to $2k per mile with a minimum of $1k
8. Water costs at $ 6,500 per acre foot
9. Present worth of capital replacement
10. Benefit listed in Muller's Cherry Creek Stream and Water Quality Assessment, Reservoir to State Park Boundary, November 2022
11. Land acquisition and water augmentation not defined. CWSD\ACWWA JWPP project influenced scope of project.
12. Total Phosphorus loading derived from laboratory sediment samples & Stantec Geomorphic Study BANCS analysis.
16. Benefit approximated based on other shoreline projects and estimates
17. Loads and performance based on calculations for 3 McMurdo Gulch ponds.
19. Approach was shifted to focus on stream reclamation (CCB-5.14) and reduction of sediment and nutrient sources from erosion.
20. Joint project with CCSP. Integrate design with Dog Park uses and improvements.
21. Phosphorus: Shoreline 177 lbs/yr + Parking Lot 2 lbs/yr =179 lbs/yr
22. Updated O&M Cost to $2k per 1000' with a minimum of $1k

REFERENCES

1. Muller Eng 2003. *Feasibility Evaluation for Cherry Creek State Park Wetlands Project*
2. Muller Eng 2003. *Feasibility Evaluation for Cottonwood Creek Stream Stabilization Project*
3. AMEC 2005. *Draft Feasibility Report Cherry Creek Reservoir Destratification*
4. AMEC 2006. *Recommendations for Prepurchase of Jamor Equipment for Cherry Creek Reservoir Destratification Project.*
5. Tetra Tech August 2006. *Phosphorus Estimates in Cherry Creek and Cost for Removal via Sediment Trap.*
6 WERF 2000. *Phosphorus Credit Trading in the Cherry Creek Basin: An Innovative Approach to Achieving Water Quality Benefits.*
7. Ruzzo, WP September 5, 2003. Cherry Creek Corridor Master Plan-*Estimate of Phosphorus Reduction from Stream Reclamation*
8. Ruzzo, W. P. September 21, 2006. *Cottonwood Creek Reclamation - Water Rights Augmentation Requirements*.
9. TetraTech December 2006. *Design of Cherry Creek Sediment Basin and Stream Stabilization.*
10. Brown and Caldwell Feb 2007. *Shop Creek Wetlands Pollutant Reduction Facility Wetland Assessment*
11. PBSJ October 2006. *Draft McMurdo Gulch Major Drainageway Master Plan*
12. Brown and Caldwell 2010. *Cherry Creek Stream Reclamation at Shop Creek Trail.*
13. CCBWQA TAC June 16, 2011. *Stream Reclamation Water Quality Benefit Evaluation Interim Status Report*
14. Ruzzo Memo, September 4, 2013, *West Shade Shelter Shoreline Stabilization PRF - Water Quality Analysis.*

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

TABLE 2 - SUMMARY OF RECOMMENDED POLLUTANT REDUCTION FACILITIES

2024 - 2033 BUDGET PROJECTIONS (1000$)

Color Code: First year in 10-year CIP

		November 2, 2023				Residual PRF Costs	Proposed 2024 Budget				Proposed 2025 Budget	Proposed 2026 Budget	Proposed 2027 Budget	Proposed 2028 Budget	Proposed 2029 Budget	Proposed 2030 Budget	Proposed 2031 Budget	Proposed 2032 Budget	Proposed 2033 Budget	2024-2033 Total
	Project No.	Project Title	Total	Authority Portion	Authority Portion		Design	Capital	Land	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Budget Category - General																				
Budget Category - Reservoir Projects																				
	CCB-17.5.1	East Shade Shelter Shoreline Stabilization Phase III	$ 975	$ 842	86%	$ 658	$ -	$ 658	$ -	***$ 658***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 658***
	CCB-17.7	Tower Loop Shoreline Stabilization Phase II	$ 1,035	$ 1,035	100%	$ 1,035	$ -	$ -	$ -	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 155***	***$ 880***	***$ 1,035***
Budget Category - Stream Reclamation Projects																				
	CCB-5.4	Cherry Creek Stream Reclamation at Main Street (Parker)	$ 5,600	$ 1,280	23%	$ 1,280	$ -	$ -	$ -	***$ -***	***$ -***	***$ -***	***$ 700***	***$ 580***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 1,280***
	CCB-5.6	Cherry Creek Stream Stabilization at Lincoln Avenue (Parker)	$ 3,290	$ 755	23%	$ 755	$ -	$ -	$ -	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 411***	***$ 344***	***$ -***	***$ -***	***$ 755***
	CCB-5.14C	Cherry Creek Stream Reclamation at Arapahoe Rd. - Valley Country Club to Soccer Fields, Reaches 3 to 4	$ 10,600	$ 1,655	16%	$ 1,104	$ -	$ 300	$ -	***$ 300***	***$ 340***	***$ 340***	***$ 124***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 1,104***
	CCB-5.16A	Cherry Creek - Reservoir to Lake View Drive Alternatives Analysis and Development of Preferred Alternative	$ 438	$ 438	100%	$ 181	$ 181	$ -	$ -	***$ 181***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 181***
	CCB-5.16A, B, C	Cherry Creek all Reaches in CCSP	$ 30,488	$ -	0%	$ -	$ -	$ -	$ -	***$ -***	***$ 770***	***$ 1,110***	***$ 225***	***$ 195***	***$ 1,280***	***$ 500***	***$ 1,190***	***$ 1,470***	***$ 910***	***$ 7,650***
	CCB-6.5	Piney Creek - Cherry Creek to Parker Road, Reaches 1 to 2 (SEMSWA)	$ 4,060	$ 930	23%	$ 829	$ 39	$ -	$ -	***$ 39***	***$ 25***	***$ 75***	***$ 150***	***$ 125***	***$ 125***	***$ 125***	***$ 125***	***$ 40***	***$ -***	***$ 829***
	CCB-6.6	Piney Creek south of Orchard Rd., Reaches 4 to 5 (SEMSWA)	$ 5,320	$ 1,220	23%	$ 1,220	$ -	$ 75	$ -	***$ 75***	***$ 150***	***$ 235***	***$ 250***	***$ 250***	***$ 260***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 1,220***
	CCB-7.4	McMurdo Gulch Reclamation (Castle Rock)	$ 5,162	$ 1,292	25%	$ 1,121	$ -	$ -	$ 1,121	***$ 1,121***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 1,121***
	CCB-13.5.3	Cottonwood Creek Tributary - Shooting Area Tributary (CCSP)	$ 720	$ 180	25%	$ 180	$ -	$ -	$ -	***$ -***	***$ -***	***$ -***	***$ -***	***$ 180***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 180***
	CCB-13.5.4	Cottonwood Creek and Tributary C (IWSD)	$ 2,496	$ 624	25%	$ 624	$ -	$ -	$ -	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 624***	***$ -***	***$ -***	***$ -***	***$ 624***
	CCB-21.1	Lone Tree Creek in CCSP downstream of Pond (CCBWQA Only)	$ 600	$ 600	100%	$ 600	$ 120	$ -	$ -	***$ 120***	***$ 480***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 600***
	CCB-21.3	Lone Tree Creek in CCSP upstream of Pond (Centennial Trail Portion)	$ 448	$ 112	25%	$ 112	$ -	$ 112	$ -	***$ 112***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ -***	***$ 112***
	CCB-22.1	Happy Canyon Creek at Jordan Road (SEMSWA)	$ 6,300	$ 1,445	23%	$ 1,264	$ -	$ 50	$ -	***$ 50***	***$ 75***	***$ 75***	***$ 171***	***$ 170***	***$ 170***	***$ 170***	***$ 170***	***$ 170***	***$ 43***	***$ 1,264***
Budget Category - PRF Water Quality/Wetland Ponds																				
Budget Category - PRF Preservation, Acquisition, Lease																				
	CCB-16	PRF Preservation, Acquisition, Lease of Land or Water	$ 1,000	$ 1,000	100%	$ 1,000	$ -	$ 100	$ -	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 100***	***$ 1,000***
		SUB-TOTALS								***$ 2,756***	***$ 1,940***	***$ 1,935***	***$ 1,720***	***$ 1,600***	***$ 1,935***	***$ 1,930***	***$ 1,929***	***$ 1,935***	***$ 1,933***	***$ 19,613***

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

TABLE 2 - SUMMARY OF RECOMMENDED POLLUTANT REDUCTION FACILITIES

2024 - 2033 BUDGET PROJECTIONS (1000$)

Color Code: First year in 10-year CIP

Project No.	November 2, 2023 Project Title	Total	Authority Portion	Authority Portion	Residual PRF Costs	Proposed 2024 Budget Design	Capital	Land	Total	Proposed 2025 Budget Total	Proposed 2026 Budget Total	Proposed 2027 Budget Total	Proposed 2028 Budget Total	Proposed 2029 Budget Total	Proposed 2030 Budget Total	Proposed 2031 Budget Total	Proposed 2032 Budget Total	Proposed 2033 Budget Total	2024-2033 Total
	OPERATIONS AND MAINTENANCE																		
	Routine Category																		
OM-7	Reservoir Destratification	$ 400	$ 400	100%					$ 40	$ 40	$ 40	$ 40	$ 40	$ 40	$ 40	$ 40	$ 40	$ 40	$ 400
OM-14.1	PRF Weed Control	$ 103	$ 103	100%					$ 13	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 10	$ 103
OM-14.2	PRF Reseeding at CCSP	$ 45	$ 45	100%					$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 50
OM-14.3	PRF Mowing	$ 50	$ 45	100%					$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 50
	SUB-TOTAL	$ 598	$ 593						$ 63	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60	$ 60	$ 603
	Operations Category																		
O - 1	RDS Utilities	$ 720	$ 720	100%					$ 72	$ 72	$ 72	$ 72	$ 72	$ 72	$ 72	$ 72	$ 72	$ 72	$ 720
O - 2	RDS Service Plan	$ 172	$ 172	100%					$ 13	$ 14	$ 15	$ 16	$ 17	$ 18	$ 19	$ 20	$ 20	$ 20	$ 172
O - 3	PRF Emergency Repairs	$ -	$ -	100%					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
O - 4	Meteorological Station	$ 30	$ 30	100%					$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 3	$ 30
	SUB-TOTAL	$ 922	$ 922						$ 88	$ 89	$ 90	$ 91	$ 92	$ 93	$ 94	$ 95	$ 95	$ 95	$ 922
	Restorative Category																		
OM -	Tree/Shrub Planting	$ 18	$ 18	100%					$ 2	$ 2	$ 2	$ 2	$ 2	$ 2	$ 2	$ 2	$ 2	$ 2	$ 20
OM -	Fence Repair	$ 72	$ 72	100%					$ 8	$ 8	$ 8	$ 8	$ 8	$ 8	$ 8	$ 8	$ 8	$ 8	$ 80
OM -	Shoreline / Bank Restoration																		$ -
	Average Annual Cost	$ 1,755	$ 1,755	100%					$ -	$ 195	$ 195	$ 195	$ 195	$ 195	$ 195	$ 195	$ 195	$ 195	$ 1,755
	Shop Creek	$ 17	$ 17	100%					$ 17										$ 17
	Cottonwood Wetlands	$ 31	$ 31	100%					$ 31										$ 31
	Tower Loop	$ 3	$ 3	100%					$ 3										$ 3
	East Shade Shelter	$ 3	$ 3	100%					$ 3										$ 3
	East Boat Ramp	$ 16	$ 16	100%					$ 16										$ 16
	Mountain/Lake Loop Shoreline	$ 65	$ 65	100%					$ 65										$ 65
	Cherry Creek 12-mile	$ 8	$ 8	100%					$ 8										$ 8
OM -	Wetland Harvesting	$ 900	$ 900	100%					$ 90	$ 90	$ 90	$ 90	$ 90	$ 90	$ 90	$ 90	$ 90	$ 90	$ 900
	SUB-TOTAL	$ 2,888	$ 2,888						$ 243	$ 295	$ 295	$ 295	$ 295	$ 295	$ 295	$ 295	$ 295	$ 295	$ 2,898
	Rehabilitation Category																		
OM -				100%															
	SUB-TOTAL	$ -	$ -						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	SUB-TOTAL O&M								$ 394	$ 444	$ 445	$ 446	$ 447	$ 448	$ 449	$ 450	$ 450	$ 450	$ 4,423
	GRAND TOTAL								$ 3,150	$ 2,384	$ 2,380	$ 2,166	$ 2,047	$ 2,383	$ 2,379	$ 2,379	$ 2,385	$ 2,383	$ 24,036

CHERRY CREEK BASIN WATER QUALITY AUTHORITY

TABLE 3 - SUMMARY OF 10 COMPLETED POLLUTANT REDUCTION FACILITIES

FOR CONSIDERATION IN 2024 - 2033 CIP

Date: November 2, 2023

Color Code: Blue: Project Completed

* Corrected to reflect final project information, see comments for details

Projects taken from Table 1. Project updated based on best available information. Projects have best accounting information that includes total project costs of design, construction, construction management, and permit clearance. Other information such as stream length was adjusted based on information noted in comments on spreadsheet. O&M costs were adjusted to be similar cost baseline. Projects that were bid/constructed in phases, were separated into those phases to facilitate adjustment to 2023 costs on PRFs for WQ Analysis.

Proj. Designation	Project Title	Status	Description	Design Basis				Projected Loads					Projected Treatment			Cost Estimate (1000$)								WQ Unit Cost ($/pound)		Adjusted to 2023 $ (1000$)				2023 WQ Unit Cost ($/pound)		Note
			PRF Type	Quantity	Unit	Rate	Volume	Rate		Total		Source	Removal	lbs Removed		Capital	Land Acquisition	Water Augment[8]	Capital Replace[9]	O&M	Annual Cost @ 4%	CCBWQA Share (%)	CCBWQA Share ($)	w/o cost sharing	w/cost sharing	Bid Date/Construction Date	ENR Factor	Construction Cost	Cost per mile	w/o cost sharing	w/cost sharing	
(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)		(9)		(10)	(11)	(12)	(13)	(14a)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)							(24)
CCB-5.7*	Cherry Creek Stream Stabilization at Eco-Park (SEMSWA)	IGA w/SEMSWA for design in 2010 and construction in 2011/2012	Local stream stabilization (L = 4850 ft)	0.92	mi			100	lbs/mi	92	lbs/yr	Storm Flow	90%	83	lbs/year	$ 4,756	$ -	$ -	$ -	$ 2	$ 257	19%	$905	$ 3,106	$ 591	August 2012	1.58	$ 7,531	$ 8,199	$ 4,919	$ 936	1, 2
CCB-5.11*	Cherry Creek Stream Stabilization at Norton Farms (Parker)	Conceptual design by UDFCD identified priority 3	Local stream stabilization (L = 2500 ft)	0.47	mi			100	lbs/mi	47	lbs/yr	Storm Flow	90%	43	lbs/year	$ 1,103	$ -	$ -	$ -	$ 1	$ 60	23%	$255	$ 1,410	$ 326	January 2016	1.48	$ 1,634	$ 3,452	$ 2,090	$ 483	1, 2
CCB-5.15*	Cherry Creek Stream Reclamation at Country Meadows (Hess Rd)	Project by Town of Parker and Douglas County	Local stream stabilization (L = 4200 ft)	0.80	mi			100	lbs/mi	80	lbs/yr	Storm Flow	90%	72	lbs/year	$ 2,788	$ -	$ -	$ -	$ 2	$ 151	25%	$695	$ 2,114	$ 527	October 2014	1.51	$ 4,222	$ 5,307	$ 3,202	$ 798	1, 2
CCB-5.17.1A*	Cherry Creek Stream Reclamation at KOA	Prelimiinary design completed 2019, Extension Requested by UDFCD and Parker in 2019	Local stream stabilization (L =1400 ft original, L=2000 ft with 600 ft extension)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 1,806	$ -	$ -	$ -	$ 1	$ 98	18%	$333	$ 2,868	$ 529	July 2020	1.32	$ 2,378	$ 6,278	$ 3,776	$ 696	1, 2
CCB-6.4A *	Piney Creek Stream Reclamation - Reach 7	Request from UDFCD in 2014	Local stream stabilization (L = 2,340 ft)	0.44	mi			100	lbs/mi	44	lbs/mi	Storm Flow	90%	40	lbs/year	$ 3,765	$ -	$ -	$ -	$ 1	$ 203	14%	$512	$ 5,082	$ 691	December 2016	1.44	$ 5,422	$ 12,234	$ 7,319	$ 995	1, 2
CCB-6.4B.1 *	Piney Creek Stream Reclamation - Reach 6 upstream of Caley	Request from UDFCD in 2014	Local stream stabilization (L = 1,600 ft)	0.30	mi			100	lbs/mi	30	lbs/yr	Storm Flow	90%	27	lbs/year	$ 2,896	$ -	$ -	$ -	$ 1	$ 156	14%	$394	$ 5,726	$ 779	November 2016	1.45	$ 4,194	$ 13,840	$ 8,292	$ 1,128	1, 2
CCB-6.4B.2 *	Piney Creek Stream Reclamation - Reach 6 Phase 2	Request from UDFCD in 2014	Local stream stabilization (L = 2,580 ft)	0.49	mi			100	lbs/mi	49	lbs/yr	Storm Flow	90%	44	lbs/year	$ 2,659	$ -	$ -	$ -	$ 1	$ 143	14%	$361	$ 3,262	$ 443	November 2017	1.40	$ 3,712	$ 7,597	$ 4,554	$ 618	1, 2
CCB-7.2 *	McMurdo Gulch Reclamation (Castle Rock) 19/20 Project	Design in 2019, Construction in 2020	Stream Reclamation (L = 2,000 lf)	0.38	mi			100	lbs/mi	38	lbs/yr	Storm Flow	90%	34	lbs/year	$ 1,156	$ -	$ -	$ -	$ 1	$ 63	25%	$289	$ 1,846	$ 462	February 2020	1.33	$ 1,532	$ 4,045	$ 2,447	$ 612	1, 2
CCB-7.3 *	McMurdo Gulch Reclamation (Castle Rock) 20/21/22 Project	Design in 2020, Construction 2021	Stream Reclamation (L = 3,700 lf)	0.70	mi			100	lbs/mi	70	lbs/yr	Storm Flow	90%	63	lbs/year	$ 1,940	$ -	$ -	$ -	$ 1	$ 105	24%	$466	$ 1,664	$ 400	November 2021	1.14	$ 2,204	$ 3,145	$ 1,890	$ 454	1, 2
CCB-22..2*	Happy Canyon Creek Upstream of I-25 (MHFD)	Requested in 2020	3000 lf of stream reclamation	0.57	mi			100	lbs/mi	57	lbs/yr	Storm Flow	90%	51	lbs/year	$ 4,021	$ -	$ -	$ -	$ 1	$ 216	9%	$362	$ 4,232	$ 381	May 2023	1.02	$ 4,114	$ 7,240	$ 4,330	$ 390	1, 2

		$/pound of phosphorus (w/ CCBWQA participation at historical limit of 25%)	Stream Reclamation Cost per mile	$/pound of phosphorus (w/o cost sharing)	$/pound of phosphorus (w/ CCBWQA participation at historical limit of 25%)
Minimum =	0.30	$ 1,410	$ 1,532	$ 1,890	$ 472
Maximum =	0.92	$ 5,726	$ 7,531	$ 8,292	$ 2,073
Mean =	0.52	$ 2,975	$ 3,498	$ 4,064	$ 1,016
Median =	0.48	$ 2,987	$ 3,913	$ 4,053	$ 1,013
Standard Deviation =	0.20	$ 1,477	$ 1,864	$ 2,137	$ 534

BASIS FOR ANALYSIS:

(A) Unit cost of phosphorus removal based on annualized cost of completed project over 35 years at 4% interest rate. CRF = 0.053577

(B) All projects identified provide for additional phosphorus immobilization beyond minimum requirements, unless noted otherwise.

2023 CIP NOTES:

1. Corrected project information as noted in comments in spreadsheet.
2. Updated O&M Cost to $2k per mile with a minimum of $1k for projects outside of CCSP

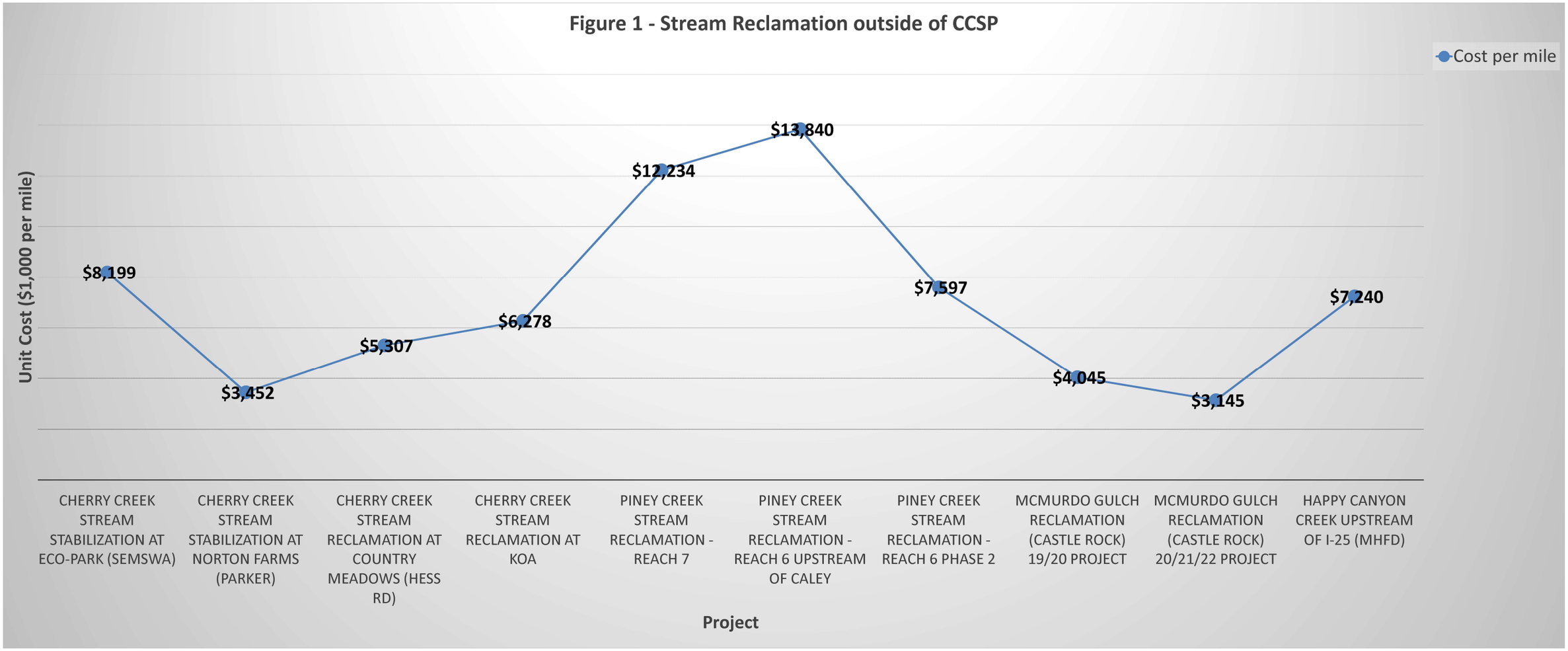
Figure 1 - Stream Reclamation outside of CCSP
Cost per mile
Unit Cost ($1,000 per mile)
$8,199
$3,452
$5,307
$6,278
$12,234
$13,840
$7,597
$4,045
$3,145
$7,240
CHERRY CREEK STREAM STABILIZATION AT ECO-PARK (SEMSWA)
CHERRY CREEK STREAM STABILIZATION AT NORTON FARMS (PARKER)
CHERRY CREEK STREAM RECLAMATION AT COUNTRY MEADOWS (HESS RD)
CHERRY CREEK STREAM RECLAMATION AT KOA
PINEY CREEK STREAM RECLAMATION - REACH 7
PINEY CREEK STREAM RECLAMATION - REACH 6 UPSTREAM OF CALEY
PINEY CREEK STREAM RECLAMATION - REACH 6 PHASE 2
MCMURDO GULCH RECLAMATION (CASTLE ROCK) 19/20 PROJECT
MCMURDO GULCH RECLAMATION (CASTLE ROCK) 20/21/22 PROJECT
HAPPY CANYON CREEK UPSTREAM OF I-25 (MHFD)
Project

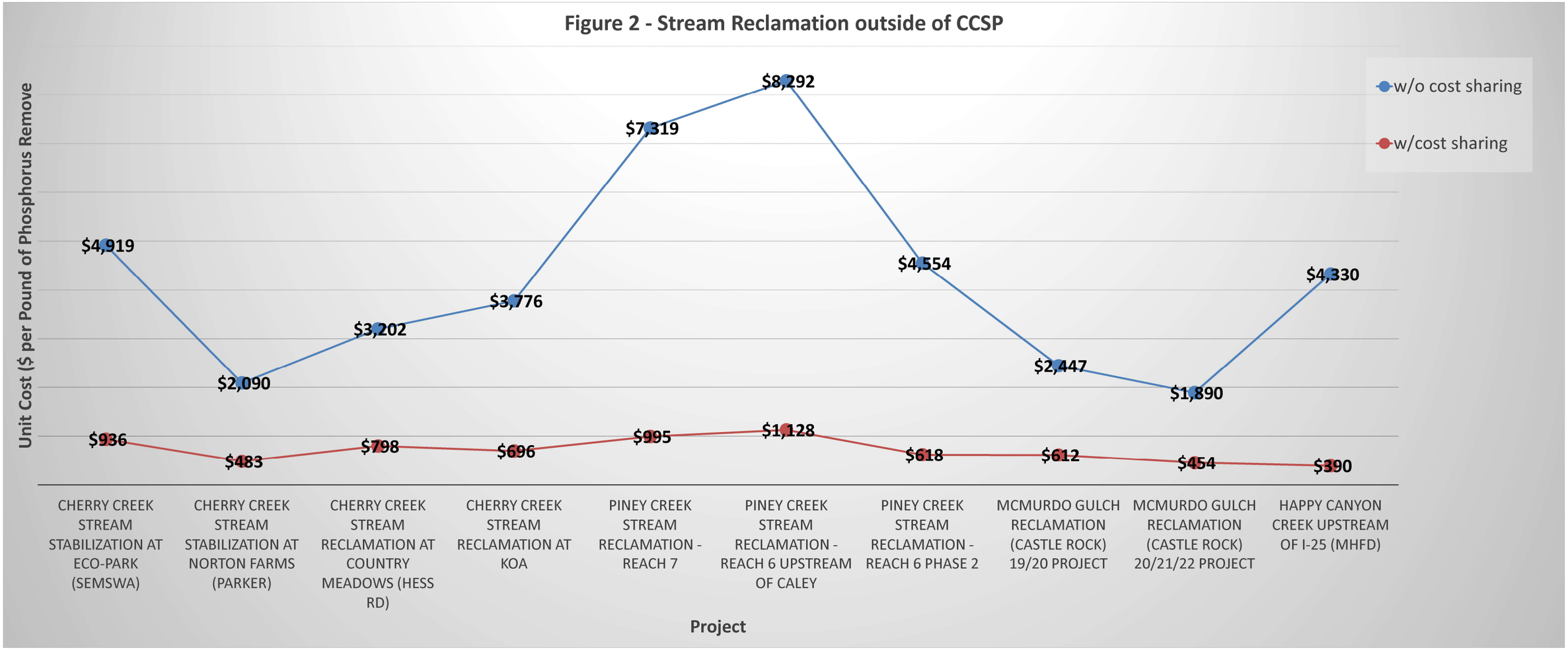
Figure 2 - Stream Reclamation outside of CCSP
Unit Cost ($ per Pound of Phosphorus Remove
w/o cost sharing
w/cost sharing
$4,919
$2,090
$3,202
$3,776
$7,319
$8,292
$4,554
$2,447
$1,890
$4,330
$936
$483
$798
$696
$995
$1,128
$618
$612
$454
$390
CHERRY CREEK STREAM STABILIZATION AT ECO-PARK (SEMSWA)
CHERRY CREEK STREAM STABILIZATION AT NORTON FARMS (PARKER)
CHERRY CREEK STREAM RECLAMATION AT COUNTRY MEADOWS (HESS RD)
CHERRY CREEK STREAM RECLAMATION AT KOA
PINEY CREEK STREAM RECLAMATION - REACH 7
PINEY CREEK STREAM RECLAMATION - REACH 6 UPSTREAM OF CALEY
PINEY CREEK STREAM RECLAMATION - REACH 6 PHASE 2
MCMURDO GULCH RECLAMATION (CASTLE ROCK) 19/20 PROJECT
MCMURDO GULCH RECLAMATION (CASTLE ROCK) 20/21/22 PROJECT
HAPPY CANYON CREEK UPSTREAM OF I-25 (MHFD)
Project