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Selenium Management Program Gunnison River Basin 2021 Annual Progress Report

**Selenium Management Program
Upper Colorado Basin, Western Colorado Area Office**



Mission Statements

The mission of the Department of the Interior is to protect and manage the Nation's natural resources and cultural heritage; provide scientific and other information about those resources; and honor its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Selenium Management Program Gunnison River Basin 2021 Annual Progress Report

Selenium Management Program Upper Colorado Basin, Western Colorado Area Office

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Cover Photo: The EQ Laterals of the Uncompahgre Valley Water Users Association's system in Peach Valley, Delta County, Colorado, May 2022. (Rare Earth Science/Dawn Reeder).

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Introduction and Background

In compliance with several key agreements and decisions, the following report was cooperatively developed by the Bureau of Reclamation (Reclamation) and the Selenium Management Program (SMP) Workgroup. It details the progress of the SMP since its inception with an emphasis on 2021 activities and accomplishments.

In 2009, the Gunnison Basin Programmatic Biological Opinion (PBO) issued by the U.S. Fish and Wildlife Service (FWS) directed Reclamation to “develop and implement a Selenium Management Program (SMP), in cooperation with the State of Colorado and Gunnison River basin water users to reduce adverse effects of selenium on endangered fish species in the Gunnison and Colorado rivers...”. A Selenium Program Formulation Document (PFD) was developed by the SMP Workgroup and finalized in December 2011. The SMP was also identified as a “Conservation Measure” in the 2012 Record of Decision (ROD) related to the Aspinall Unit Re-Operations Environmental Impact Study (EIS); together with the PFD, these documents and agreements have guided SMP activities.

The SMP Workgroup typically meets on a quarterly basis and/or on an as-needed basis. Science & Research and Outreach subcommittees have been established to support the SMP program. SMP Workgroup ground rules were developed and adopted in July 2013. Program activities and status updates are reported in the following annual reports to the FWS and interested parties consistent with the PFD; these reports and studies help the SMP Workgroup monitor conditions and comply with SMP goals and objectives:

- The Selenium Management Program Gunnison River Basin Annual Progress Report (this report) details the activities and progress of the SMP from the previous year relative to the SMP Action Plan (discussed below).
- The USGS prepares Annual Selenium Trend Analysis reports. Prior to 2017, the Trend Analysis reports were attached to the annual summary report. Due to the timing constraints related to publishing requirements, the USGS now creates and publishes a separate, citable Selenium Trend Analysis report. The most recently published Annual Selenium Trend report update is the 2020 report (<https://cmerwebmap.cr.usgs.gov/catalog/item/63077593d34e3b967a8c0d95>).
- The USGS publishes annual reports that incorporate the annual water quality monitoring data. Each report summarizes and evaluates selenium data and performs trend analysis from the preceding five years.

SMP Action Plan

The SMP Action Plan is a living document (Appendix B). It evolves and changes as more is learned about selenium fate and transport, and as implementation activities to reduce selenium loading and concentrations in the Gunnison River are identified, initiated and/or completed. The narrative below highlights the SMP progress and activities and corresponds to the most recent revisions to the SMP Action Plan. The SMP Action Plan is referenced throughout the document by task item number (e.g. A.1.30).

Part A - Reduce Existing Selenium Load

The following are actions that control and/or will control selenium loading from existing sources, such as current irrigated agricultural (off- and on-farm) non-point sources and current non-agricultural point and non-point sources related to municipal, residential and industrial water use practices.

Irrigated Agriculture – Off-Farm – In 2019, Reclamation issued another FOA for Salinity Control Projects above Imperial Dam, pursuant to Title II of the 1974 Salinity Control Act (ref.). Six new projects within the Lower Gunnison Basin were selected for funding, totaling about \$24.2 million (A.1.34 – A.1.39). In total, these new Lower Gunnison Basin projects are predicted to control about 14,488 tons of salt per year.

Two salinity control projects selected in prior year FOAs were completed in 2021 (A.1.29 and A.1.32), one is under construction (A.1.30). Eight salinity control projects are in the planning/National Environmental Policy Act (NEPA) stage (A.1.31, and A.1.33 – A. 1.39). While all of these projects focus on reducing salinity in the Lower Gunnison Basin, there is significant associated selenium load reduction via these salinity control efforts.

Through Phase 10 of Uncompahgre Valley Water User Association’s (UVWUA) East Side Laterals (ESL) Piping Project, approximately 71% of the ESL Project has been completed, is under construction, or is in pre-construction, as shown in Appendix B (A.1.2 - A.1.5, A.1.7-A1.9, A.1.17, A.1.29, and A.1.34). It is anticipated that Phase 10 will begin construction in 2022.

Activities to Target, Define, Plan, and Implement Off-farm Projects – Planning and implementation efforts related to off-farm projects continued in FY2021. These efforts included the use of Natural Resources Conservation Service’s (NRCS) Regional Conservation Partnership Program (RCPP) (RCPP) (associated with PL-566) funding for off-farm improvements (A.2.3.2) related to the Lower Gunnison Project (LGP) Phase 1. Total directed funding of more than \$6M from this program was received and expenditures were made through July 2021 from the Natural Resources Conservation Service (NRCS). This funding was leveraged with approximately \$18M from federal and state sources. The Colorado River District curated this project. The final summary report for this effort can be found here: <https://www.coloradoriverdistrict.org/wp-content/uploads/2022/07/2021-11-12-rcpp-summary-report-v2-1.pdf>.

Beginning in 2018, to the LGP targets four focus areas in the Lower Gunnison Basin for both on- and off-farm projects that control both salt and selenium loading. These areas include Bostwick Park, Crawford, North Fork Water Conservancy Districts (WCDs) and UVWUA. Additional Salinity Control Program and Colorado River Storage Project Memorandum of Agreement (CRSP MOA) funds are being used to leverage the NRCS RCPP funds and to expand these projects while meeting RCPP cost-share matching requirements, as part of the LGP. For example, the SMP continues to support efforts of the UVWUA to develop strategies that maximize funding and cost-share opportunities for completion of the remaining ESL project. Consistent with the other focus areas, the UVWUA has taken a pro-active approach to securing additional grants to maximize water quality benefits and to extend available funding. These cost share funds include both salinity control grants and the CRSP MOA funds. This leveraging concept is the basis for the LGP and is important to the success of SMP project implementation.

A total of \$15M from the CRSP MOA funding has been committed for piping and/or lining additional ESLs (A.1.14), as well as related water efficiency projects. These funds were originally approved and reserved in 2012-13. These funds served as cost share for the LGP.

In June 2020, the parties to the CRSP MOA entered into a new agreement that extends and clarifies the terms of the original CRSP MOA; hereafter, this is referred to as MOA2. The MOA2 preserves revenues to be collected pursuant to the original MOA, and adds additional revenues to be collected beginning in October 2020. The MOA2 funding is available through September 2037. The types of activities that could be funded under the MOA include elective operation, maintenance, and replacement (elective OM&R) and “costs of environmental compliance for CRSP initial units, including biological opinions or programmatic biological opinions and associated improvements that are necessary to satisfy compliance for continuation of operation of facilities...” The CRSP MOA does not provide funding for normal OM&R or new construction/facilities. These funds can and should be used to continue to address selenium loadings in the SMP area of the Lower Gunnison River Basin, as appropriate.

Data has been collected by the U.S. Geological Survey (USGS) on loading impacts of non-agricultural sources, including ponds, individual septic disposal systems, and other point/non-point sources (C.1.9). Preliminary findings indicate some non-ag features such as septic systems and storage ponds are significant variables in selenium models. Findings will be published in FY2023 as part of the GIS Selenium and Salinity Model (C.1.11). See C.1 (Expand Knowledge Base) for additional information on investigations, including the USGS led Selenium Science Plan (C.1.2), which is available upon request, the wetlands study (C.1.7), and the monitoring of the 30-well groundwater network (C.1.6.A). Additional informational documents are published and hosted at <https://www.usbr.gov/uc/progact/Selenium/index.html>.

The SMP Workgroup continued working with sub-basin level data developed by USGS to determine where to encourage, support and target projects that accomplish selenium reduction goals (A.2.3). Based on current information, projects with the largest potential to reduce selenium loading include the Uncompahgre Project’s East side and identified drainages in the North Fork, Crawford and Bostwick Park areas of the Gunnison River watershed (<https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>, and Williams, C.A., Gidley, R.G., and Stevens, M.R., in press, Salinity and selenium yield maps derived from geostatistical modeling in the lower Gunnison River Basin, Western Colorado, 1992–2013:U.S. Geological Survey Scientific Investigations Report).

The SMP also continues to work with the USGS on ranking contributing areas of salt and selenium in the Lower Gunnison Basin using new, updated multiple linear regression models (A.2.3). In 2013, USGS published previous modeling results in a report entitled Ranking Contributing Areas of Salt and Selenium in the Lower Gunnison Basin, Colorado, Using Multiple Linear Regression Models. The report is available online at <http://pubs.usgs.gov/sir/2013/5075/>. Results from the current modeling effort are scheduled to be published in 2023 (C.1.11). Preliminary findings indicate significance in models for septic and pond layers as well as traditional features such as irrigated lands and geology and soil types. New techniques were applied in this version of the modeling effort to better define areas that should be targeted or discussed as high selenium loading areas. Resolution has been effectively increased from square miles to acres (Williams, C.A., Gidley, R.G., and Stevens, M.R., in press, Salinity and selenium yield maps derived from geostatistical modeling in the lower Gunnison River Basin, Western Colorado, 1992–2013: U.S. Geological Survey Scientific Investigations Report).. This increased definition for the models allows the user to more accurately define areas to target for discussion of salinity and selenium control efforts.

Under the Agricultural Improvement Act of 2018 (also known as the 2018 Farm Bill), NRCS may also now enter into EQIP contracts with “water management entities” including States, irrigation districts, and similar entities to implement water conservation and efficiency practices under a watershed-wide project using a streamlined process. These programmatic changes, which were finalized in 2020, will provide new opportunities to utilize NRCS-EQIP funding to support larger, off-farm improvement projects such as canal piping and lining that reduce selenium loading and would provide other water quality and resource management benefits.

Irrigated Agriculture – On-farm – Projects completed from FY2011 through FY2020 under the Environmental Quality Incentives Program (EQIP) and the Salinity Control Program’s Basin States Program (BSP) are described in A.3.1.1 to A.3.1.10. The NRCS EQIP and BSP continues to promote irrigation efficiency projects (A.3.1).

NRCS reports that three on-farm EQIP salinity contracts within the Gunnison River Basin in Delta and Montrose Counties were awarded in FY2021. A little over \$2M was obligated for these projects (A.3.1.11). This does not include the associated costs to provide technical assistance by NRCS nor through the Lower Gunnison Project RCPP EQIP activities curated by the Colorado River District. While these programs may primarily focus on reducing salinity in the Lower Gunnison Basin, there is significant associated selenium load reduction with these salinity control efforts.

In 2012, Reclamation and the State of Colorado finalized an agreement that provided \$2M Basin States Funds to the State Department of Agriculture for on- and off-farm irrigation improvements. This program replaced the previous “Parallel Program”. In 2021, no new contracts were written under the Basin States Program for on-farm improvements (A.3.1.11).

Activities to Target, Define, Plan, and Implement On-farm Projects – Consistent with on-going EQIP and BSP improvements, NRCS agency staff assists landowners with improving water management on their land (A.4.4). These projects have the potential to reduce the mobilization of selenium in the Gunnison Basin through more efficient use of irrigation water. As part of the LGP, 28 planning projects were completed and 14 on-farm water efficiency construction projects were completed through 2021 in the targeted area. In all, a total of \$1.5 million was expended to develop these conservation activity plans covering a total of 1,072 acres, 16 projects were designed and 15 were implemented, treating approximately 401 acres and controlling approximately 800 tons of salt, assuming an average of 2 tons per acre per year.

Pond Seepage (Recreational, Farm, Aesthetic) – The SMP continues to explore options and formulate plans for identifying and mitigating any impacts due to seepage from unlined recreational, farm and aesthetic ponds (A.5.1 to A.5.3)

Municipal & Industrial Sources – Funded by the SCTF, the USGS completed the delineation and inventory of septic sources using GIS. It is anticipated that this data will help to determine if septic systems are a potentially significant source of selenium loading (A.6.3). This information will be published in FY2023 as part of the GIS Selenium and Salinity Model (C.1.11).

Public Lands – The Bureau of Land Management (BLM) Uncompahgre Field Office finalized their Resource Management Plan (RMP) in April 2020. The RMP addresses selenium by including a stipulation to require special design plans for development on soils mapped as saline/selenium soils (A.7.1).

Part B – Outreach and Education

The following are actions that help to educate and inform water users and the public regarding selenium fate, transport and related issues with the intent to prevent, minimize and/or mitigate selenium loading, with a focus on domestic, municipal, residential and industrial water sources.

Public Education and Outreach Activities – The SMP Education and Outreach Subcommittee continues to work on planning and coordination activities that include educating the public, county

commissioners, and collaborating with and supporting other outreach efforts occurring in the Lower Gunnison Basin which benefit selenium reduction goals of the SMP. This includes a growing presence on the GunnisonRiverBasin.org website.

The Gunnison Basin and Grand Valley Selenium Task Force (STF) and the Colorado River District continue to help to support the annual Soil Health Conference in Delta (B.2.2). The conference is an opportunity to meet with water users and landowners and provide information on selenium activities in the Lower Gunnison Basin and beneficial relationship to healthy soil practices.

The SMP will also continue to explore opportunities to address new sources of selenium loading. In 2022, the SMP will endeavor to continue developing strategies to facilitate and encourage Lower Gunnison Basin water users and the public to undertake projects and implement BMPs to minimize new sources (B.2.4).

Participation in the SMP by federal and state agencies and local water users' organizations has been good. Additional outreach to local and county officials and regulatory agencies will continue in 2022.

Part C - Support Activities – Studies, Research and Monitoring

The following are additional support activities such as research and monitoring that expand our knowledge base on selenium loading, fate, transport and mitigation.

Selenium Studies – The SMP continues to support expanding the knowledge base as illustrated in C.1 through C.2. These investigations are intended to increase our knowledge and ultimately lead to additional or more focused implementation activities. The SCTF has financially supported a majority of these investigations, performed by the USGS, along with agency and other matching cooperator funding.

In 2013, the State of Colorado and USGS funded the development of a Selenium Science Plan intended to describe and identify data gaps in monitoring and research efforts as needed to more fully understand selenium occurrence and the efforts to mitigate projects in the Lower Gunnison Basin (C.1.2). A draft 5-Year plan was completed in late 2013 and finalized in 2014. The final Plan was approved by the SMP Workgroup. The Workgroup and its Science Team are planning to update the Selenium Science Plan, beginning in 2022. Currently, the SMP and USGS are targeting late 2022 or early 2023 to accomplish this update. The Workgroup and Science Team will continue to document and approve updates as needed.

Other major accomplishments include continued monitoring of the 30-Well Groundwater Monitoring Network (C.1.6.A). While it is still known as the 30-Well Network, only 28 of the original wells remain. Monthly groundwater levels have been taken at each well in the past, however there is not a current funding source for this effort and most are not currently monitored. The installation of this 30-well network and the data collected allowed for the development of a conceptual model of selenium mobilization and transport in the shallow groundwater system. Monitoring wells were sampled between August 2013 and March 2015 to understand groundwater quality, seasonality, sources of recharge, and groundwater age. Concentrations of dissolved selenium ranged from less than 0.01 micrograms per liter (<0.10/1 µg/L) to a high of to 4,100 µg/L, with a median concentration of 14.0 µg/L. Concentrations showed a high degree of spatial variability and no seasonal difference. Similarly, no seasonal pattern was observed in specific conductance values of groundwater despite the influence of seepage from irrigation water that typically exhibits considerably lower specific conductance values.

Nitrate concentrations in groundwater derived from geologic material has been identified to be a primary control on reduction-oxidation conditions in groundwater

(<https://www.sciencedirect.com/science/article/abs/pii/S0883292714001516?via%3Dihub>). As such, nitrate values in the local geology play a significant role in the degree of selenium oxidation and mobility in groundwater. Nitrate concentrations in groundwater can be reduced by denitrification, but in the study area, data suggest that groundwater denitrification may not be sufficient, or to the extent necessary, to enable selenium reduction. Thus, selenium mobility remains relatively high and groundwater discharge to the surface water system remains a significant source of selenium loading where nitrate groundwater concentrations are elevated.

Additionally, groundwater age analyses were performed for groundwater samples from eight wells and results ranged from 6 to 20 years old. Importantly, these isotopic data results indicate groundwater was recharged by irrigation water; no information collected supported an older, deeper source of recharge to the shallow groundwater system. These results, along with others were published in 2019, and are available here: <https://pubs.er.usgs.gov/publication/sir20195029> (C.1.6.B).

FY2021 Groundwater Level Measurements: This is a continuation of monitoring the existing 30 well network for an additional 12 months. All 29 wells will be measured once a month. This work tracks trends and helps the SMP to better understand seasonal groundwater fluctuations, leading to a better definition of flow paths that affect fate and transport of selenium loads from the east side of the UVWUA project area. The water level data was collected by a volunteer for some months as well as USGS. All work is checked and approved by USGS. A request to the SMP and SCTF has been made to continue water level monitoring into 2022.

In FY2017, Reclamation received a \$15,000 Science and Technology (S & T) Grant to investigate available technologies for in situ selenium removal from groundwater, and to identify locations within the study area best suited for a demonstration project. Work included a literature search and site visits. A scoping report was completed in February 2018. The next step would be to potentially select one or two areas to conduct a demonstration project and determine what in situ techniques show the most promise. The S & T Grant funding source allows Reclamation to write a follow-on proposal and apply for another grant, in the event a demonstration project is identified. Through this funding source, Reclamation can solicit up to \$100,000 each year for three years to implement a demonstration project. This is a joint effort between Reclamation and the USGS (C.2.3). This effort is currently on hold as the key Reclamation and USGS personnel involved in this effort have moved on to other positions.

The USGS investigated loading impacts of individual septic systems as part of its GIS Selenium and Salinity Model (C.1.11).

The USGS completed the Sunflower Drain groundwater/surface water interaction study (C.1.13). This study provides information about the spatial and temporal distribution of groundwater inflow to Sunflower Drain and quantifies instantaneous groundwater selenium loads during the non-irrigation and irrigation seasons. Locations of diffuse and focused groundwater discharge to Sunflower Drain were identified. This report was published in 2020 (<https://pubs.usgs.gov/sir/2020/5132/sir20205132.pdf>).

In support of the Selenium Management Program (SMP), the USGS is developing an Ecosystem-scale Selenium Accumulation Model (ESAM) for the critical habitats of the Gunnison River (C.1.14). Selenium is accumulated in aquatic organisms through their diet rather than directly from aqueous or dissolved selenium in the water column. An ESAM is needed to understand how selenium enters the food web and to accurately relate dissolved (aqueous) selenium to effects in fish. A report on the ESAM was published in 2021 (<https://pubs.acs.org/doi/full/10.1021/acs.est.0c06582>).

Monitoring Activities: Water Quality – The SMP continues to support a robust surface water

quality monitoring program (C.3.1 through C.3.3). These data are published to the USGS' National Water Information System (NWIS) webpage (See hyperlinks in Appendix C).

The USGS, in cooperation with Reclamation, the Colorado River Water Conservation District (CRWCD), and the BLM, analyzed salinity and selenium data collected at sites across Western Colorado to develop a series of regression models. The study area includes sites throughout the Colorado River Basin and/or in one of three tributary basins: the White River Basin, the Lower Gunnison River Basin, and the Dolores River Basin. By using data collected from water years 2009 through 2011, regression models which are able to estimate concentrations were developed for salinity and selenium at selected sites. This effort was published in a report titled Regression Models for Estimating Salinity and Selenium Concentrations at Selected Sites in the Upper Colorado River Basin, Colorado, 2009–2012 ([of2014-1015.pdf \(usgs.gov\)](#)).

The regression models are used in conjunction with real time water-quality information from streamflow gages to estimate 'real time' concentrations and loads for selenium (and at some locations, salinity). Several of these sites are located in the Lower Gunnison River Basin (LGRB) and critical fish habitat. These real time sites are listed and indicated by a * in Appendix C. Estimates from the regressions are displayed and housed and the USGS National Real-Time Water Quality (NRTWQ) website: [US Geological Survey Real-Time Water Quality Data For the Nation \(usgs.gov\)](#).

An observation may be made that some of the selenium estimates exceed the actual laboratory values by as much as 25% during certain periods of the year. The USGS explains that the estimates were more accurate a decade ago; however, decreasing trends in selenium have caused the more recent estimates to be high. The SMP Science Team will discuss the utility of updating the selenium equations at future meetings and decide if the effort fits with the programmatic and or scientific goals of the SMP.

Research and Monitoring Activities: Endangered Fish – The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) continues to conduct population monitoring in the Gunnison River (C.4.1). In previous years, the SMP provided funding through the SCTF to the Upper Colorado River Monitoring Program for Mercury and Selenium in Native Fish. The program is a collaboration between BLM, FWS, the states of Utah and Colorado, the Recovery Program, and the USGS. Data collected will provide a better understanding of the extent of selenium accumulation in various native and non-native fish in the Upper Colorado River system.

The PBO stipulates that endangered fishes and the sympatric fish community be monitored to determine their status before and after the SMP is implemented and following reoperation of the Aspinall Unit reservoirs. The PBO specifies multi-life stage monitoring and density estimates of Colorado pikeminnow and razorback sucker in the Gunnison and Colorado rivers. The entire fish assemblage is monitored using electrofishing catch rates (number of fish per unit sampling effort) to track trends in species relative abundance both in the Gunnison River and the 18-mile reach of the Colorado River downstream of the Gunnison River confluence. Larval seining conducted in both rivers provides an index of reproductive success using mean number of larval fish per sample. For young-of-year and small-bodied fish monitoring, seining is conducted during fall (mid-September) using standardized methodology in both the Gunnison (Delta, CO to the confluence) and Colorado (Gunnison confluence to CO/UT state line) rivers.

Larval sampling was completed in both the Gunnison and 18-mile reach of the Colorado River (eight passes in each) during May through July, 2021; samples were preserved and forwarded to Colorado State University (CSU) for identification. Young-of-year sampling was completed in September 2021 on both rivers and samples were preserved for enumeration at CSU. Endangered fish collected in 2021 through electrofishing include 1 bonytail and 15 razorback sucker on the Colorado River, and 2 Colorado pikeminnow and 197 razorback sucker on the Gunnison River. Native and endangered fish catch rates in the Colorado and Gunnison rivers have generally remained stable since the study began in 2011, especially

in the Gunnison River. Catch rates of non-native white sucker and white sucker hybrids are generally higher in the Gunnison River than they were in the 1990s, and common carp catches have declined in recent years. Catch rates of all fish species in the Colorado River are variable without clear trends over time. No smallmouth bass were captured in the Gunnison River in 2021, likely due to lack of spillway operations at Ridgeway Reservoir. No fish tissue sampling for selenium concentrations was conducted in 2021 (https://coloradoriverrecovery.org/uc/wp-content/uploads/sites/2/2022/01/163_FY21AR_508-2.pdf) (C.4.2).

APPENDIX A – ACRONYMS LIST

The following acronyms and abbreviations are used in this Annual Progress Report and in the Action Table:

Acronym or Abbreviation	Description
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BPWCD	Bostwick Park Water Conservancy District
BSP	Basin States Program (Salinity Control Program)
BWP	Basinwide Program (Salinity Control Program)
CDPHE	Colorado Department of Public Health and Environment
CRSP MOA	Colorado River Storage Project Memorandum of Agreement
CRWCD	Colorado River Water Conservation District
CSCB	Colorado State Conservation Board
CSU	Colorado State University
CWCB	Colorado Water Conservation Board
CWCD	Crawford Water Conservancy District
DCD	Delta Conservation District
EQIP	Environmental Quality Incentives Program
ESL	East Side Laterals
FOA	Funding Opportunity Announcement
Forum	Colorado River Basin Salinity Control Forum
FWS	Fish and Wildlife Service
GW	Groundwater
LGP	Lower Gunnison Project
MCD	Mesa Conservation District
NEPA	National Environmental Policy Act
NFWCD	North Fork Water Conservancy District
NRCS	Natural Resources Conservation Service
NWIS	National Water Information System
PBO	Programmatic Biological Opinion
PFD	Program Formulation Document
RCPP	Regional Conservation Partnership Program
Reclamation	Bureau of Reclamation
Recovery Program	Upper Colorado River Endangered Fish Recovery Program
RMP	Resource Management Plan
ROD	Record of Decision
S & T	Science and Technology
SCTF	Species Conservation Trust Fund
SCD	Shavano Conservation District
SMP	Selenium Management Program
STA	Subject to Appropriation
STF	Selenium Task Force
SW	Surface Water
TDB	To Be Determined
USGS	U.S. Geological Survey
UVWUA	Uncompahgre Valley Water Users Association
WNTSC	NRCS West National Technology Support Center, Portland
WQ	Water Quality

APPENDIX B – PROGRAM 2021 ACTION PLAN

Current activities for the Selenium Management Program are identified in the following table. Separate sections are included for activities that:

- A. Reduce existing selenium load
- B. Perform outreach and education to the public, water users, and local agencies
- C. Provide support for Program activities and goals

Entities cooperating to complete an activity are identified, typically with the lead entity identified first. Schedules are shown where they have been identified by placing an “X” in the appropriate Federal fiscal year (Oct-Sept) column. Funding sources are only identified when funding has been committed or assurances have been provided by an organization.

Please email Jenny Ward at jward@usbr.gov to request a copy of the 2021 Action Plan.

APPENDIX C – 2021 WATER QUALITY SAMPLE SITES

LBG SMP 2021 Water Quality Sites

2021 USGS Water-quality sites in the Lower Gunnison Basin associated with the SMP

[09129600](#) Smith Fork near Lazear, CO #

[09128500](#) Smith Fork Near Crawford, CO #

[384434107432701](#) Alum Gulch Near Hotchkiss, CO

[384822107411201](#) Cottonwood Creek at County Road J75, Near Mouth

[384200107381401](#) Smith Fork at 38.5 Road Bridge Near Hotchkiss, CO #

[09136100](#) North Fork Gunnison River above mouth near Lazear, CO *

[384624107570701](#) Gunnison River at 2200 Road Bridge, at Austin, CO #

[09146200](#) Uncompahgre River near Ridgway, CO #

[09147500](#) Uncompahgre River at Colona, CO *

[382802107513301](#) Montrose Arroyo at East Niagara Street

[383926107593001](#) Loutsenhizer Arroyo at Hwy 50 near Olathe, CO

[09149500](#) Uncompahgre River at Delta, CO *

[09144250](#) Gunnison River at Delta, CO *

[09150500](#) Roubideau Creek at mouth near Delta, CO #

[384527108152701](#) Gunnison River above Escalante Creek, near Delta, CO #

[385011108225401](#) Gunnison River blw Dominguez Creek nr Whitewater, CO #

[09152500](#) Gunnison River near Grand Junction, CO (aka Whitewater site) *

Denotes site that are discontinued, unless additional funding is identified.

* Denotes real-time, continuous monitor sites using linear regression to calculate instantaneous dissolved selenium loads. The *'s are hyperlinked to the site's real-time USGS data site.

2021 Selenium Task Force water-quality sites in the Lower Gunnison Basin associated with the SMP

USGS 09146200	Uncompahgre River near Ridgway, CO
USGS 381716107454301	Billy Creek at Mouth
USGS 381933107455101	Onion Creek at County Rd 906A near Colona
USGS 382034107464501	Beaton Creek at Uncompahgre Rd near mouth
USGS 09137050	Currant Creek, near Read, CO (Bridge at mile marker 8 on Hwy 92)
USGS 384812107524501	Oasis Ditch at Hwy 92
USGS 384802107522201	Lawhead Gulch at Hwy 92
USGS 384752107502201	Sulphur Gulch at Hwy 92
USGS 384756107490801	Big Gulch at Hwy 92
USGS 384747107430501	Short Draw west of County Fairgrounds at Hotchkiss
USGS 384915107412101	Jay Creek at Hwy 133 near mouth

Note: All sites are active, but no samples were collected in FY2021

APPENDIX D – 2021 ASPINALL UNIT OPERATIONS

Aspinall Unit Operations for Calendar Year 2021 under the Gunnison River PBO

In water year 2021, Western Colorado experienced a near average snow season. Most months accumulated less than average snow, and spring was relatively dry. Spring runoff ended up with 2021 falling into the Dry year category as melting snow was absorbed into dry soils, and river flows underperformed expectations. With the Record of Decision for the Final Aspinall Unit Operations EIS that was signed on May 3, 2012, peak and base flow targets were established for the Whitewater gage near Grand Junction, Colorado to aid in the recovery of four endangered fish; the Humpback Chub, Bonytail Chub, Razorback Sucker, and the Pikeminnow. This report will assess how well the 2021 operations of the Aspinall Unit provided sufficient releases of water at critical times and quantities necessary to avoid unnecessary harm to the endangered fish species and their essential habitat while continuing to meet the authorized purposes of the Aspinall Unit.

Peak Flows Despite snow accumulation that was not much below average, 2021 was considered a dry year. Year type is determined by the forecasted April through July inflow volume to Blue Mesa Reservoir. Dry years are defined as years where the forecasted inflow volume is less than 381,000 acre-feet. The April 1st issue of the runoff forecast predicted 440,000 acre-feet of inflow to Blue Mesa Reservoir, in the lower half of the moderately dry category. The actual April through July inflow volume for 2021 totaled 317,000 acre-feet, with runoff conditions declining significantly after a dry month of April. The May 1 runoff forecast placed 2021 in the dry year category with a peak flow target of 900 cfs at the Whitewater gage, and no duration day requirements for half bankfull or peak flow levels. Figure 1 shows the peak flow and duration day targets for the Gunnison River at Whitewater based on 2021 landing in the dry year category.

Peak Flow and Duration Day Targets at Whitewater

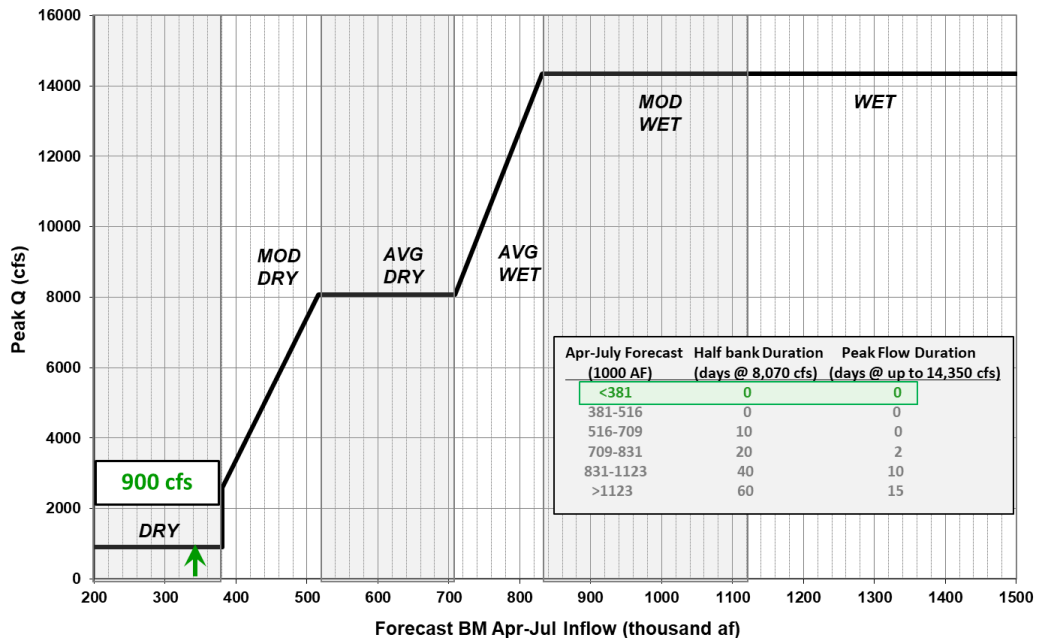


Figure 1. Peak flow and duration day targets at the Whitewater gage as determined by April-July Forecasted Inflow. A peak flow of 1,930 cfs was reached on the Gunnison River at Whitewater on June 7th. This peak flow was primarily in response to tributary flows from the North Fork of the Gunnison River, downstream from the Aspinall Unit.

Half Bankfull Flow Duration The recommended number of duration days at half-bankfull flows and at peak flow are also dependent on the forecasted inflow volume to Blue Mesa Reservoir. The table insert in Figure 1 shows the recommended duration of days at peak flow and half bankfull flows for ranges of forecasted inflow volume to Blue Mesa Reservoir. In dry years, there are no requirements for a duration at half bankfull flow levels.

Base Flows Base flow recommendations were determined by a study conducted by the Fish and Wildlife Service (Figure 2). Year type for base flow is also determined by the April-July forecasted inflow volume to Blue Mesa Reservoir, so 2021 followed the targets for a dry year based on the spring forecasts for April through July

inflow volume to Blue Mesa Reservoir. Since 2020 was considered a moderately dry year, the moderately dry year baseflow targets are carried over for the January-March time period as the hydrology of these months is more dependent on the previous year's hydrology than the current year. Per the drought rules in the Aspinnall Operations EIS, the baseflow target for July and August was lowered to 900 cfs. The drought rule states that in Dry and Moderately Dry years, when the content of Blue Mesa Reservoir is below 600,000 acre-feet, the baseflow target is reduced from 1,050 cfs to 900 cfs. The content of Blue Mesa Reservoir was below 600,000 acre-feet for the entire year.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	1050	1050	1050	1050	1050	1500	1500	1500	1050	1050	1050	1050
Mod Wet	1050	1050	1050	1050	1050	1500	1500	1500	1050	1050	1050	1050
Avg Wet	1050	1050	1050	1050	1050	1500	1500	1050	1050	1050	1050	1050
Avg Dry	1050	1050	1050	1050	1050	1500	1500	1050	1050	1050	1050	1050
Mod Dry*	750	750	750/790	750/890	750/890	1050	1050	1050	750/890	750/790	750/790	750
Dry*	750	750	750/790	750/890	750/890	1050	1050	750/890	750/890	750/790	750/790	750

*During March through November in Moderately Dry and Dry type years, additional releases will be made as necessary to provide flows above the 750 cfs anticipated to be diverted by the Redlands Water and Power Company, for the fish ladder and fish screen as shown.

Figure 2. Base flow recommendations to support critical flows and habitat for the endangered fish.

Baseflow targets were met or exceeded for most days in 2021 with a combination of releases from the Aspinnall Unit and tributary flow contributions to the mainstem Gunnison River. Flows in the Gunnison River at Whitewater dropped below the baseflow target level for several periods during January, February and March. In January and February, this was a result of icing of the stream gage which caused data to be inaccurate or unavailable. In March this was due to maintenance and repair work at the Redlands diversion dam which was assisted by flows below the 750 cfs baseflow target. Throughout the rest of the year, release adjustments at the Aspinnall Unit were made to increase river flows when flows were forecast to remain below the baseflow target for an extended period of days.

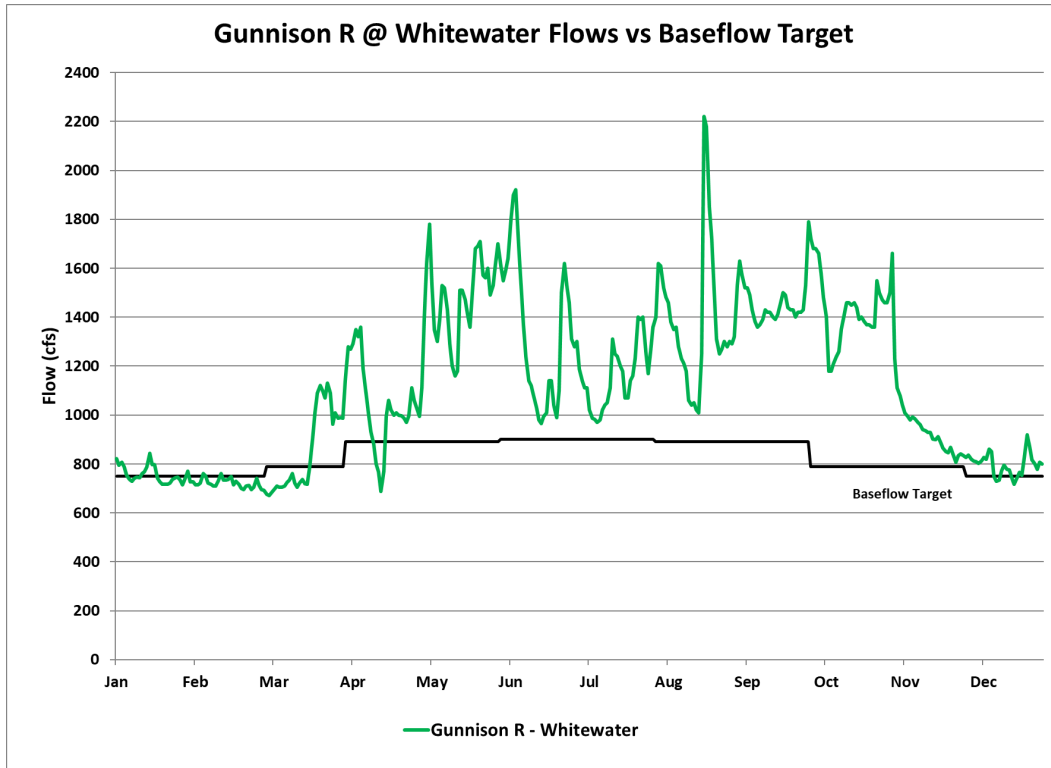


Figure 3. 2021 Base Flow Target vs. Actual Flows at Whitewater Gage.

[Gunnison River @ Whitewater](#)

Gunnison River Flow differences between the Gunnison River at Whitewater and the Gunnison River below the Redlands Diversion Dam are primarily due to the diversion of water to the Redlands Canal. 2021 was a dry year and flows on the lower Gunnison River saw several periods below 300 cfs during the summer months. Figure 4 shows the flows in the Gunnison River below the Redlands Diversion Dam, along with the diversion rate at the Redlands Canal.

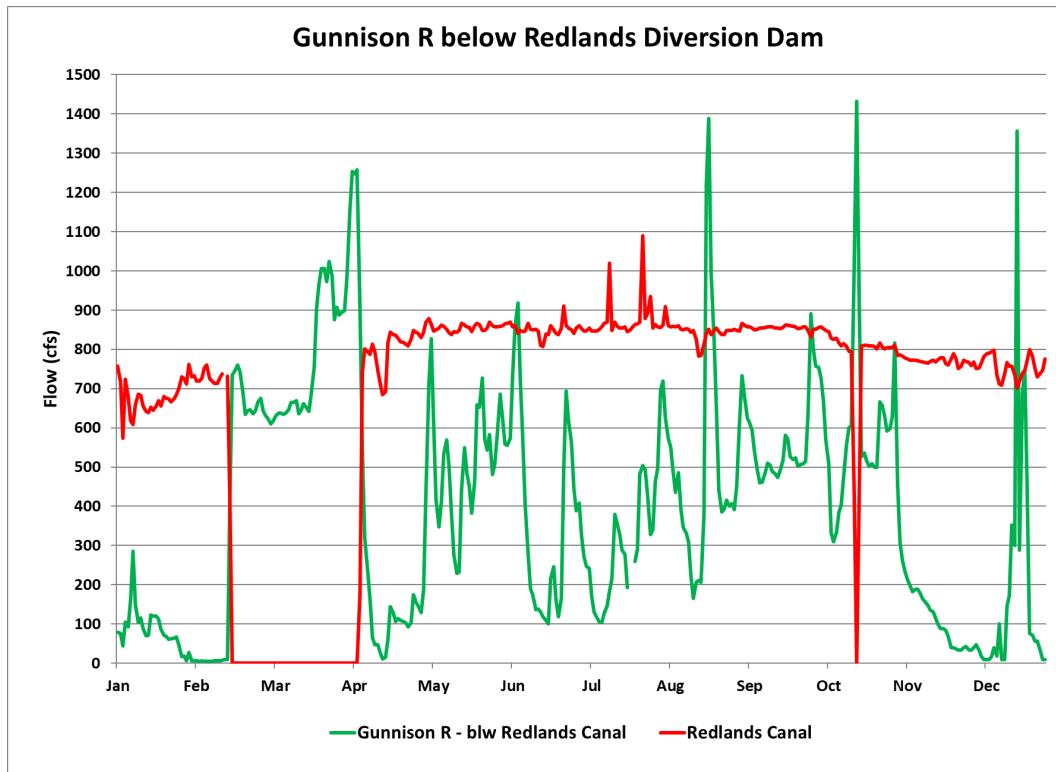


Figure 4. Gunnison River flows as measured below the Redlands Diversion Dam.

[Gunnison River below Redlands Diversion](#)

[Redlands Canal](#)

Operational Issues There were no operational issues that impeded flows from the Aspinall Unit to the Whitewater gage during the 2021 water year.

Summary In 2021, hydrologic conditions remained in the dry category once the runoff season began. Conditions throughout the Gunnison Basin were somewhat dry during the winter and very dry during the spring. Monsoon rains were pretty good during the early summer and provided some relief from the poor runoff. Dry conditions required additional releases from the Aspinall Unit to sustain the baseflow target levels in the lower Gunnison River as measured at the Whitewater gage. Additionally, during August, September and early October, releases from the Aspinall Unit as part of the Drought Response Operations Agreement (DROA) to preserve water levels at Lake Powell benefitted the lower Gunnison River by providing river flows above the baseflow target. By the end of the year, storage in Blue Mesa Reservoir was well below a normal end of year level.

APPENDIX E – 2021 ANNUAL FLOW MANAGEMENT AND CONSERVATION STATUS OF THE DOLORES RIVER

Annual Flow Management of the Dolores River and Status of Conservation Recommendations Water Year 2021

Background: In 1975, the Dolores River was designated as a component of the National System of Wild and Scenic Rivers. Nearly 40-years later the San Juan Public Lands Center (SJPLC) began revising their San Juan National Forest Resource Management Plan. A requirement of the planning process was that all planning area rivers be assessed for their eligibility, classification, and suitability for inclusion in the National Wild and Scenic River System. The San Juan Public Lands Draft Land Management Plan (DLMP) found the Dolores River from the outlet of McPhee Reservoir to Bedrock Colorado to be preliminarily suitable for inclusion in the National Wild and Scenic River System. Outstanding Remarkable Values (ORV's) identified in the DLMP for this section of the Dolores River include fish and wildlife resources, recreation, scenery, and other geological, ecological, and archeological values. Some of the specific ORV's are the roundtail chub, rafting, New Mexico privet, canyon treefrog, and Eastwood's monkeyflower. Since the Dolores River Dialogue (DRD) had been focusing on the lower Dolores River, the SJPLC felt that the DRD had potential to find an alternative to the Wild and Scenic suitability designation that would achieve similar protections for the stream and its ORV's.

In 2008, the SJPLC asked the DRD for assistance in protecting the ORV's and in considering alternatives to Wild and Scenic suitability. The DRD in conjunction with the SJPLC established the Lower Dolores River Working Group (LDWG) and began a process of understanding the human, ecological, and political dynamics at play on the lower Dolores River and how to best address the needs of the ORV's.

As an outcome of the LDWG, a legislative committee was established to consider an alternative to Wild and Scenic designation. A National Conservation Area was considered the most promising alternative and language was being drafted for legislative consideration. While drafting the language, it was determined that in order to protect the native fish ORV, assistance would be needed from native fishery experts. The "A Way Forward" committee was established and a team of scientists (Bill Miller, Kevin Bestgen, and Phaedra Budy) was hired to review existing data and summarize the status and trends of the three species from McPhee Dam to the confluence with the San Miguel River. The final report presented nine potential management opportunities that may assist with the improvement of the native fish. They are: spill management, base flow management, sediment transport flows, habitat maintenance flows, thermal regime modification, reducing the effects of introduced coldwater species, reducing the effects of introduced warm water species, and supplementing native fishes.

Upon completion of the A Way Forward final report, a Monitoring and Recommendation Team (MRT) consisting of water managers, NGOs, and State and Federal Agencies was formed to find ways to implement the nine recommendations. The MRT, with financial assistance of the Colorado Water Conservation Board, completed its first iteration of "The Lower Dolores River Implementation, Monitoring and Evaluation Plan for Native Fish" (IME Plan) in August 2012. Public comments to the plan were received, and the second iteration was published in June 2014.

An electronic version of this plan and appendices can be obtained from the Dolores River Dialogue website: <http://ocs.fortlewis.edu/drd/pdf/Lower-Dolores-River-Implementation-Monitoring-and-Evaluation-Plan-for-Native-Fish-June%202014.pdf>

A July 2018 Reclamation report prepared for the U.S. Fish and Wildlife Service entitled "Flow Management and Endangered Fish in the Dolores River during 2012 – 2017" concluded that "...available information appears insufficient to identify linkages between Reclamation's flow management at McPhee and endangered fish recovery" on the lower reaches of the Dolores River. However, coordinated efforts between the Colorado Parks and Wildlife (CPW), Reclamation and district managers to meet IME Plan targets for native fish habitat maintenance and improvement are ongoing.

Senator Michael Bennet posted draft legislation in 2020 on his website from a proposal to develop a National Conservation Area on the lower Dolores River from McPhee Dam to the Colorado state line and received comments. Edits to the draft legislation from the comments are expected to be complete by early June 2022 for introduction as a bill.

Downstream Releases: The Dolores Project experienced its most severe Project water shortages in 2021 due to lack of snowmelt runoff and lack of carryover in McPhee Reservoir from the previous season. Managers provided the shorted Project water supply (almost no Project water) and downstream senior rights totaling 3,225 AF below McPhee Dam. Downstream releases for water year 2021 ranged from 15 cubic feet per second (CFS) to 10 CFS April through July 22, and 5 CFS through March 2022. McPhee Reservoir did not fill in 2021.

Conservation Recommendation No. 1. *We recommend that Reclamation continue support efforts of the three species conservation strategy on a range-wide basis, including conservation efforts on the Dolores River.* The Bureau of Reclamation has been an active participant of the Dolores River Dialogue since its inception in 2004, and is currently an active member of the Monitoring and Recommendation Team (MRT), formerly the Implementation Team. The MRT provides management recommendations, to Reclamation, related to releases to the lower Dolores River (from McPhee Dam to the confluence of the San Juan Miguel River) for the native and non-native fishes and rafting, and promulgates additional monitoring downstream to help inform future recommendations.

Reclamation supported, with the MRT, a grant funded by the Colorado Water Conservation Board to Four Corners Water Center at Fort Lewis College for Dolores River Adaptive Management Support, a five-year monitoring effort to improve understanding of how the Dolores River channel below McPhee Reservoir is responding to changes in streamflow and sediment. The monitoring data from this effort will be used to help inform decisions related to management of releases downstream of McPhee Dam, among other uses.

Conservation Recommendation No. 2. *We recommend that Reclamation continue to work with the Biology Committee to consider spill and flow management options to benefit the native fishery in the middle and lower Dolores River while continuing to honor commitments related to downstream rafting.* The Biology committee was setup as an advisory committee for fishery pool management only. Reclamation and the Dolores Water Conservancy District are actively involved with the DRD and MRT in performing downstream release management. Reclamation also supported, with the MRT, the addition of permanent PIT array sites that help Colorado Parks and Wildlife (CPW) and the biology committee monitor fish movements within the Dolores and San Miguel Rivers which can help inform decisions related to management of releases downstream of McPhee Dam.

Reclamation takes an active role in the Biology Committee in identifying base needs and possibilities. Annual base release budgets are drafted by CPW and recommendations are made to project operators.

Conservation Recommendation No. 3. *We recommend that Reclamation continue to take an active role in the Dolores River Dialogue, in particular activities related to native fish.*

See background narrative.

WY 2021 Dolores Project Hydrograph

