FRUITA
COLORADO

AGENDA ITEM COVER SHEET

TO: FRUITA CITY COUNCIL AND MAYOR

FROM: KIMBERLY BULLEN, PUBLIC WORKS DIRECTOR

DATE: AUGUST 3, 2021

RE: PRESENTATION – SGM ENGINEERING, CONSULTING & SURVEYING, INC. AND MESA COUNTY WILL GIVE A PRESENTATION ON THE TOTAL MAXIMUM DAILY LOAD ASSESSMENT (TMDL) FOR COLORADO RIVER TRIBUTARIES IN THE GRAND VALLEY

BACKGROUND

As part of the federal Clean Water Act, Section 303(d), states are required to periodically submit to the EPA a list of waterbodies that are impaired. A waterbody is considered impaired when it does not meet a state's water quality standards. States develop water quality standards that (1) designate the beneficial uses a waterbody can support, (2) define the levels of certain pollutants and certain characteristics that a waterbody can contain while still supporting the designated beneficial uses, and (3) protect waterbodies that currently support their designated beneficial uses from becoming impaired.

The Clean Water Act and EPA regulations require that states develop total maximum daily loads (TMDLs) for impaired waters identified on the section 303(d) List. In Colorado, the agency responsible for developing the 303(d) List is the Water Quality Control Division at the Colorado Department of Public Health and Environment. The List is adopted by the Water Quality Control Commission as Regulation No. 93. A TMDL is used to determine the maximum amount of a pollutant that a waterbody may receive and still maintain water quality standards.

The waterbodies of concern are in the Lower Colorado River Basin that includes all tributaries to the Colorado River. The Grand Valley watershed is a portion of the Lower Colorado River Basin which encompasses more than 30 stream/river segments and six lake/reservoir segments. Pollutants of concern are <u>dissolved selenium</u>, <u>total recoverable iron</u>, and <u>E.coli bacteria</u>. These pollutants can originate from an array of sources including point (e.g. wastewater treatment facilities) and nonpoint (e.g. crop field runoff) sources.

The Draft TMDL came out in *April 2021* and Grand Valley stakeholders (City of Grand Junction, City of Fruita, Grand Valley Water Users Association and Mesa County) as well as the Colorado Stone, Sand & Gravel Association provided comments regarding the draft TMDL document. The concerns included the <u>source assessment</u>, <u>allocation of loads</u>, and <u>prioritization of implementation activities</u> (TMDL allocations).

Source Assessment - the concerns include poor data or missing data, limited ability to identify and assess sources of pollutants, and a challenge to bridge the link between sources and the observed impairments.

Allocation of Loads - point sources (wasteload allocation), seven (7) permits identified, GVWUA inaccurate assignment of (non-standard MS4 permit) loadings to Indian Wash, Mesa County MS4 Permit loadings outside of the urbanized area. Nonpoint sources (load allocation), need to understand baseflow loadings (irrigation and non-irrigation seasons) and stormwater loadings, and need to understand background contributions of loadings.

TMDL allocations and implementation responsibilities - Delineation of the drainage areas isn't accurate and misrepresents implementation responsibilities for loadings outside the urbanized area; no data to understand the influence of stormwater loadings upstream of the TMDL watershed upper boundary versus the background loadings; large loading reductions are required for the non-irrigation season. Most of the loadings are from agricultural return flows. The ability to control these loadings is limited; and E. coli loadings for Adobe and Leach Creeks need to be characterized to understand the sources.

A request was made to the Water Quality Control Division (WQCD) to delay the determination of the Final TMDL for three years to allow the following:

- Continue ongoing Grand Valley Watershed Plan and stakeholder process
- Initiate the Colorado Mesa University's E. coli research to inform better characterization of the source loadings
- United States Geological Survey's (USGS's) post-fire water quality monitoring plan to be developed and implemented. Specifically, initiate a monitoring study that will increase the number of streamflow and water quality gages to: collect paired water quality and streamflow measurements at the 9 "high" priority and 6 "medium" priority monitoring locations to aid analysis, specifically, strengthen the linkage between the pollutant sources and impairments and the contribution of stormwater loadings and baseload loadings during the distinct irrigation and non-irrigation seasons; update data to "current conditions" in areas and evaluate loadings across wet, dry, and average years and shifting land uses to understand the influence of climactic variations; and integrate the Orchard Mesa and Walter Walker Wildlife Areas as well as other backwater habitats that support the threatened and endangered fish in the Grand Valley.
- Provide annual reports and periodic updates to WQCD and EPA to document progress across these projects

A follow up discussion with WQCD staff was held on June 24, 2021 to further explain our concerns. We anticipate the report to be submitted to EPA that will open a 30-day comment period. There is concern that the report will be similar to the draft version without much consideration given to the comments submitted by the group, leaving limited options for the stakeholder group.

This agenda item is for informational purposes only; no Council action is required.

FRUITA COLORADO — GVWUA ~Since 1905~ — MESA COUNTY — CITY OF Grand Junction COLORADO PUBLIC WORKS

April 30, 2021
Tristan Acob
CDPHE
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RE: Grand Valley Public Comments on the Total Maximum Daily Load Assessment (TMDL) – Colorado River tributaries in the Grand Valley (COLCLC13b), Mesa County, Colorado April 2021 Draft Version

Tristan,

Thank you for all your efforts and time in compiling the Draft Total Maximum Daily Load (TMDL) for the Colorado River tributaries in the Grand Valley (COLCLC13b), Mesa County, Colorado (April 2021). The Colorado Department of Public Health and Environment (CDPHE) – Water Quality Control Division (WQCD) (Division) and U.S. Environmental Protection Agency (EPA) staff listened to the stakeholders. Most importantly, you were willing to work cooperatively and delayed the TMDL schedule to allow additional water quality data collection to inform the process. This letter documents the primary concerns of the Grand Valley Water Users Association (GVWUA), the City of Grand Junction, Mesa County Stormwater Division, and the City of Fruita associated with the above-referenced Draft TMDL Assessment.

We understand the importance of the Division and EPA's roles to restore and protect the quality of all Colorado waters at levels that fully support established water quality standards. TMDLs are one aspect of making progress towards these goals. We also understand that progress will be made through the collective efforts of the Grand Valley stakeholders, representing both point sources and nonpoint sources; however, additional monitoring and analysis are needed to ensure the mitigation efforts will reduce the loadings.

As you are aware, in working on this TMDL, the Grand Valley is unique. It is characterized by a rich agricultural presence and semi-arid climate, requiring a non-traditional approach to understanding the hydrology and pollutant loadings throughout the area due to the historical irrigation practices. Although the Draft TMDL is highly technical, the area is complex, and the document falls short of depicting the hydrology and pollutant sources accurately. Hence, we respectfully request that you delay the issuance of the TMDL to allow the planned water quality monitoring efforts to characterize the water quality.

The Grand Valley stakeholders have also taken the initiative to understand better the impairments in the Grand Valley. They are updating the 2012 Selenium Watershed Management Plan Update for the Lower Gunnison River Basin and the Grand Valley, Colorado, as part of this effort. The Updated Watershed Plan will enhance the Grand Valley area with information and develop a water quality monitoring strategy to understand the data gaps and pollutant loadings causing stream impairments. Information regarding the Lower Gunnison's lessons learned and successes in mitigating selenium loadings is also being considered for implementation in the Grand Valley area. Hence, we request your consideration in delaying this TMDL to keep this initiative moving forward and informing collaborative solutions rather than regulating permit holders that may or may not have the authority to control sources due to their unique function in the Grand Valley (i.e., some irrigation districts don't collect stormwater and only deliver irrigation water to lands and have no control of the water beyond the delivery structure, can't mitigate the water)

The Draft TMDL emphasizes the importance of the water quality restoration planning process in that it involves several steps, including:

- Watershed characterization,
- Target identification,
- Source assessment,
- Allocation of loads, and
- Prioritization of implementation activities.

Our primary concerns with the Draft TMDL are with the source assessment and allocation of loads, which then impact the prioritization of implementation activities steps. The following sections provide additional justification for these concerns.

Primary Concerns

This section summarizes our primary concerns associated with the Draft TMDL.

Source Assessment

The existing data sets used to determine the TMDLs are inadequate and limited in that they:

- o Lack of continuous streamflow data on the tributaries
- o Lack of paired water quality and streamflow data on the tributaries
- o Lack of adequate characterization of stormwater data
- o Are missing data to characterize the influence of stormwater-related loadings from the BLM lands upstream of the Government Highline Canal (GHC)

Therefore, the ability to identify and assess sources of the pollutants of concern and provide the link between sources and the observed impairments is therefore limited by the poor streamflow and water quality data.

The U.S. Geological Survey (USGS), in cooperation with the Grand Valley Drainage District (GVDD) and the Colorado Water Conservation Board (CWCB), conducted a study to 1) characterize concentrations, loads, and load reductions for Escherichia coli (*E. coli*), total recoverable iron, and dissolved selenium using existing data and 2) identified water-quality data gaps to inform future monitoring strategies for the development of TMDLs (Thomas, 2020). The Grand Valley stakeholders initiated this effort as part of the Watershed Plan Update process. Key findings from this work included:

- Overall lack of continuous streamflow data
- Total Recoverable Iron
    - None of the sampling sites had enough concurrent total recoverable iron and streamflow data to compute annual loads
- Dissolved Selenium
    - Analysis of 3 Colorado River mainstem sites show decreasing trends in concentration and load from 1980 – 2018
    - The downward trends at the mainstem sites could indicate that the tributary concentrations and loads might also be changing over time, however, there is a lack of paired flow and concentration data to be able to confirm this at this time

The USGS also conducted a loading analysis for selected constituents and tributaries to the Colorado River in the Grand Valley, western Colorado, using data from 1991 to 2018, to characterize concentrations, stream loading, and load reductions for *E. coli*, total recoverable iron, and dissolved selenium for stream segments on the State of Colorado 303(d) list of impaired waters. *E. coli*, total recoverable iron, and dissolved selenium concentrations, and streamflow data were compiled from the Water Quality Portal (WQP). The data tables include information on sites, data collection time periods, concentrations, computed loads, and regression model diagnostics. Dissolved selenium annual loads, percentage load reductions required to meet State regulatory standards, mean daily loads computed for irrigation and non-irrigation seasons, and regression model diagnostics and results are presented for sites where sufficient data were available. The USGS integrated this information into an interactive map tool[1] to support the visual representation of the data and future monitoring efforts (Gidley and Miller, 2020).

Allocation of Loads

The Draft TMDL describes the allocation of pollutant loads by defining point sources and nonpoint sources and the relative contribution of each to impairments.

Grand Valley Point Sources (Wasteload Allocations)

In general dischargers covered by individual Colorado Discharge Permitting System (CDPS) as well as stormwater dischargers covered by general CDPS permits are point sources. The TMDL implementation will occur through CDPS permits for point sources and through Best Management Practice (BMP) implementation from various remediation efforts led by local stakeholders. There are seven facilities that have permits in the Grand Valley watershed and discharge directly to the impaired tributaries (listed in Table 7).

[1] Analysis of Escherichia coli, total recoverable iron, and dissolved selenium concentrations and loads for selected 303(d) listed segments in the Grand Valley, western Colorado, 1991–2018 (ver. 2.0, August 2020) - ScienceBase-Catalog

Grand Valley Water Users Association MS4

The GVWUA has a non-standard Municipal Separate Storm Sewer System (MS4) permit and is included in the WLA of the TMDLs for Leach Creek and Indian Wash (note Table 8 needs to be revised to reflect Leach Creek instead of Persigo Wash). The operations of the GVWUA will not allow them to implement control measures and management practices to directly influence the loading reductions. It should be noted that the GVWUA doesn't directly discharge to these impaired tributaries and delivers water to lands that irrigate with water diverted from the Colorado River and conveyed through the GHC. Once the water is diverted from the GHC the GVWUA doesn't have the ability to control or mitigate the use of the water nor the agricultural runoff from the irrigated lands or return flows. In addition, the GVWUA doesn't receive nor discharge stormwater.

The Clean Water Act definition for point sources does not include agriculture stormwater discharges and return flow from irrigated agriculture.

Mesa County MS4

The Mesa County MS4 Permit is responsible for stormwater discharges within the Mesa County Urbanized Area and therefore only has the ability to implement control strategies and management practices within this area.

Grand Valley Nonpoint Sources (Load Allocations)

In general discharge from irrigation and fertilization practices, in conjunction with the natural geological features of the area are nonpoint sources. TMDL implementation will also occur through volunteer efforts led by local stakeholders and watershed groups to remediate nonpoint source contributions.

The Draft TMDL also recognizes the contributions from unregulated stormwater, during wet weather (rainfall and snowfall) events outside the Urbanized (regulated) Area. It is important to characterize the unregulated stormwater influence of the lands upstream from the upper TMDL watershed boundary, above the GHC, to distinguish between baseflow and stormwater loading contributions to the impairments in the Grand Valley.

TMDL Allocations and Implementation Responsibilities

We have the following overall concerns with the Wasteload and Load Allocations for the TMDL:

- Delineation of the drainage areas isn't accurate and mis-represents implementation responsibilities for loadings outside the urbanized area (MS4 implementation for WLAs)
- No data to understand the influence of stormwater loadings upstream of the TMDL watershed upper boundary versus the background loadings
- Large loading reductions are required for the non-irrigation season. Most of the loadings are from agricultural return flows. The ability to control these loadings is limited.
- *E. coli* loadings for Adobe and Leach Creeks need to be characterized to understand the sources.

Grand Valley Drainage Areas and Hydrology

The TMDL drainage areas for each impaired tributary were calculated using Hydrologic Unit Code (HUC) 12 watershed delineations or a combination of HUC12 and drainage areas determined by local Mesa County maps. The upper boundary is the Government Highline Canal (GHC) which acts as a boundary between the Bureau of Land Management (BLM) lands and the urbanized and agricultural land uses of the Grand Valley. We don't believe the drainage areas are accurately delineated and therefore don't depict the pollutant loadings and TMDL allocations correctly.

The following explanation of GVWUA's water delivery near Indian Wash is just one example of the inaccurate delineation of the sources of impairment and misrepresentation of them as a WLA.

Figure 1 shows the diversion of water from the GHC and flowpaths. Note there is a ridge to the east of the pink lateral (running north and south, immediately after the diversion) that keeps the water to the west, not discharging to Indian Wash.

- Red circles represent points of diversion off the GHC
- The yellow circles represent the location where Indian Wash goes under the GHC (no comingling of GHC and Indian Wash)
- Water is applied to the farm fields, which slope to the west/southwest or conveyed in the lateral represented by the pink and red lines that deliver water to the southwest (red arrows).
- This water ultimately travels to the west, where it is used to irrigate lands and ultimately returns to the Grand Valley Irrigation Canal (red arrows).

In addition, MS4's or "urbanized areas" will have multiple sources of pollution. Not just storm runoff. Deep percolation from irrigated areas (parks, lawns, hobby farms), irrigation delivery systems, septic systems, leaky domestic pipes, and even retention basins all contribute to the overall complexity of pollution sources and quantities in "urban areas". These are all nonpoint sources. These complexities would affect the allocation of pollutant loads from this land use type.

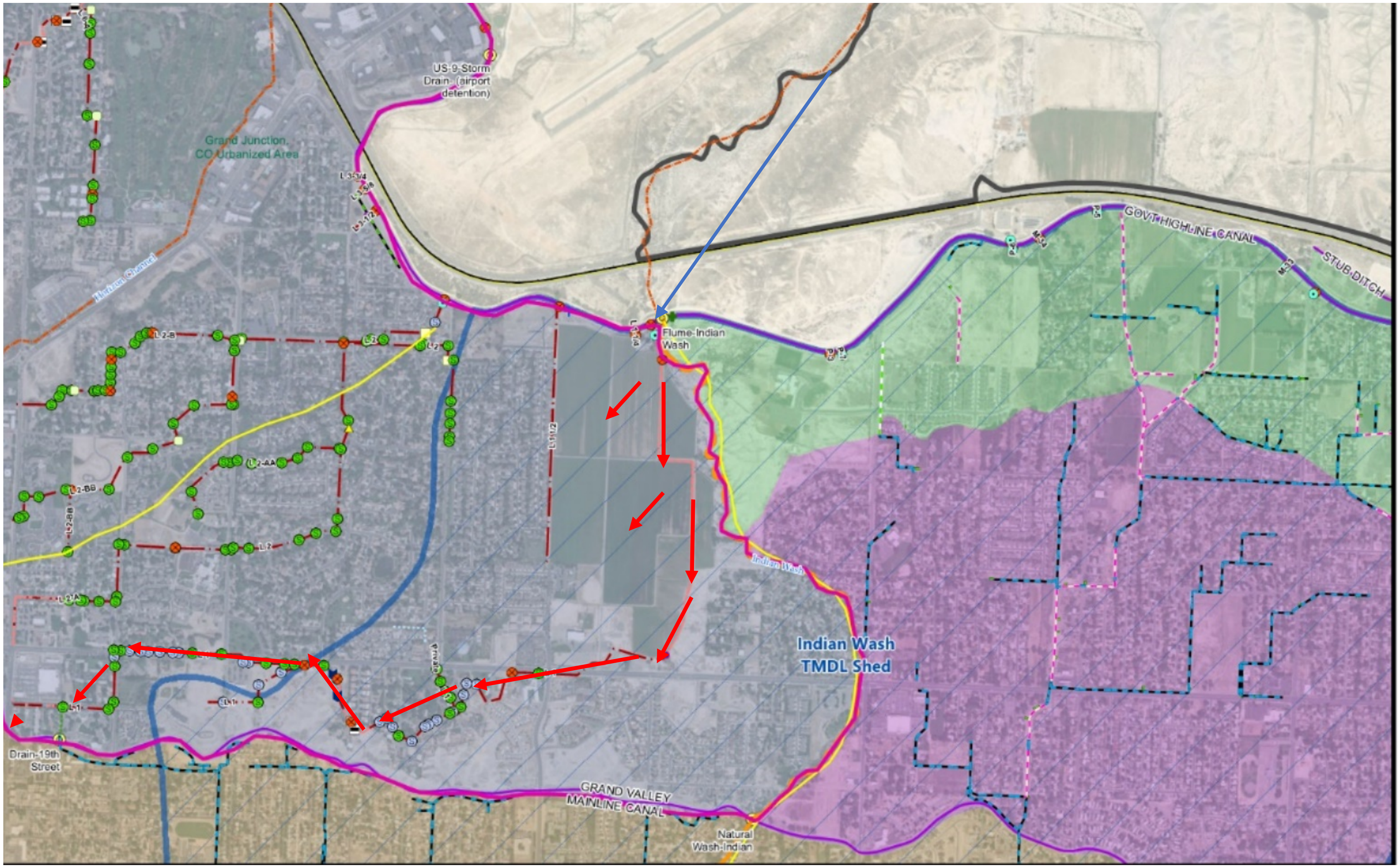

Figure 1. Indian Wash Example for GVWUA.

Stormwater Loadings from Upstream of TMDL Watersheds

The tributaries and natural washes that flow into the Grand Valley from above the upper TMDL watershed boundary at the GHC are ephemeral in nature and potentially contribute to the stormwater loads during precipitation events. The characterization of stormwater events is not technically supported with the existing water quality and streamflow datasets and needs further monitoring and analysis.

Control of Non-Irrigation Season Loadings

The pollutant loadings in the non-irrigation season (November – March) are primarily due to the conveyance of agricultural return flows and seepage of ground water into the natural washes, tributaries, and drains. In general, these loadings should be accounted for in the Load Allocation portion of the TMDL. The average precipitation during these months is less than 1 inch, therefore most likely reducing the pollutant loadings from the Wasteload Allocation (WLA) categories as there is little to no stormwater runoff.

E. coli Loadings

The Draft TMDL lists the major *E. coli* sources of impairment for Adobe and Leach Creeks as runoff from pastures and small farms, wildlife and domestic pets, septic system failures, and urban stormwater runoff and that based upon the available *E. coli* and flow data, it was determined that the observed flows do not correlate to the observed magnitude of the E. coli concentration, therefore, the source assessment was completed over an entire year. The GVWUA and Mesa County Stormwater Division are identified as having “pertinent discharge” (Table 8) contributing to *E. coli* loadings.

The GVWUA and Mesa County Stormwater Division’s MS4 Permits apply to those areas within the Urbanized Area and most of the potential E. coli sources are outside the Urbanized Area, hence, limiting the opportunity for them to control the sources.

The Mesa County Stormwater Division is working with the Colorado Mesa University and Mesa County to characterize the specificity of the *E. coli* loadings (humans, cows, horses, dogs, and ducks) using the ddPCR method. The objective for this work is to provide Mesa County with a tool to better understand the sources of fecal contaminations in hopes to mitigate them.

Requests and Recommendations

Overall, we are requesting that you ***delay the determination of the Final TMDL for three years to allow the on-going Grand Valley Watershed Plan and Stakeholder process to continue***, ***USGS’ post-fire water quality monitoring plan, and the Colorado Mesa University’s E. coli research to inform better characterization of the source loadings***. Specifically, the implementation of the water quality monitoring study that will increase the number of streamflow and water quality gages to:

- Collect paired water-quality and streamflow measurements at the 9 ‘high’ priority and 6 ‘medium’ priority monitoring locations (see USGS proposed future monitoring discussion above) to aid analysis, specifically, strengthen the linkage between the pollutant sources and impairments and the contribution of stormwater loadings and baseload loadings during the distinct irrigation and non-irrigation seasons,

- Update data to "current conditions" in areas with probable trends and evaluate loadings across wet, dry, and average years and shifting land uses to understand the influence of climactic variations, and
- Integrate the Orchard Mesa and Walter Walker Wildlife Areas as well as other backwater habitats that support the Threatened and Endangered fish in the Grand Valley

We commit to providing annual reports and periodic updates to you and EPA to document progress across these projects.

Additional Minor Comments

The following list identifies minor comments and suggested edits.

- Page 22 - Add a footnote for Leach Creek in Table 1. There is a footnote under the table but no cross-reference within the table.
- Section 3.1 (Project Setting) recognizes several municipalities, special districts such as the GVDD and Mesa County Stormwater Division, and GVWUA. There are other irrigation districts within the Grand Valley that should be included in the Project Setting of the TMDL.
- Table 8 mentions Persigo Wash for the GVWUA. Should this be Leach Creek?

We appreciate your time reviewing our comments and want to be clear that the request for a delay in the implementation of the TMDL is not intended to avoid responsibility, but set realistic goals based upon sound science and data with on-going and upcoming projects. Please don't hesitate to reach out to Angie Fowler at angief@sgm-inc.com or 970-384-9027 if you have any questions.

Truly yours,

Mark Harris
General Manager
Grand Valley Water Users Association

DocuSigned by:
Scott Mai
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Scott Mai
Deputy Public Works Director
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cc: Tammy Allen, CDPHE-WQCD (tamara.allen@state.co.us)
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Citations

Gidley, R.G., and Miller, L.D., 2020, Analysis of Escherichia coli, total recoverable iron, and dissolved selenium concentrations and loads for selected 303(d) listed segments in the Grand Valley, western Colorado, 1991–2018 (ver. 2.0, August 2020): U.S. Geological Survey data release, https://doi.org/10.5066/P9P6WI44.

Thomas, J.C., 2020, Analysis of Escherichia coli, total recoverable iron, and dissolved selenium concentrations and loads for 303(d) listed segments in the Grand Valley, Colorado, 1991-2018: U.S. Geological Survey data release, https://doi.org/10.5066/P9WYN7DK.

CSSGA
Colorado Stone, Sand & Gravel Association

May 3, 2021

Via Email: tristan.acob@state.co.us

Mr. Tristan Acob
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Re: Public Comment on COLCLC13b Grand Valley TMDL Draft

Dear Tristan:

Thank you for the opportunity to comment on the draft Total Maximum Daily Load (TMDL) for Segment COLCLC13b of the Lower Colorado River in the Grand Valley. Colorado Stone, Sand and Gravel Association's (CSSGA) members have been significantly affected by implementation of selenium-related requirements related to TMDLs in the Grand Valley and Gunnison River Basin in their discharge permits, which is the reason for our interest in this TMDL. We note that there are no permitted sand and gravel discharges to the tributaries included in this TMDL; therefore, no wasteload allocations are assigned to current sand and gravel operations. Nonetheless, sand and gravel operations are active in the general area and could potentially have operations with future wasteload allocations assigned from the reserve capacity included in the TMDL. Additionally, CSSGA is interested in ensuring that sound scientific principles are included in TMDLs as they may establish precedent for future TMDLs in other locations where sand and gravel facilities operate. CSSGA requested Wright Water Engineers review the draft TMDL for CSSGA. Our joint comments on the TMDL follow.

1. **General:** The TMDL is written in a clear and straightforward manner that appears to cover the requirements of a TMDL. We did not independently evaluate the calculations included in the TMDL. Our comments focus primarily on the characterization of the sources of selenium loading in tributaries and the need to reference the well documented watershed-specific science related to selenium in the TMDL.

2. **Major Sources of Selenium Impairment (Executive Summary Tables and Other Sections throughout the TMDL):** For each tributary, the major sources of impairment for dissolved selenium and total recoverable iron are identified as "urban stormwater runoff" and "runoff from pastures and small farms." Although these statements are likely accurate for total recoverable iron, this characterization is not correct for dissolved selenium, based on decades of work and research by the U.S. Geological Survey (USGS), U.S. Bureau of Reclamation (USBR) and the U.S. Department of Agriculture (USDA). The sources and transport pathways for the two pollutants are

fundamentally different: total recoverable iron issues are typically runoff-driven, but selenium issues in the Grand Valley are predominantly driven by shallow (subsurface) groundwater flows to streams in areas with naturally occurring selenium-bearing geologic formations with mobilization and transport exacerbated by irrigation systems and practices.

Properly characterizing the source and transport pathways for selenium in the TMDL are fundamental to next phase of TMDL implementation. Substantial reductions in selenium loading in the Grand Valley and Gunnison Basin that have occurred are due to changes in irrigation-related practices such as canal lining and irrigation improvements. Although the TMDL lightly touches on naturally occurring geologic sources and groundwater, the greater emphasis of the TMDL in terms of load reductions is surface runoff, which is not correct based on decades of work completed in the Grand Valley. This misplaced emphasis could have an unintended consequence of decreasing focus on the actual dominant sources and transport pathways for selenium. In contrast, the long-term science established by the USGS and USBR focuses on the natural background geology and irrigation-related agricultural components of the selenium issue. We recommend that key findings from USGS, USBR and USDA research and projects be integrated throughout the TMDL for selenium. For example, a few representative quotes from Lieb (2008) based on a USGS study of the tributaries (with emphasis added on key points) include:

- *Selenium exists naturally in the Mancos Shale and in Mancos Shale-derived soils common to the Grand Valley. Studies in the Grand and Gunnison Valley regions of western Colorado (Butler, 2001; Butler and Leib, 2002) indicate that* ***selenium mobilization occurs primarily in shallow aquifers and results from deep percolation from irrigation and seepage of irrigation water from unlined canals.*** *Water in shallow aquifers is a diffuse nonpoint source of return flow to tributaries and the Colorado River, thus making it difficult to determine source locations of selenium loading.*

- *The most prevalent water-quality concerns in the Grand Valley are related to elevated concentrations of salinity and selenium in the Colorado River and tributaries to the Colorado.* ***Elevated levels of these two constituents are directly attributable to the location and amount of irrigation in the Grand Valley.***

- *The salinity and selenium stored in the Mancos Shale, however, are not harmful to the aquatic environment while in situ. Water is needed to mobilize the salinity and selenium stored in the Mancos Shale. Water comes in the form of precipitation or it is diverted and delivered from the Colorado and Gunnison Rivers for irrigation of residential and agricultural areas. During the process of delivering and applying irrigation water, some of the water remains on the land surface and becomes "tail water," and some is lost to the groundwater system as seepage (from the delivery system) or deep percolation (irrigation water that percolates below the crop root zone and is not consumed).* ***As the unused irrigation water moves over the land surface or through the subsurface as groundwater, it mobilizes salinity and selenium by mechanical or chemical means. Without irrigation water, the rate of mobilization and loading of salinity and selenium from the Mancos Shale would be greatly reduced because only water that originated as***

precipitation would be available. ***Approximately 8 inches of precipitation falls in the Grand Valley annually, whereas the applied irrigation water averages about 54 inches annually*** *(U.S. Bureau of Reclamation, 1978).*

- *Perisigo Wash…The surface- and groundwater sources are* ***predominantly from diffuse groundwater inflow from canal seepage and deep percolation from irrigated lands.***

- *Perisigo Wash…Seepage and deep percolation occur during the irrigation season (April through October),* ***but the water that is recharged to the groundwater system (via seepage and deep percolation) continues to drain out during the nonirrigation season, mobilizing selenium and salinity in the process.***

- *Adobe Creek…The effects of seepage and deep percolation appear to be most prominent in the early part of the nonirrigation season … With high rates of seepage and deep percolation, irrigation water readily infiltrates from canals and irrigated lands to the groundwater system and ultimately the stream as diffuse groundwater inflow.* ***High rates of seepage and deep percolation create the potential to mobilize selenium and salinity at an accelerated rate relative to other areas with lower seepage rates.***

In additional to the Executive Summary, Sections 2.3.2, 4.1, 4.3.3 and 4.3.5 of the TMDL could be strengthened by integration of this watershed-specific research regarding sources and transport of selenium to the tributaries. In particular, the basic paradigm of selenium sources and transport in the Grand Valley is missing from the technical approach discussion in Section 4.1. Selenium sources (e.g., agriculture, storm runoff) are treated as equally relevant contributors in the "Potential Sources of Impairment" section, which is misleading based on the long-term work of other agencies in the watershed.

3. **Flow Data:** The flow data used in the TMDL are extremely old, with the most recent gauge data being 20 to 40 years old, with the exception of Lewis Wash at 15 years old. This is a major limitation of the TMDL that needs to be explicitly acknowledged. CDPHE states, "Although the flow data from these stations are relatively old, the WQCD has determined that they are representative of current flows based on the strict regulation of water rights in the watershed." This statement needs to be further substantiated, given that changes in use for water rights can and do occur and other practices related to canal lining and irrigation practices also may have occurred in the subwatersheds for the tributaries. This is a major limitation of the TMDL given that flows are a fundamental component of load calculations. We understand CDPHE's constraints in this regard; however, we believe it is important that this significant constraint be explicitly acknowledged. Instantaneous flow data are referenced in the TMDL, but it is not clear how or if these data were used in terms of reasonableness checks of historic flow data. Example statements from Lieb (2008) indicating that simple assumptions regarding flow may not be valid include:

    - ***The data also indicate that streamflow and salinity loads in Lewis Wash declined from the 1970s to the early 2000s.***

- *The **reduction in streamflow**, salinity concentration, and salinity load in Lewis Wash may have resulted from several anthropogenic influences. The first possibility is the effect of salinity control projects by the USBR or NRCS. The USBR lined approximately 16.6 mi of canals and laterals (off-farm improvements) on the Government Highline Canal system (Mike Baker, U.S. Bureau of Reclamation, written commun., 2007) and the NRCS improved irrigation systems on about 15 percent of the agricultural fields (on-farm improvements) throughout Lewis Wash subbasin (James Currier, Natural Resources Conservation Service, oral commun., 2007). The off-farm improvements by the USBR were estimated to result in a salinity-load reduction of about 7,000 ton/yr from Lewis Wash subbasin (Mike Baker, written commun., 2007).*

Additionally, in *Estimating the Effects of Conversion of Agricultural Land to Urban Land on Deep Percolation of Irrigation Water in the Grand Valley, Western Colorado, USGS Scientific Investigations Report 2008-5086*, Mayo (2008) states:

- ***The study found that the conversion of land use from agricultural land use to urban land use reduces water use by about 74 percent and deep percolation as much as about 90 percent**. Estimated reductions in salt loading were as much as 92 percent.*

- *Demographic and Area Changes in the Grand Valley: …For several years it was noted the parcel and field sizes were changing in the Grand Valley Unit… During the 25-year period **from 1985 to 2006, the information collected showed a 19.85% decrease in the total irrigated agricultural acres in Mesa County**. Acres include reductions in irrigated cropland, hayland, pasture and orchards.*

4. **Selenium Data (Section 4):** Similar to the concerns stated for older flow data, the water quality monitoring data included in the TMDL are quite dated for several of the tributaries. For example, the majority of data for Lewis Wash is prior to 2006. Although it may not be possible to collect more data at this point in the process, an acknowledgement that selenium reductions may have occurred through projects such as canal lining, irrigation improvements and conversion of agricultural land to urban land should be included. Ideally, statistical analysis of old versus new data should be completed for all of the tributaries to assess whether there are statistically significant differences over time. If so, the calculations in the TMDL should be revised and limited to more recent representative data. The five-year time period used in the Division's 303(d) Listing methodology would be a better basis for conducting loading analysis where sufficient recent data are available. If this is not possible, then the limitations of aged data and limited number of samples for recent data should be explicitly stated so that those tasked with implementation of the TMDL, particularly in permits, understand the limitations of the data used in the analysis.

5. **Section 2.5 Impairments:** Suggest adding a sentence: "Although the Lower Colorado River (COLCLC03) was previously listed on the Monitoring and Evaluation List for selenium in 2016, the Lower Colorado River now attains the selenium standard. The USGS and USBR have documented the benefits of selenium and salinity control projects in the Grand Valley that have focused on irrigation-related practices and have successfully reduced irrigation-related selenium loading to the Colorado River."

6. **Section 4.3.3 Agriculture:** This section should be updated based on the scientific research conducted by USGS and USBR. Groundwater return flows (e.g., subsurface irrigation drainage) to the tributaries are the primary transport and mobilization pathway for dissolved selenium to the tributaries. Surface runoff and erosion are the likely paths for total recoverable iron—these are not similar source and transport pathways.

7. **Section 4.3.5 Soils and Geology:** This section could be significantly improved by citing local research by USBR and USGS. The pollutant fate and transport paradigm in the Grand Valley is well researched and should be included (as described in #2 above), as opposed to the current generic discussion. Background conditions related to geology may be a limiting factor on whether the TMDL is attainable. A discussion of natural or irreversible human-induced conditions should be considered somewhere in the report, either in this section or in the implementation discussion.

8. **Section 5.2.2 Load Allocation:** We suspect that the background concentration of selenium calculated at 1.7 ug/L dramatically underestimates the actual background loading. This is a fundamental limitation of whether the TMDL is actually attainable. The data set is extremely limited both spatially and temporally. Limitations of this data set should be clearly stated. We understand that from a wasteload allocation perspective, it is more generous to dischargers to not have a large background load in the TMDL; therefore, we are not opposed to leaving this value as-is for the TMDL exercise itself. However, a better understanding of background conditions should be recognized as a potential basis for future regulatory adjustments such as a site-specific standard based on natural or irreversible human-induced conditions and other permit-related flexibilities.

9. **Section 5.2.3 Reserve Capacity (RC) (p. 75):** "An RC for urban growth was added for all TMDL sub-watersheds to a certain degree. A percentage of the 2016 NLCD natural land use was reserved and was set aside as reserve capacity for potential development." It is unclear from this language whether the Reserve Capacity is intended to include industrial activity such as gravel mining in the absence of broader development. We request that the sentence be edited as follows "…for potential development <u>and industrial activity</u>." Additionally, Table 47 is somewhat confusing in the context of the stated assumption "the cultivated crops is assumed to remain constant from 2016 to 2030". What is the basis of this assumption and what is the meaning of the "(-)" in the cultivated crops column of Table 47? Given that irrigation associated with cultivated crops is a well-documented significant source of selenium in the Grand Valley, this assumption is important. Additionally, is there a mechanism for the Reserve Capacity to be increased as selenium loading from cultivated crops decreases?

10. **TMDL Implementation, Non-point Source (p. 85):** The list of CDPHE's non-point source projects in the basin is encouraging; however, we are unclear why the long-term work of the USBR and USDA in the basin is not included. The long-term study and work over the past 30 years provides a basis for better understanding non-point sources and solutions that have been effective in reducing selenium loads. Additionally, knowing where non-point source projects have already been completed would be helpful in prioritizing areas where new non-point source projects may be effective in reducing selenium mobilization and loading to the tributaries. We hope that this information can be referenced in the Watershed Plan Update.

With regard to urban runoff and selenium, it is particularly important that the source and transport pathways for selenium be properly characterized throughout the report so that stormwater control measures can be properly evaluated for the TMDL. The MS4s may find themselves in a conflicting situation: green infrastructure practices that rely on infiltration are ideal for *E. coli*, but they may exacerbate subsurface selenium transport. As currently written, the TMDL implies that selenium is a surface runoff issue, which points urban areas in the wrong direction for implementation-phase solutions.

11. **References:** The reference list in the TMDL is very dated—with many references 20 years old or more and others relying on somewhat generic EPA sources. We recommend that information from USGS and USBR work in the Grand Valley be incorporated into the TMDL, given that they provide a more robust scientific path forward related to implementation of the TMDL. Two representative examples of useful information that we have cited in this letter include:

    - Leib, Kenneth J., 2008. Concentrations and loads of selenium in selected tributaries to the Colorado River in the Grand Valley, western Colorado, 2004–2006: U.S. Geological Survey Scientific Investigations Report 2008–5036, 36 p.

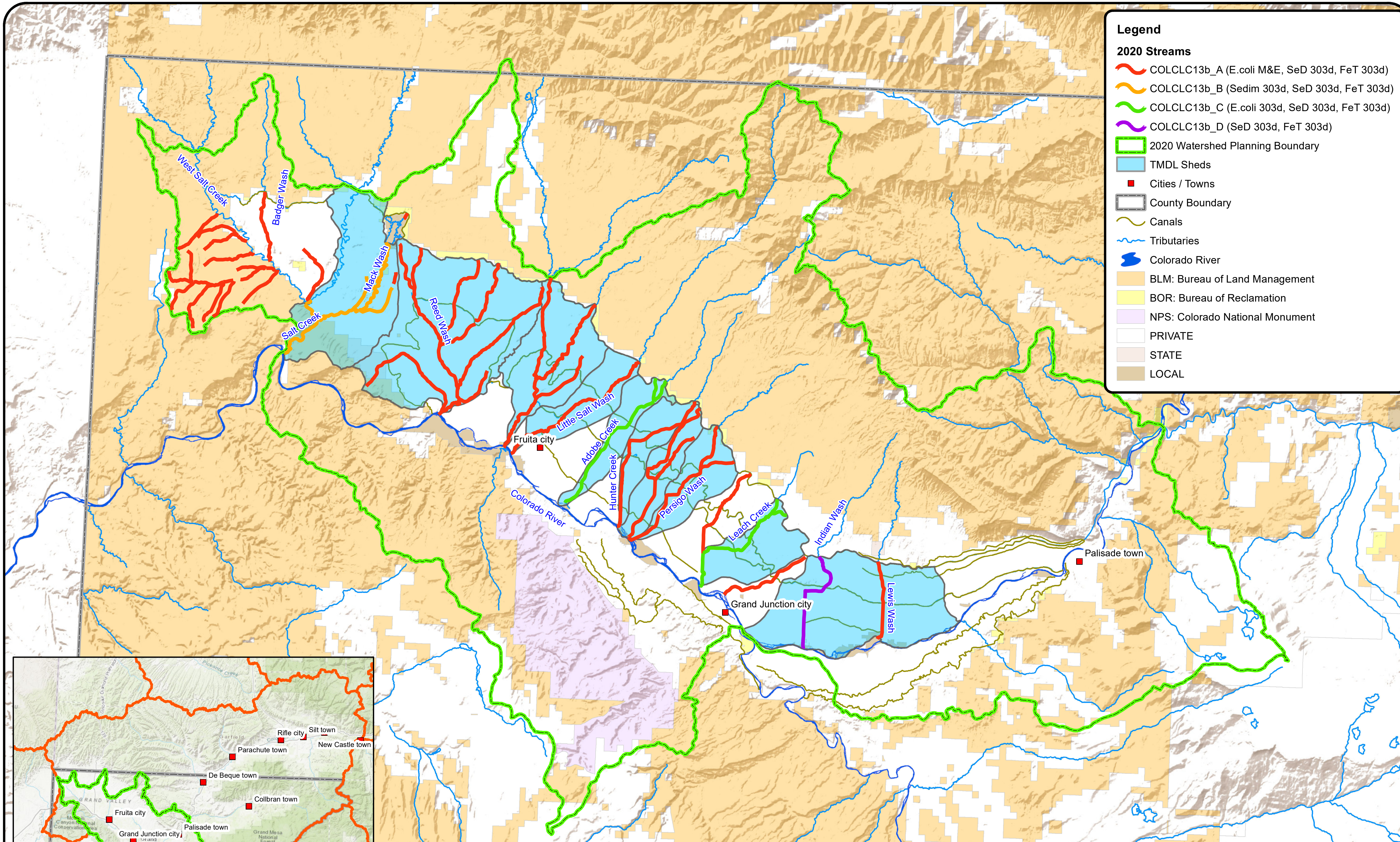
    - Mayo, J. 2008. Estimating the Effects of Conversion of Agricultural Land to Urban Land on Deep Percolation of Irrigation Water in the Grand Valley, Western Colorado, USGS Scientific Investigations Report 2008-5086.

Thank you for considering these comments.

Sincerely,

Todd R. Ohlheiser
CSSGA Executive Director

cc: Jane Clary and Pete Foster, P.E., Wright Water Engineers, Inc.



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2020 Impaired Streams
Grand Valley Drainage District, Colorado

Date: 6/1/2020	Job No. 2016-249.002 Ph. 00	Map by: JDF	
Coordinate System: NAD 1983 StatePlane Colorado Central FIPS 0502 Ft US		Projection: Lambert Conformal Conic	
Data Sources: ESRI, USGS, CDSS, BLM, CDOT, GVDD, GVWUA, Mesa County, SGM		Page: 2020 Impaired Streams	
File: I:\2016\2016-249-GrandValleyDrainage\002-WatershedPlan\H-Dwgs\GIS\MXDs\2020_ImpairedStreams - 11x17.mxd			

The information displayed above is intended for general planning purposes. Refer to legal documentation/data sources for descriptions/locations.

Total Maximum Daily Load Assessment

Colorado River tributaries in the Grand Valley (COLCLC13b), Mesa County, Colorado

April 2021
Draft Version

Executive Summary

The scope of the Total Maximum Daily Loads (TMDLs) presented in this document addresses selenium, iron and *Escherichia coli (E. coli)* impairments found in certain tributaries within the Grand Valley, located along the Colorado River in Mesa County, Colorado. The impaired waterbody, Segment COLCLC13b, represents "all tributaries to the Colorado River, including wetlands, from the Government Highline Canal Diversion to a point immediately below Salt Creek, and down-gradient from the Government Highline Canal, the Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and the northeast Colorado National Monument boundary."

Segment COLCLC13b is broken down into four separate Assessment Units (AUIDs), A through D. AUID COLCLC13b_A consists of "all tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash." AUID COLCLC13b_B consists of "Salt Creek and tributaries below lake and reservoir, including Mack Wash." COLCLC13b_C consists of "Adobe Creek, Leach Creek and tributaries below canal." COLCLC13b_D consists of "Indian Wash." TMDLs were developed for the following waterbodies, grouped by their respective AUID:

- COLCLC13b_A: Lewis Wash, Hunter Wash, Pritchard Wash, Persigo Wash, Little Salt Wash, Big Salt Wash, and Reed Wash
- COLCLC13b_B: Salt Creek
- COLCLC13b_C: Adobe Creek and Leach Creek
- COLCLC13b_D: Indian Wash

The tributaries listed represent a combined drainage area of approximately 138 square miles that discharge into the Colorado River. The drainage area for each impaired tributary was calculated using HUC12 watershed delineations or a combination of HUC12 and drainage areas determined by local Mesa County maps. The Government Highline Canal demarks the upper boundary of each drainage area covered by the TMDLs. All listed tributaries are impaired for dissolved selenium and total recoverable iron based on Aquatic Life standards. In addition, AUID COLCLC13b_C (Adobe Creek and Leach Creek) are impaired for *E. coli* based on Recreation standards. The aquatic life use in AUID COLCLC13b_B is also impaired by sediment but this impairment will be addressed in a future TMDL effort. Figure ES-1 displays the location and impairments for each waterbody evaluated. It is the intent to protect the water quality of the Colorado River mainstem by implementing TMDLs for the tributaries identified above. Note that a tributary included in AUID COLCLC13b_A West of Indian Wash that was not evaluated in this TMDL. Although the tributary is included on the 303(d) List, no data from this tributary were available to assess. Therefore, the WQCD will work to create a separate AUID for this segment and a TMDL will be addressed for this tributary in the future.

There are several point source discharges and nonpoint sources potentially contributing to the impairments of the tributaries in the Grand Valley. Point sources addressed in this TMDL include dischargers covered by individual Colorado Discharge Permitting System (CDPS) permits as well as stormwater dischargers covered by general CDPS permits. Nonpoint sources addressed in this TMDL include discharge from irrigation and fertilization practices, in conjunction with the natural geological features of the area. This TMDL assigns allocations for dissolved selenium, total recoverable iron, and *E. coli*, and identifies the load reductions necessary to attain the currently adopted standards. TMDLs and loading reductions for dissolved selenium and total recoverable iron were evaluated for all the aforementioned tributaries during the irrigation season (April to October) and non-irrigation season (November to March). TMDLs and loading reductions for *E. coli* were evaluated annually for Adobe and Leach Creek.

The Federal Clean Water Act and U.S. Environmental Protection Agency (U.S. EPA) regulations require that States develop TMDLs for waters on the Section 303(d) impaired waters list. A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. When future growth is a concern and can be quantified, it is also included and is referred to in this report as the reserve capacity (RC). Conceptually, this is defined by the equation:

$$TMDL = \sum WLAs + \sum LAs + MOS + RC$$

The WQCD, in conjunction with U.S. EPA, collected water quality samples for the waterbodies listed above. In addition, hydrological and water quality data were available from United States Geological Survey (USGS) and Riverwatch. These data were used to determine the current ambient load in the waterbodies and to calculate the required reductions to attain water standards. The TMDL was then allocated to the point and nonpoint sources identified as potential contributors to the impairments in the waterbody. Tables ES-1 to ES-4 summarize relevant information for each waterbody evaluated in this TMDL.

TMDL implementation is to occur through CDPS permits for point sources and through best management practice (BMP) implementation from various remediation efforts led by local stakeholders and watershed groups for nonpoint sources.

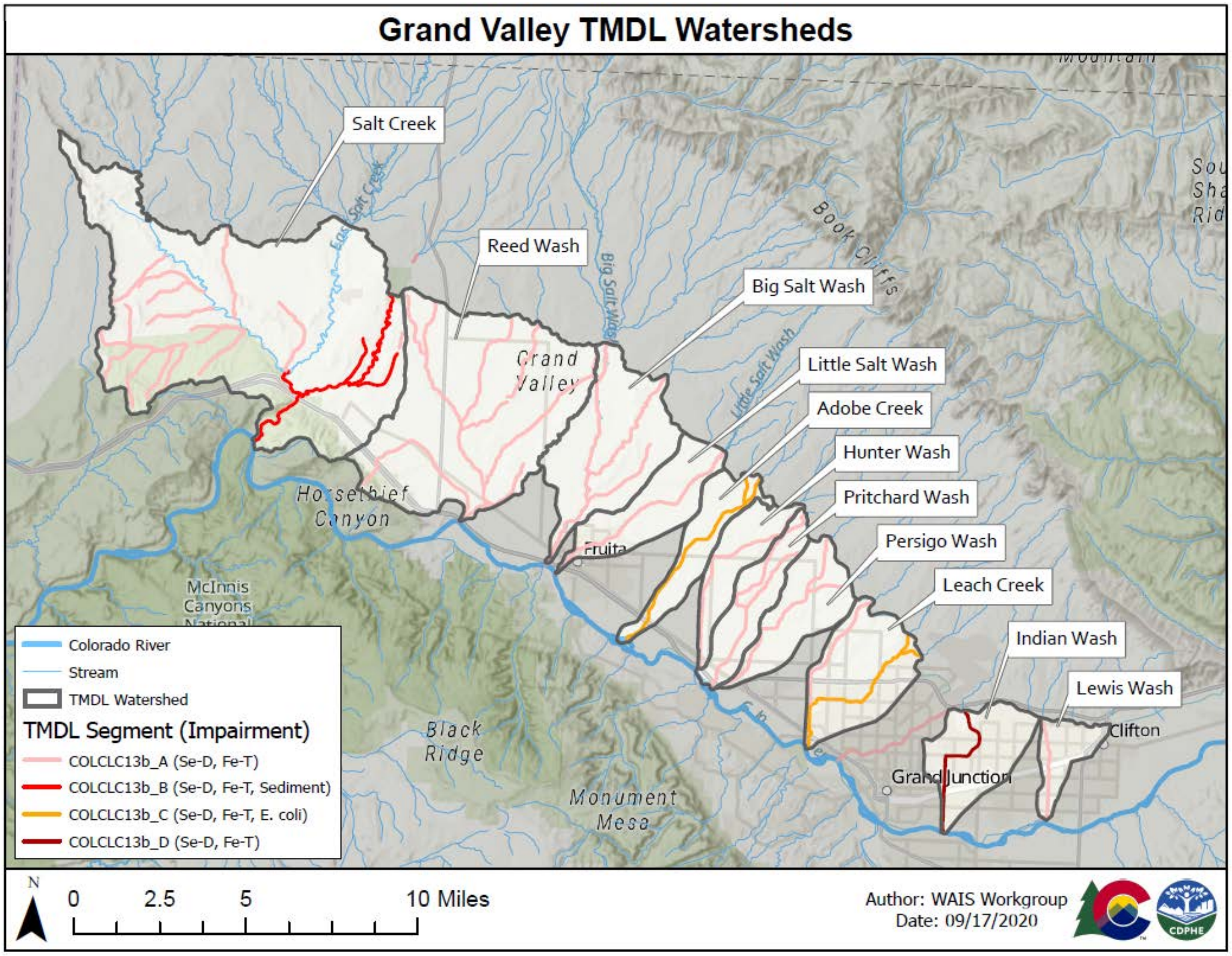

Figure ES-1. Impaired segments in the Grand Valley for which TMDLs were developed.

Table ES-1. Dissolved Selenium and Total Recoverable Iron TMDLs for Lewis Wash

Waterbody AUID	COLCLC13b_A			
Segment portion description	All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash			
HUC12 sub-watersheds	140100051503: Indian Wash-Colorado River			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Urban stormwater Runoff from pastures and small farms			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	0.30	65	0.015	3.2
LA	0.029	6.0	0.0014	0.30
Sum of WLAs	0.24	52	0.012	2.6
MOS	0.030	6.5	0.0015	0.32
RC	0.0011	0.0854	0.00005	0.004
Existing load	0.13	32	0.11	1.1
Reductions	0%	0%	86%	0%

Table ES-2. Dissolved Selenium and Total Recoverable Iron TMDLs for Indian Wash

Waterbody AUID	COLCLC13b_D			
Segment portion description	Indian Wash			
HUC12 sub-watersheds	140100051503: Indian Wash-Colorado River			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Urban stormwater Runoff from pastures and small farms			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	0.69	151	0.032	7.0
LA	0.071	15	0.0033	0.68
Sum of WLAs	0.55	121	0.026	5.6
MOS	0.069	15	0.0032	0.70
RC	0.0025	0.20	0.0001	0.009
Existing load	1.4	332	0.77	1.7
Reductions	50%	55%	96%	0%

Table ES-3. Dissolved Selenium, Total Recoverable Iron, and *E. coli* TMDLs for Leach Creek

Waterbody AUID	COLCLC13b_C			
Segment portion description	Adobe Creek, Leach Creek and tributaries below canal			
HUC12 sub-watersheds	140100051602: Leach Creek			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Not Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec), and *E. coli*			
Major sources of impairment	Runoff from pastures and small farms Wildlife and Domestic Pets (*E. coli*) Septic System Failures (*E. coli*) Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic) *E. coli*: 126 cfu/ml			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l *E. coli*: 126 cfu/ml			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			

Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**		**Year Round**
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)	*E. coli* (giga-cfu-d)
TMDL	1.1	243	0.20	43	105
LA	0.38	79	0.067	14	34
Sum of WLAs	0.62	139	0.11	25	60
MOS	0.11	24	0.020	4.3	10.5
RC	0.01	0.32	0.0018	0.057	0.342
Existing load	3.9	355	4.2	13	136
Reductions	71%	32%	95%	0%	23%

Table ES-4. Dissolved Selenium and Total Recoverable Iron TMDLs for Persigo Wash

Waterbody AUID	COLCLC13b_A			
Segment portion description	All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash			
HUC12 sub-watersheds	140100051604: Persigo Wash			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Runoff from pastures and small farms Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	1.1	248	0.082	18
LA	0.80	175	0.058	13
Sum of WLAs	0.21	48	0.015	3.5
MOS	0.11	25	0.0082	1.8
RC	0.010	0.33	0.0007	0.023
Existing load	3.7	468	1.5	3.4
Reductions	69%	47%	95%	0%

Table ES-5. Dissolved Selenium and Total Recoverable Iron TMDLs for Pritchard Wash

Waterbody AUID	COLCLC13b_A			
Segment portion description	All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash			
HUC12 sub-watersheds	140100051606: Monument Canyon-Colorado River			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Runoff from pastures and small farms Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	0.92	200	0.067	15
LA	0.53	115	0.039	8.4
Sum of WLAs	0.29	64	0.021	4.7
MOS	0.092	20	0.0067	1.5
RC	0.0084	0.26	0.0006	0.019
Existing load	2.3	539	0.36	17
Reductions	60%	63%	81%	16%

Table ES-6. Dissolved Selenium and Total Recoverable Iron TMDLs for Hunter Wash

<table>
<tr><td>Waterbody AUID</td><td colspan="4">COLCLC13b_A</td></tr>
<tr><td>Segment portion description</td><td colspan="4">All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash</td></tr>
<tr><td>HUC12 sub-watersheds</td><td colspan="4">140100051605: Hunter Wash</td></tr>
<tr><td rowspan="3">Use classifications and impairments</td><td colspan="2">Agriculture</td><td colspan="2">Fully Supporting</td></tr>
<tr><td colspan="2">Aquatic Life – Warm Water Class 2</td><td colspan="2">Not Supporting</td></tr>
<tr><td colspan="2">Recreation – E</td><td colspan="2">Fully Supporting</td></tr>
<tr><td>Pollutant addressed</td><td colspan="4">Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)</td></tr>
<tr><td>Major sources of impairment</td><td colspan="4">Runoff from pastures and small farms
Urban stormwater runoff</td></tr>
<tr><td>Loading capacity approach</td><td colspan="4">Mass Balance</td></tr>
<tr><td>Criteria</td><td colspan="4">Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute)
Fe-Trec: 1000 µg/l (chronic)</td></tr>
<tr><td>TMDL target</td><td colspan="4">Se-D: 4.6 µg/l
Fe-Trec: 1000 µg/l</td></tr>
<tr><td>Margin of safety</td><td colspan="4">Explicit (10% for all parameters)</td></tr>
<tr><td>Reserve capacity</td><td colspan="4">Based on the projected change from natural to urban land cover from 2020 to 2030</td></tr>
<tr><td>Flow Season</td><td colspan="2">Irrigation (Apr-Oct)</td><td colspan="2">Non-Irrigation (Nov-Mar)</td></tr>
<tr><td>Parameter</td><td>Se-D (lb/d)</td><td>Fe-Trec (lb/d)</td><td>Se-D (lb/d)</td><td>Fe-Trec (lb/d)</td></tr>
<tr><td>TMDL</td><td>0.84</td><td>183</td><td>0.060</td><td>13</td></tr>
<tr><td>LA</td><td>0.64</td><td>140</td><td>0.045</td><td>10</td></tr>
<tr><td>Sum of WLAs</td><td>0.11</td><td>25</td><td>0.008</td><td>1.8</td></tr>
<tr><td>MOS</td><td>0.084</td><td>18</td><td>0.006</td><td>1.3</td></tr>
<tr><td>RC</td><td>0.0077</td><td>0.24</td><td>0.0005</td><td>0.017</td></tr>
<tr><td>Existing load</td><td>1.6</td><td>515</td><td>0.65</td><td>2.4</td></tr>
<tr><td>Reductions</td><td>48%</td><td>64%</td><td>91%</td><td>0%</td></tr>
</table>

Table ES-7. Dissolved Selenium and Total Recoverable Iron, and *E. coli* TMDLs for Adobe Creek

Waterbody AUID	COLCLC13b_C				
Segment portion description	Adobe Creek, Leach Creek and tributaries below canal				
HUC12 sub-watersheds	140100051607: Adobe Creek				
Use classifications and impairments	Agriculture		Fully Supporting		
	Aquatic Life – Warm Water Class 2		Not Supporting		
	Recreation – E		Not Supporting		
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec), and *E. coli*				
Major sources of impairment	Runoff from pastures and small farms Wildlife and Domestic Pets (*E. coli*) Septic System Failures (*E. coli*) Urban stormwater runoff				
Loading capacity approach	Mass Balance				
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic) *E. coli*: 126 cfu/ml				
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l *E. coli*: 126 cfu/ml				
Margin of safety	Explicit (10% for all parameters)				
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030				
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**		**Year Round**
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)	*E. coli* (giga-cfu/d)
TMDL	0.89	194	0.065	14	86
LA	0.67	147	0.049	11	65
Sum of WLAs	0.12	28	0.009	2.0	12
MOS	0.089	19	0.0065	1.4	8.6
RC	0.0081	0.26	0.0006	0.019	0.282
Existing load	2.5	621	0.61	2.2	395
Reductions	65%	69%	89%	0%	78%

Table ES-8. Dissolved Selenium and Total Recoverable Iron TMDLs for Little Salt Wash

Waterbody AUID	COLCLC13b_A			
Segment portion description	All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash			
HUC12 sub-watersheds	140100051608: Little Salt Wash			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Runoff from pastures and small farms Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	1.2	254	0.084	18
LA	0.78	170	0.057	12
Sum of WLAs	0.26	58	0.019	4.2
MOS	0.12	25	0.0084	1.8
RC	0.011	0.33	0.0008	0.024
Existing load	1.8	558	0.42	6.6
Reductions	34%	55%	80%	0%

Table ES-9. Dissolved Selenium and Total Recoverable Iron TMDLs for Big Salt Wash

Waterbody AUID	COLCLC13b_A			
Segment portion description	All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash			
HUC12 sub-watersheds	140100051613: Lower Big Salt Wash			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Runoff from pastures and small farms Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	2.1	453	0.32	70
LA	1.7	363	0.26	56
Sum of WLAs	0.19	45	0.030	6.9
MOS	0.21	45	0.032	7.0
RC	0.019	0.60	0.0029	0.093
Existing load	6.9	1516	3.0	26
Reductions	70%	70%	89%	0%

Table ES-10. Dissolved Selenium and Total Recoverable Iron TMDLs for Reed Wash

Waterbody AUID	COLCLC13b_A			
Segment portion description	All tributaries to the Colorado River from Government Highline Canal Diversion to below Salt Creek, and downgradient from Government Highline Canal, Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and northeast Colorado National Monument boundary, except Salt, Adobe, Leach Creeks, Indian Wash and Mack Wash			
HUC12 sub-watersheds	140100051614: Reed Wash			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Runoff from pastures and small farms Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (lb/d)	Fe-Trec (lb/d)	Se-D (lb/d)	Fe-Trec (lb/d)
TMDL	1.7	367	0.14	31
LA	1.4	295	0.11	25
Sum of WLAs	0.15	34	0.012	2.9
MOS	0.17	37	0.014	3.1
RC	0.0061	0.48	0.0005	0.041
Existing load	7.6	1713	3.4	5.9
Reductions	78%	79%	96%	0%

Table ES-11. Dissolved Selenium and Total Recoverable Iron TMDLs for Salt Creek

Waterbody AUID	COLCLC13b_B			
Segment portion description	Salt Creek and tributaries below lake and reservoir, including Mack Wash			
HUC12 sub-watersheds	140100051807: Lower East Salt Creek			
Use classifications and impairments	Agriculture		Fully Supporting	
	Aquatic Life – Warm Water Class 2		Not Supporting	
	Recreation – E		Fully Supporting	
Pollutant addressed	Dissolved Selenium (Se-D) and Total Recoverable Iron (Fe-Trec)			
Major sources of impairment	Runoff from pastures and small farms Urban stormwater runoff			
Loading capacity approach	Mass Balance			
Criteria	Se-D: 4.6 µg/l (chronic), 18.4 µg/l (acute) Fe-Trec: 1000 µg/l (chronic)			
TMDL target	Se-D: 4.6 µg/l Fe-Trec: 1000 µg/l			
Margin of safety	Explicit (10% for all parameters)			
Reserve capacity	Based on the projected change from natural to urban land cover from 2020 to 2030			
Flow Season	**Irrigation (Apr-Oct)**		**Non-Irrigation (Nov-Mar)**	
Parameter	Se-D (µg/l)	Fe-Trec (µg/l)	Se-D (µg/l)	Fe-Trec (µg/l)
TMDL	2.8	609	0.23	51
LA	2.2	468	0.19	39
Sum of WLAs	0.29	79	0.024	6.6
MOS	0.28	61	0.023	5.1
RC	0.010	0.80	0.0008	0.067
Existing load	6.1	1283	3.2	24
Reductions	54%	52%	93%	0%

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Abbreviations, Acronyms, and Units of Measure

Abbreviation/acronym	Description
BMP	Best Management Practice
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
CWA	Clean Water Act
FDC	Flow Duration Curve
LA	Load Allocation
LDC	Load Duration Curve
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
RC	Reserve Capacity
TMDL	Total Maximum Daily Load
U.S. EPA	U.S. Environmental Protection Agency
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey (U.S. Department of the Interior)
WBID	Waterbody Identifier
WLA	Wasteload Allocation
WQCC	Water Quality Control Commission (Colorado)
WQCD	Water Quality Control Division (Colorado)
WWTP	Wastewater Treatment Plant

Unit of measure	Description
cfs	Cubic Foot per Second
cfu	Colony Forming Unit
ft^3	Cubic Feet
gal	Gallon
lb	Pound
mgd	Million Gallons per Day
mg/l	Milligram per Liter (equal to parts per million)
sec	Second
ton	Ton
µg/l	Microgram per Liter (equal to parts per billion)

1 Introduction

Section 303(d) of the federal Clean Water Act (CWA) requires States to periodically submit to the U. S. Environmental Protection Agency (U.S. EPA) a list of waterbodies that are impaired. A waterbody is considered impaired when it does not meet a State's water quality standards. States develop water quality standards that (1) designate the beneficial uses a waterbody can support, (2) define the levels of certain pollutants (numeric criteria) and certain characteristics (narrative criteria) that a waterbody can contain while still supporting the designated beneficial uses, and (3) protect waterbodies that currently support their designated beneficial uses from becoming impaired (*i.e.* anti-degradation).

The CWA and U.S. EPA regulations require that States develop total maximum daily loads (TMDLs) for impaired waters identified on the section 303(d) List. In Colorado, the agency responsible for developing the 303(d) List is the Water Quality Control Division (WQCD) at the Colorado Department of Public Health and Environment (CDPHE). The List is adopted by the Water Quality Control Commission (WQCC) as Regulation No. 93. WQCD also develops TMDLs for impaired waterbodies on Colorado's 303(d) List.

For waterbodies on the 303(d) List, a TMDL is used to determine the maximum amount of a pollutant that a waterbody may receive and still maintain water quality standards. The TMDL is the sum of the waste load allocation (WLA), which is the load from permitted point source discharges, load allocation (LA), which is the load attributed to natural background and/or nonpoint sources (NPS), and a margin of safety (MOS). When future growth is a concern and can be quantified, it is also included as reserve capacity (RC).

$$TMDL = \Sigma WLA + \Sigma LA + MOS + RC$$

The TMDL and water quality restoration planning process involves several steps including watershed characterization, target identification, source assessment, allocation of loads, and prioritization of implementation activities. TMDL targets and allocations are derived from the water quality standards (designated beneficial uses, numeric and narrative criteria, and anti-degradation).

The overall goals and objectives in developing the TMDLs for the waterbodies included in this report are as follows:

- Summarize the existing water quality within the project area and identify key issues associated with the impairments and potential pollutant sources.
- Use the available research and data to identify the water quality conditions that will result in all waterbodies fully supporting their designated uses.
- Prepare a final TMDL report that meets the requirements of the CWA.
- Provide information that can be used to facilitate implementation activities and improve water quality.

The results of the TMDL process are documented in this report. However, this TMDL was developed within a statewide environmental framework established by CDPHE.

WQCD's ultimate goal is to restore and protect the quality of all Colorado waters at levels that fully support established water quality standards. TMDLs are one step in a much larger and iterative process toward addressing water quality problems. The Colorado Statewide Water Quality Management Plan[1] and A Guide to Colorado Programs for Water Quality Management and Safe Drinking Water: A Continuing Planning Process[2] are useful references that describe how different regulations, programs, agencies, and stakeholders work together to set strategies and make progress on this goal.

TMDL effectiveness depends on the degree to which the WLAs and LAs are eventually implemented. WQCD has authority to require implementation of WLAs through surface water discharge permits issued to point sources. In Colorado, such permits are issued in the Colorado Discharge Permit System (CDPS). U.S. EPA performs this role in limited circumstances, where Tribal Lands or federal facilities are involved. TMDLs can support WLA implementation by establishing clearly defined expectations for point sources to ensure that future CDPS permits are consistent with the assumptions and requirements of WLAs.

WQCD primarily relies on incentive-based approaches that encourage partners to leverage resources in support of voluntary actions to address LAs. TMDL analyses can provide the necessary foundation to spur interest and funding opportunities, such as CWA §319 grants, to help local stakeholders develop implementation-focused Nine-Element Watershed Plans[3] and carry out NPS restoration activities.

1.1 Water Quality Impairments and TMDLs Addressed in this Document

The waterbodies of concern are in COLCLC13b (Segment 13b), which is a segment in the Lower Colorado River Basin that includes all tributaries to the Colorado River, including wetlands, from the Government Highline Canal Diversion to a point immediately below Salt Creek, and down-gradient from the Government Highline Canal, the Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and the northeast Colorado National Monument boundary. The Government Highline Canal demarks the upper boundary of each drainage area covered by the TMDLs.

The waterbodies are further broken down using Assessment Unit Identifications (AUIDs). An AUID consists of the waterbody identification with an underscore and a letter (_A, _B, etc.). These assessment units represent the portions of waterbodies that have been listed and tracked by the assessment unit. Each AUID is unique with no spatial overlap. On the 303(d) List, each AUID with its corresponding impairment is assigned a TMDL development priority. Priority options within Regulation 93 include: H = High Priority, M = Medium Priority, and L = Low Priority.

TMDLs were completed using existing data to perform analyses. Each impairment and a description of the portion addressed are listed in **Table 1**. The tributaries listed in **Table 1** will be referenced collectively as the Grand Valley watershed in this document.

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[1] https://www.colorado.gov/pacific/sites/default/files/A-Guide-To-Colorado-Programs.pdf
[2] https://cdphe.colorado.gov/water-quality-planning
[3] https://www.epa.gov/sites/production/files/2015-12/documents/watershed_mgmnt_quick_guide.pdf

Table 1. Impairments addressed by the TMDLs in this document

Assessment Unit ID (AUID)	Stream name	Size (river miles)	Impaired use classification(s)	Cause of impairment	Priority ranking
COLCLC13b_A	Lewis Wash	3.1	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_D	Indian Wash	4.5	Aquatic life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_A & COLCLC13b_C	Leach Creek	10.3	Aquatic life Recreation	Dissolved selenium, Total recoverable iron, *E. coli* (13b_C only)	M H
COLCLC13b_A	Persigo Wash	7.7	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_A	Pritchard Wash	9.0	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_A	Hunter Wash	6.7	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_C	Adobe Creek	7.5	Aquatic Life, Recreation	Dissolved selenium, Total recoverable iron, *E. coli*	M H
COLCLC13b_A	Little Salt Wash	6.8	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_A	Big Salt Wash	14.7	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_A	Reed Wash	30.7	Aquatic Life	Dissolved selenium, Total recoverable iron	M
COLCLC13b_A & COLCLC13b_B	Salt Creek	A: 30.3 B: 13.1 Total: 43.4	Aquatic Life	Dissolved selenium, Total recoverable iron	M

[1]Only the mainstem of Leach Creek is listed for *E. coli*. Tributaries for Leach Creek are a portion of A. However, load calculations will include the tributaries as they contribute to the *E. coli* load in the mainstem.

1.2 Document Structure

This document addresses all the required components of a TMDL and includes an implementation and monitoring strategy. In addition to this introductory section, the document includes:

Section 2 (Standards and Impairments) describes Colorado's water quality standards and the impairments in the Grand Valley watershed.

Section 3 (Watershed Characterization) summarizes the physical characteristics and social profile of the Grand Valley watershed, with a focus on factors that influence the impairments.

Section 4 (Source Assessment) summarizes potential point and nonpoint sources that may contribute to the impairments in the Grand Valley watershed. This section presents available monitoring data, evaluates the monitoring data with respect to the impairment, assesses loading from potential sources, and links in-stream impairments to potential sources.

Section 5 (TMDLs and Allocations) defines each component of a TMDL and describes how each component was determined for the Grand Valley watershed TMDL.

Section 6 (Public Participation) describes stakeholder involvement in the development of the Grand Valley watershed TMDL and addresses public comments received during the public notice of the TMDL.

2 Standards & Impairments

The *Colorado Basic Standards and Methodologies for Surface Water* (Regulation No. 31) establishes water quality standards[4] for the State. This section begins with a discussion of how waterbodies in Colorado are segmented. The section continues with discussions of Colorado's water quality standards (*i.e.* use classifications, criteria), pollutants of concern, and impairments. The section finishes with a discussion of TMDL targets and goals.

2.1 Segments

Waterbodies in Colorado are divided into discrete units or "segments" to characterize changes in use classification(s) or ambient water quality. WQCD assigns a unique waterbody identifier (WBID) to each individual segment (i.e. COLCLC13b). WQCD then assesses individual segments to determine if such segments meet Colorado's water quality standards.

The *Colorado Basic Standards and Methodologies for Surface Water* (Regulation 31.6(4)) discusses segmentation of waterbodies in terms of several broad considerations:

> *31.6(4)(b) Segments may constitute a specified stretch of a river mainstem, a specific tributary, a specific lake or reservoir, or a generally defined grouping of waters within the basin (e.g. a specific mainstem segment and all tributaries flowing into that mainstem segment.*
>
> *31.6(4)(c) Segments shall generally be delineated according to the points at which the use, physical characteristics or water quality characteristics of a watercourse are determined to change significantly enough to require a change in use classifications and/or water quality standards...*

The Grand Valley watershed is a portion of the Lower Colorado River Basin, which encompasses more than 30 stream/river segments and six lake/reservoir segments. Water quality standards for this region are adopted into *Regulation 37: Classifications and Numeric Standards for Lower Colorado River Basin* (WQCC, 2020a).

2.2 Use Classifications

The WQCC classifies the beneficial uses for waterbodies in Colorado. The use classifications are defined in Regulation 31 (WQCC, 2020b). Waters of the State may be classified for the following uses: recreation, agriculture, aquatic life, and domestic water supply (31.13(1)). Occasionally, these uses may be qualified as goal, seasonal, or interrupted flow (Regulation 31.13(2)). Individual segments may be designated for any or all of these use classifications.

Colorado's recreation use classifications are existing primary contact (E), potential primary contact (P), not primary contact (N), and undetermined (U). The recreation use classification for Segment 13b is E, existing primary contact. Colorado's aquatic life use classifications are cold water (Class I), warm water (Class 1), cold water (Class 2), and warm water (Class 2). The aquatic life use classification for Segment 13b is warm water, class 2 (W2). Segment 13b

[4] Regulation No. 31 also defines the procedures for assigning and changing beneficial use classifications (Regulation 31.6), assigning temporary modifications and variances (Regulation 31.7), creates an antidegradation rule (Regulation 31.8), addresses the implementation of standards (Regulation 31.9), and defines mixing zones (Regulation 31.10).

is also classified for agriculture use, but currently is not classified for domestic water supply. In addition, there is a qualifier for Segment 13b in which Fish Ingestion Standards apply. If the domestic water supply use is added in the future, additional water quality standards would apply to this segment in order to protect the use. **Table 2** highlights the use classifications in Segment 13, and where those uses are not supported.

Table 2. Use classifications of Segment COLCLC13b in the Grand Valley watershed

Assessment Unit ID (AUID)	Portion description	Size (river miles)	Recreation	Agriculture	Aquatic life	Domestic water supply	Fish ingestion
COLCLC13b_A	All tributaries to the Colorado River downgradient from the Government Highline Canal[a]	112.9	E - fully supporting	Fully supporting	**W2- not supported**	NA	Fully supporting
COLCLC13b_B	Salt Creek and tributaries below lake and reservoir, including Mack Wash	13.1	E - fully supporting	Fully supporting	**W2- not supported**	NA	Fully supporting
COLCLC13b_C	Adobe Creek, Leach Creek and tributaries below canal	13.7	**E - not supported**	Fully supporting	**W2- not supported**	NA	Fully supporting
COLCLC13b_D	Indian Wash	4.5	E - fully supporting	Fully supporting	**W2- not supported**	NA	Fully supporting

a. All tributaries to the Colorado River, including wetlands, from the Government Highline Canal Diversion to a point immediately below Salt Creek, and downgradient from the Government Highline Canal, the Orchard Mesa Canal No. 2, Orchard Mesa Drain, Stub Ditch and the northeast Colorado National Monument boundary.

2.3 Pollutants of Concern

Pollutants of concern discussed in this TMDL document are dissolved selenium, total recoverable iron and *Escherichia coli (E. coli)* bacteria. These pollutants can originate from an array of sources including point (*e.g.* wastewater treatment facilities) and nonpoint (*e.g.* crop field runoff) sources.

2.3.1 *E. coli*

Microorganisms are ubiquitous across the world and while most are not harmful to humans, pathogens (*i.e.* disease-causing microorganisms) are a small subset of microorganisms that can cause sickness or death when taken into the body (U.S. EPA 2001). Certain bacteria typically indicate the presence of pathogens. *E. coli* is an indicator of pathogenic microorganisms and Colorado has established numeric criteria for *E. coli* based upon protection of designated recreation use classifications.

A waterbody with *E. coli* levels that exceed Colorado's numeric criteria does not support its designated recreation use. A person that recreates in (*e.g.* swims) and directly contacts such a waterbody is at higher risk for becoming ill.

In Colorado, pathogenic bacteria in streams are typically derived from:

- **Humans,** such as through untreated sewage from Wastewater Treatment Plants (WWTPs) and failing septic systems
- **Livestock** with unrestricted access to streams or via stormwater runoff from grazed pastures or animal operations, and via runoff from manure application to crop fields;
- **Pets** via stormwater runoff from residential lawns and parks;
- **Wildlife** via stormwater runoff from natural and developed areas.

E. coli can also re-enter the water column through re-suspension of sediments when pathogens are attached to those sediments. Runoff will increase the velocity of water in a stream, which may yield sufficient power to scour the bottom of the stream.

Regardless of the source, once pathogens enter surface waterbodies, instream pathogen levels decrease over time. The die-off is controlled by factors including sunlight, temperature, moisture conditions, and salinity (U.S. EPA 2001, p. 2-7). Instream pathogen levels are dependent upon the die-off rate and the time and distance from the source to the waterbody of interest.

2.3.2 Selenium

Selenium is an essential trace nutrient for various aquatic organisms. However, elevated selenium concentrations have been proven to cause mortality, deformities, and reproductive failure in fish and aquatic birds (U.S. EPA 1998). The toxicity and bioaccumulation of selenium depends on the form and interaction with other variables. In alkaline soils and in oxidizing conditions, selenium uptake is increased because it is in its biologically active form, which increases its availability to aquatic organisms.

Selenium is also an essential trace nutrient for plants. "At low concentrations, selenium can act as a plant growth regulator, antioxidant, anti-senescent, abiotic stress modulator, and defensive molecule against pathogens in plants. [However], at higher concentrations, plants show various toxic symptoms, which include stunting of growth, chlorosis, withering, and drying of leaves, decreased protein synthesis, premature and even death of the plant" (Kaur et al. 2014).

Selenium is found throughout the West in marine Cretaceous shale deposits. Selenium occurs in sulfide ores of heavy metals. In addition, soils in proximity to volcanic activity contain elevated selenium concentrations. Selenium can enter a water body through surface runoff or groundwater inputs as a result of natural weathering of selenium-laded soil and geology; discharges of selenium-laden groundwater to surface water can increase the rate at which selenium enters a water body. Selenium is also an enriched element in coal. Irrigation practices have been noted to concentrate selenium when irrigation waters evaporate and concentrate the dissolved components (Bureau of Reclamation 2018). Anthropogenic sources of selenium include the combustion of coal and petroleum fuels and the smelting of other metals.

2.3.3 Iron

Iron often represents a major constituent in soils and sediments, and elevated concentrations can have indirect effects to aquatic life in surface waters. Iron precipitates in river ecosystems can affect the survival, reproduction, and behavior of aquatic animals. Several studies have found that the clogging of fish gills by iron-hydroxide precipitates is common in streams with a high iron concentration. In addition, it was found that the hatching success for fathead minnow decreases due to the high iron-hydroxide precipitates, which clogs egg pores and macroinvertebrate gills. Overall, iron precipitates restrict the distribution, abundance, and diversity of fishes, benthic invertebrates, and periphyton by reducing habitat availability and quality, and directly smother organisms. It is also likely that high iron concentrations can cause changes in food resources and animal feeding behavior. Lastly, when humic substances, ferrous iron and phosphorous are present during aerobic conditions, iron decreases phosphate adsorption to iron-organic complexes and increases availability for phytoplankton. This can promote algal growth, which blocks sunlight, thereby resulting in a loss of productivity and species interactions within the river (Vuori 1995).

2.4 Numeric and Narrative Criteria

Colorado water quality standards are established in *The Basic Standards and Methodologies for Surface Water* (Regulation No. 31). All surface waters of the State are subject to the basic narrative standards listed in Regulation No. 31.11(1), which states that State surface waters shall be free from substances attributable to human-caused point source or nonpoint source discharge. In addition, basin-specific numeric standards are adopted in separate regulations (*i.e.* Regulation Nos. 32 through 38). Stream classification and water quality standards for the Lower Colorado River basin are established in *Classifications and Numeric Standards for Lower Colorado River Basin* (Regulation No. 37). The chronic and acute dissolved selenium criteria adopted for the aquatic life classification W2 are 4.6 µg/l and 18.4 µg/l, respectively. The chronic total recoverable selenium criterion for the agricultural classification is 20 µg/l. The chronic total recoverable selenium criterion for the fish ingestion qualifier is 4,200 µg/l. The chronic total recoverable iron criterion adopted for the aquatic life classification W2 is 1,000 µg/l. The *E. coli* criterion adopted for recreation class E is 126 per 100 mL.

2.5 Impairments

WQCC and WQCD (2020) established Colorado's *Listing Methodology* and determinations of attainment and impairment. The number of samples necessary to list a waterbody depends on the type of waterbody (*e.g.* stream, lake), the pollutant, and the number of samples that exceed criteria. The procedures to assess use attainment and impairment vary by beneficial use, standard duration (*i.e.* acute or chronic), waterbody type, and pollutant.

Attainment of the chronic selenium standard is determined by comparing the 85th percentile of the most recent five years of data against the underlying standard (4.6 µg/l). Segment 13b was originally listed for selenium in 2002 for specific tributaries (Indian Wash, Little Salt Wash, Adobe Creek, Hunter Wash) and all tributaries in the segment have been considered impaired in subsequent listings, including the most recent 2018 List. One source of selenium loading to the Colorado River is from the Segment 13b tributaries. Implementation of TMDLs for the tributaries will reduce the selenium loading to the Colorado River. Note that selenium standards are currently being addressed as a part of the Water Quality Roadmap[5]. A change in the selenium standard may occur in 2027; however, this TMDL will still be relevant and applicable after new standards are in place.

Attainment of the chronic total recoverable iron standard is determined by comparing the 50th percentile of the most recent five years of data against the underlying standard (1000 µg/l). Adobe Creek and Leach Creek were originally listed for total recoverable iron in 2008 and 2012, respectively. In 2016, all Segment 13b tributaries were listed as impaired for total recoverable iron. The Colorado River mainstem from the Gunnison River to the state line (Segment 3) is currently listed on the 303(d) list for total recoverable iron. The Segment 13b tributaries represent a source of iron loading contributing to the Colorado River impairment. Segment 3 was originally listed in 2020 with a 50th percentile of 1,980 µg/l. Implementation of TMDLs for the tributaries will help to reduce the total recoverable iron loading to the Colorado River.

Attainment of the *E. coli* standard is determined by comparing a 61-day rolling-geometric mean of the most recent five years of data against the underlying standard (126 per 100 ml). The Adobe Creek and Leach Creek portions of Segment 13b originally were listed as impaired for *E. coli* in 2008 and 2012, respectively.

The impaired parameters in each of the Grand Valley segments were summarized earlier in **Table 1. Figure 1** shows the locations of the impaired segments addressed in this document.

[5] https://cdphe.colorado.gov/water-quality-10-year-roadmap

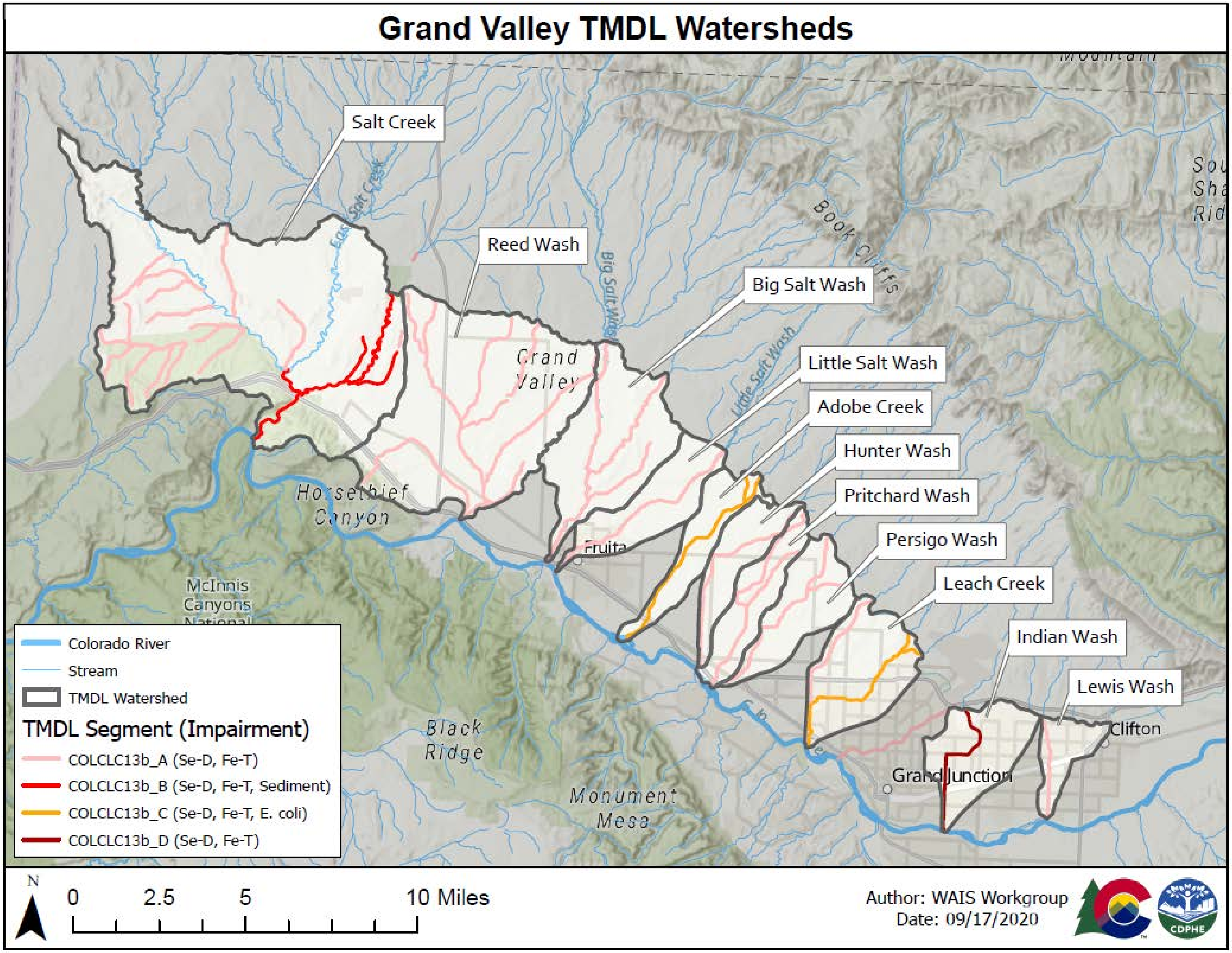

Figure 1. Impaired segments in the Grand Valley watershed.

2.6 TMDL Targets and Goals

TMDLs are required to identify a numeric target to determine whether or not the applicable water quality standard is attained. Generally, the pollutant causing the impairment and the parameter expressed as a numeric water quality criterion are the same. In these cases, selecting a TMDL target is as simple as applying the numeric criteria. Occasionally, an impairment is caused by narrative water quality criterion violations or by parameters that cannot be easily expressed as a load (*e.g.* dissolved oxygen). When this occurs, the narrative criteria or other parameters must be translated into a numeric TMDL target (*e.g.* no nuisance aquatic algae translated into a total phosphorus target) or a surrogate target (*e.g.* a pH impairment addressed through a total nitrogen target). The TMDL must demonstrate that the chosen target is protective of water quality standards. TMDL targets must also be protective of water quality standards of downstream waterbodies; this is especially important when a downstream waterbody has more stringent water quality standards than the impaired segment.

<u>Dissolved selenium</u> - The numeric dissolved selenium criterion of 4.6 µg/L for chronic exposure, and 18.4 µg/l for acute exposure, is protective of the warm water Class 2 aquatic life use for Segment 13b. A numeric criterion for chronic total recoverable selenium of 50 µg/l is protective of the agriculture use for Segment 13b. A numeric criterion for chronic total recoverable selenium of 4,200 µg/l is protective of the fish ingestion qualifier for Segment 13b. In the July 2000 Regulation No. 31 rulemaking hearing, the commission converted the total recoverable selenium standards of 5 µg/L (chronic) and 20 µg/L (acute) to dissolved selenium standards of 4.6 µg/L (chronic) and 18.4 µg/L (acute) using a conversion factor of 92.2% from EPA (1994). Therefore, when the dissolved numeric criterion of 4.6 µg/l is met, a total recoverable concentration of 5 µg/l will not be exceeded. Because the total recoverable concentration would not exceed 5 µg/l, the agriculture use and fish ingestion qualifier will be protected since the criterion to protect those uses are greater than 5 µg/l. As a result, the aquatic life use based criterion 4.6 µg/l will be used as the selenium TMDL target for Segment 13b as it is the most stringent and is protective of all uses.

<u>Total recoverable iron</u> - The numeric criterion of 1,000 µg/L chronic is the applicable standard used in this TMDL and is protective of the aquatic life use for Segment 13b.

<u>*E. coli*</u> - The numeric criterion of 126 per 100 ml is the applicable standard used in this TMDL and is protective of the existing primary contact classified recreation use for Segment 13b, and will be used as the *E. coli* TMDL target for impaired portions, Adobe and Leach creeks.

TMDLs must consider downstream water quality standards. In this case, the tributaries addressed in this TMDL (COLCLC13b) flow into the Colorado River (COLCLC02b and COLCLC03), and both segments have the same use classifications and associated criteria. Because of this alignment, TMDLs established to meet the water quality standards for the Segment 13b tributaries will also be protective of downstream water quality standards in segments 2b and 3.

The goals of this TMDL are to protect aquatic life and agriculture through attainment of dissolved selenium and total recoverable iron standards for all the tributaries listed in **Table 1** and to protect public health through attainment of the *E. coli* water quality standard for Adobe and Leach creeks. To achieve this goal, the WQCD proposes a load-based allocation approach in this TMDL that will address nonpoint and point sources of dissolved selenium, total recoverable iron and *E. coli*. The applicable water quality standard is reflective of the entire stream segment as a whole; therefore, any point sampled on tributaries in Segment 13b should meet the water quality standard. Meeting the TMDL target is expected to result in attainment of water quality standards as determined by WQCD's 303(d) Listing Methodology.

2.7 Antidegradation

Antidegradation is addressed via the Antidegradation Rule in Regulation 31*.* Regulation 31.8(1)(c) states:

> "At a minimum, for all state surface waters existing classified uses and the level of water quality necessary to protect such uses shall be maintained and protected. No further water quality degradation is allowable which would interfere with or become injurious to these uses. The classified uses shall be deemed protected if the narrative and numerical standards are not exceeded."

In addition, Basin-specific WQS regulations are contained in *Regulation 37: Classifications and Numeric Standards for Lower Colorado River Basin.* Segment COLCLC13b is designated as "Use-Protected."

The TMDLs in this report are established at levels that attain and maintain all applicable WQS because the chosen TMDL targets represent a water quality condition that is supportive of all uses at a nonimpaired status. Therefore, the antidegradation rule requirements have been met.

3 Watershed Characterization

The Grand Valley watershed is briefly characterized in this section to provide a better understanding of historic and current conditions in the watershed that affect water quality and contribute to the Grand Valley impairments. Understanding the natural and human factors affecting the watershed will assist in selecting and tailoring appropriate and feasible implementation activities to achieve water quality standards.

3.1 Project Setting

The Grand Valley is located along the Colorado River in Mesa County in western Colorado. The valley contains the City of Grand Junction and several smaller municipalities, including the City of Fruita and the Town of Palisade. The impaired tributaries addressed in this TMDL document are within the jurisdictional boundaries of the municipalities of Grand Junction and Fruita, as well as the utilities special districts Mesa County Stormwater Division, Grand Valley Drainage District (GVDD), and Grand Valley Water Users Association.

The 5-2-1 Drainage Authority was formed in 2004 to manage stormwater runoff and implement projects to maintain and upgrade the stormwater infrastructure. The 5-2-1 Drainage Authority was formed and is governed by representatives of the City of Grand Junction, City of Fruita, Town of Palisade, Mesa County and the GVDD. In April 2020, the municipal separate storm sewer system (MS4) Permit (COR90000) was transferred from the 5-2-1 Drainage Authority to the Mesa County Stormwater Division. Mesa County has intergovernmental agreements with the City of Grand Junction, City of Fruita, and Town of Palisade to implement, administrate, and enforce all aspects of the MS4 Stormwater Program.

For each waterbody listed in **Table 1**, a sub-watershed was created to analyze the TMDL in order to connect loads with associated land uses. The upper bound of the each sub-watershed included in this TMDL is the Government Highline Canal and the lower bound is the outlet of each sub-watershed to the Colorado River. The upper boundary was selected because the watershed above the Government Highline Canal is composed of federal and Bureau of Land Management (BLM) land which is not subject to the heavy irrigation as the portion of the watershed below the Government Highline Canal. The side boundaries of the sub-watersheds were based on either the Hydrologic unit code (HUC) 12 or the stormwater drainage system map within the Mesa County MS4 area in order to accurately delineate the contributing areas of each receiving stream. . **Figure 2** illustrates the location of the municipal boundaries, the Government Highline Canal, and roads within the region in relation to the streams evaluated in this TMDL.

The dominant land use in the Grand Valley is agriculture. Alfalfa comprises more than 75% of the agriculture in the project area, according to the United States Department of Agriculture's (USDA) National Agricultural Statistics Service Cropland Data Layer (2020). Other crops grown in the area include corn, winter wheat, oats, and peaches. In addition, several hobby farms are scattered throughout the TMDL watershed. Mesa County has over 75,000 irrigated acres with the majority of land flood irrigated.

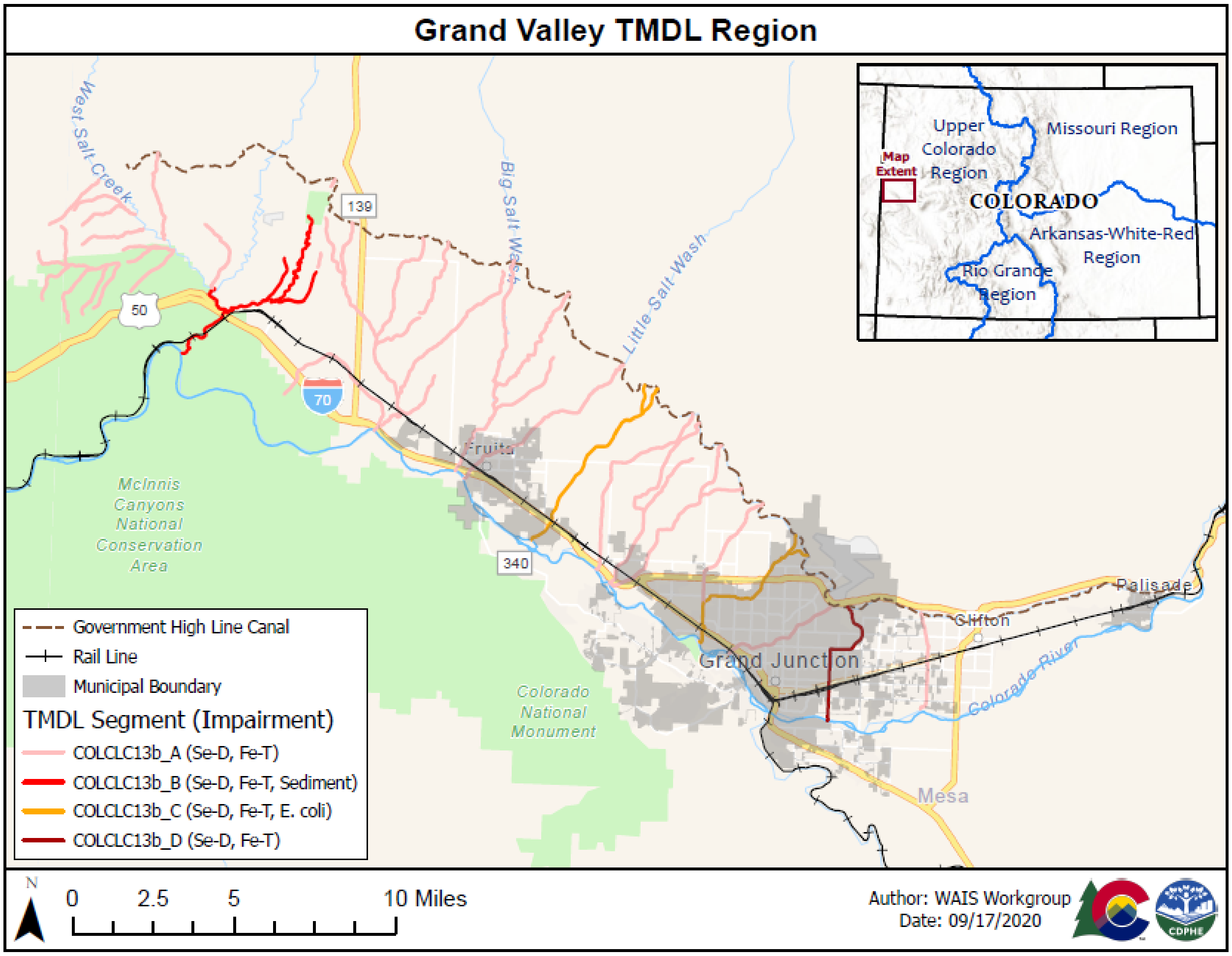

Figure 2. General Map of the Grand Valley Region

3.2 Land Use and Land Cover

Based on the 2016 National Land Cover Database (NLCD), the 168 square mile TMDL watershed is split between natural (39.2%), cultivated crops (37.5%) and developed (23.3%) land covers. **Table 3** summarizes the land cover percentages for each TMDL sub-watershed, while **Figure 3** provides a spatial land cover map. Note that the WQCD uses a "developed" designation to include the NLCD categories for "Developed, Low Intensity", "Developed, Medium Intensity", "Developed, High Intensity", and "Developed, Open Space". "Cultivated crops" includes the NLCD categories for "Cultivated Crops" and "Pasture/Hay". The remainder of the NLCD categories are lumped under "natural".

Table 3. NLCD Percentages per TMDL sub-watershed.

	NLCD 2016 Land Cover		
TMDL sub-watershed	Natural	Developed	Cropland
Lewis Wash	2.6%	87.5%	9.9%
Indian Wash	3.5%	86.4%	10.1%
Leach Creek	11.5%	57.3%	31.3%
Persigo Wash	17.8%	18.3%	64.0%
Pritchard Wash	10.1%	32.7%	57.2%
Hunter Wash	11.0%	13.7%	75.3%
Adobe Creek	13.9%	13.9%	72.2%
Little Salt Wash	11.7%	22.7%	65.6%
Big Salt Wash	25.1%	8.5%	66.4%
Reed Wash	26.6%	7.9%	65.5%
Salt Creek	74.9%	4.1%	21.1%

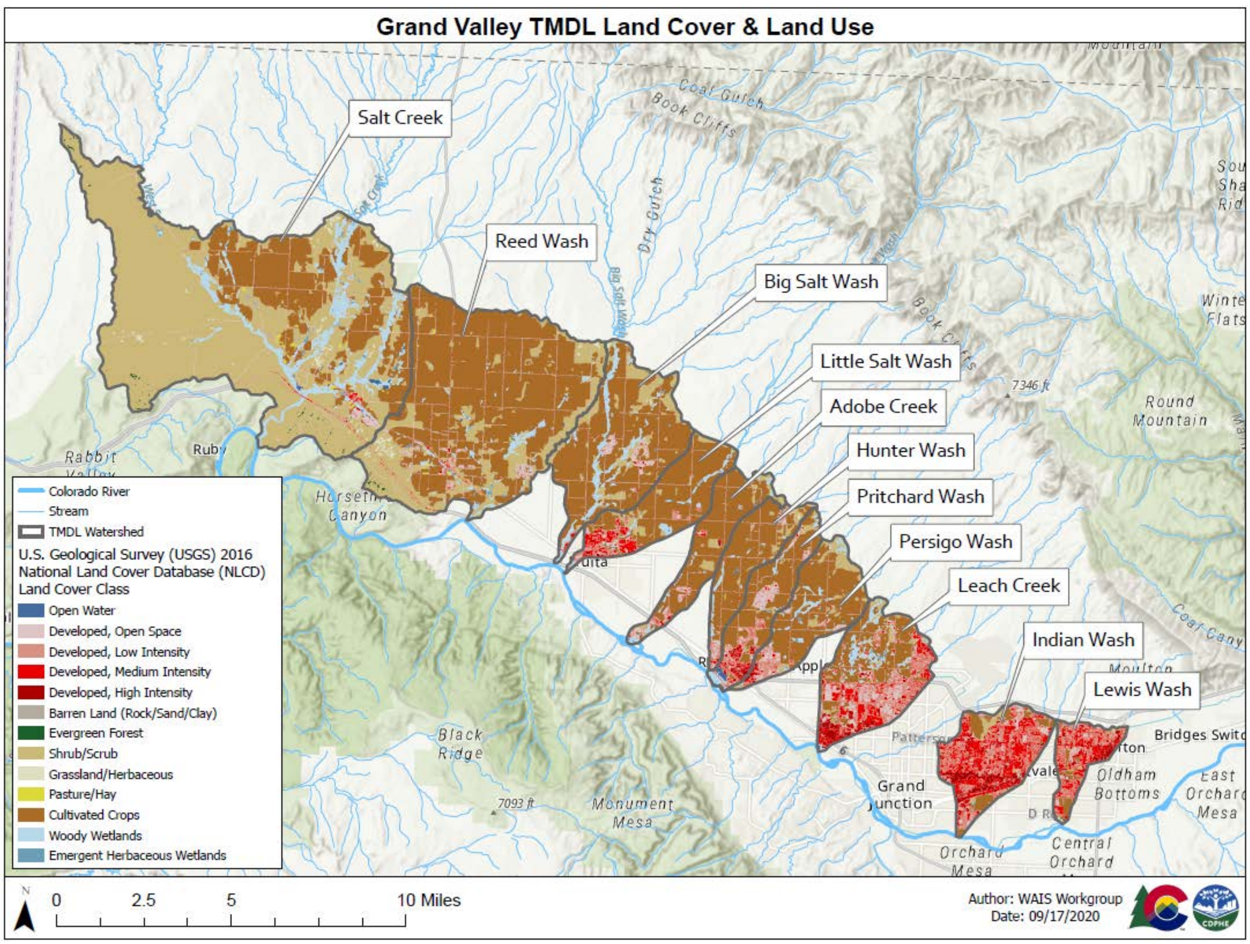

Figure 3. NLCD 2016 Land Cover Map for the Grand Valley TMDL watershed

3.3 Geology and Soils

U.S. Geological Survey's (USGS's) Digital Geologic Map of Colorado in ARC/INFO indicate that the Grand Valley TMDL sub-watersheds are underlain by shale, sandstone, gravel, and alluvium sands. **Figure 4** shows the breakdown of geological units within the TMDL watershed. Note that the upper portions of the watershed upstream of the TMDL sub-watersheds are also composed primarily of shale. Such deposits are often referred to as seleniferous shales due to their selenium content and are widely distributed throughout the western United States. Soils derived from underlying seleniferous shales also serve as selenium source material.

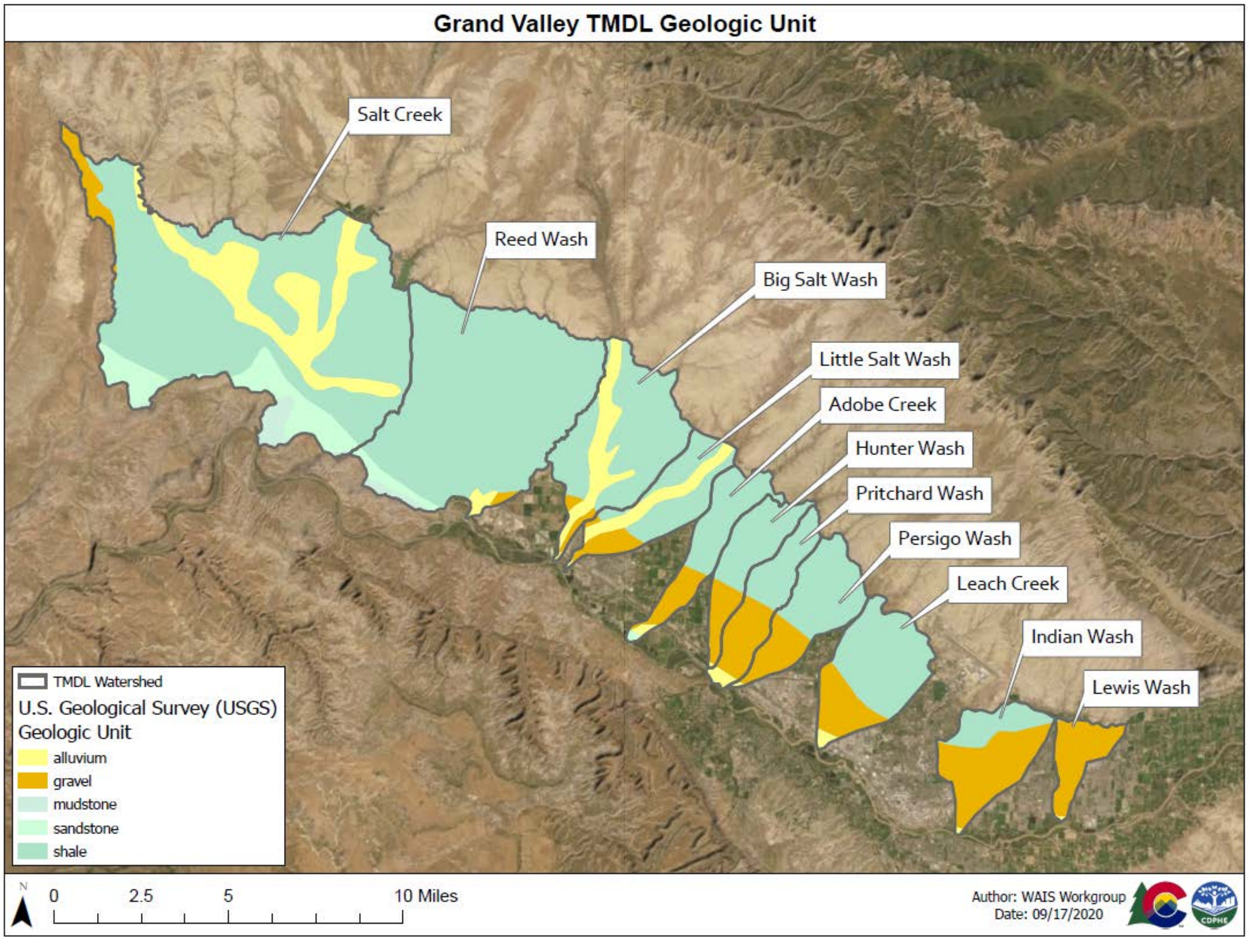

Figure 4. Geology of the Grand Valley TMDL watershed

The type of soil in the watershed can affect the magnitude and timing of pollutant loads in both surface and subsurface waters. Hydrologic Soil Groups C and D are the dominant USDA soil groups in the Segment 13b tributary catchments according to USDA's Web Soil Survey. Groups C and D are characterized as fine textured soils with slow (Group C) or very slow (Group D) infiltration and transmission rates. Some of the TMDL sub-watersheds have a high proportion of Group B soils, which are characterized by moderate infiltration and transmission rates. **Figure 5** provides the spatial representation of soils within the TMDL watershed.

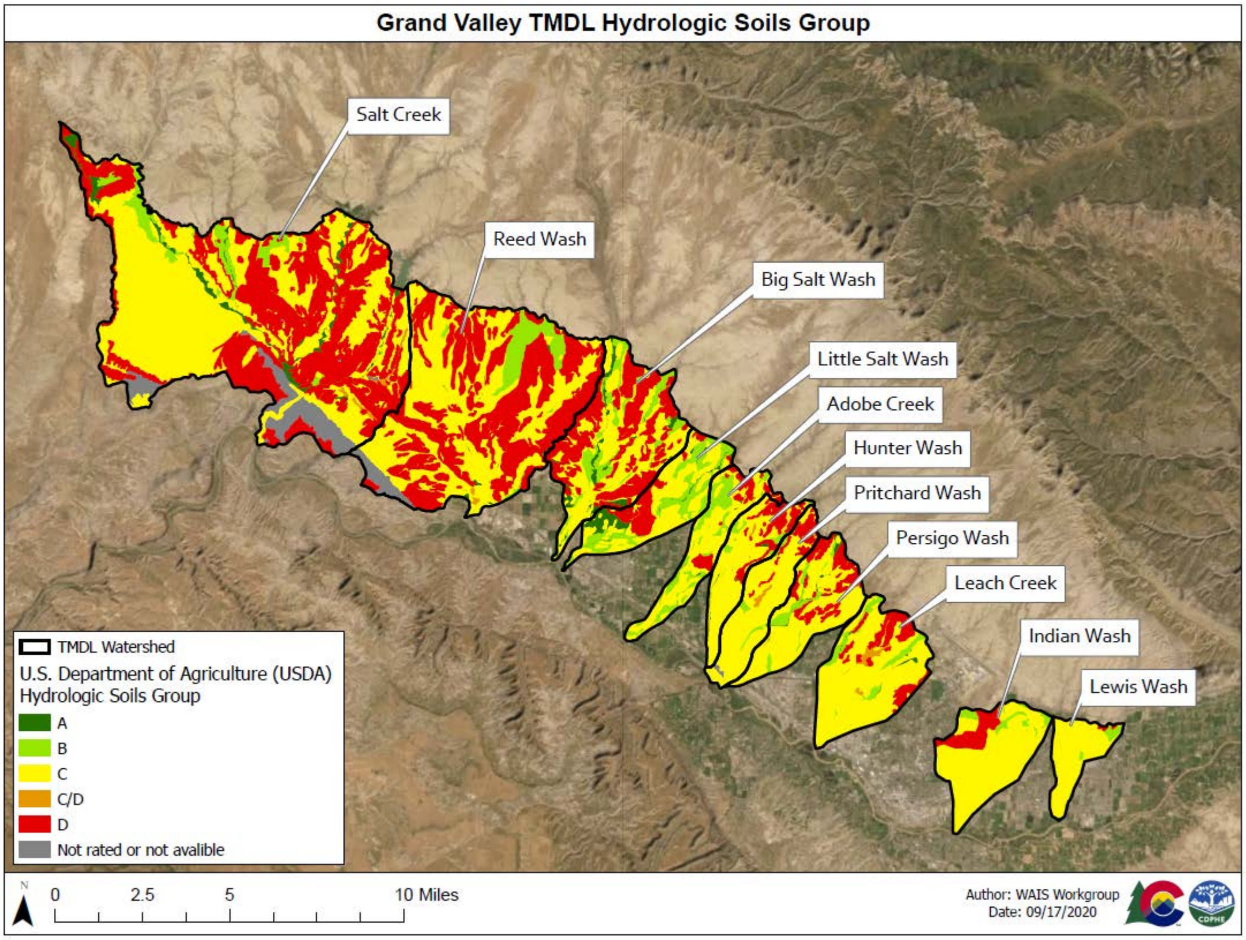

Figure 5. Hydrologic Soils Groups of the Grand Valley watershed

3.4 Climate

Because of its location at the foothills west of the Rocky Mountain Range, the Grand Valley receives lower precipitation compared to the mountains east of the Grand Valley. Based on PRISM 30-year normal (average) data (1981-2010), the Grand Valley TMDL watershed receives an average of approximately 9.86 inches of precipitation per year. The 30-year average monthly precipitation for the Grand Valley TMDL watershed are summarized in **Table 4**.

Table 4. 30-year monthly average precipitation data for the Grand Valley

Month	Precipitation (in.)
January	0.65
February	0.62
March	0.86
April	0.78
May	0.86
June	0.59
July	0.67
August	1.05

Month	Precipitation (in.)
September	1.12
October	1.13
November	0.85
December	0.69
Annual Total	**9.86**

All individual TMDL sub-watersheds follow the same precipitation pattern as the larger overall TMDL watershed. The winter season is characterized with low amounts of precipitation (usually in the form of snow) before an increase from March to May. Low precipitation in June and July is followed by a peak in precipitation from August to October. Based on the precipitation amounts, the climate in the TMDL sub-watersheds ranges from arid to semiarid.

The monthly average high temperature for the entire TMDL watershed area based on PRISM 30-year normal (average) data reaches approximately 77.9º F during the month of July while the average low temperature is approximately 27.9º F during the month January. The 30-year normal monthly temperature for the Grand Valley TMDL watershed is summarized in **Table 5**.

Table 5. 30-year monthly normal temperature data for the Grand Valley

Month	Temperature (°F)
January	27.8
February	34.7
March	44.0
April	51.8
May	61.6
June	71.2
July	77.8
August	75.2
September	66.0
October	53.0
November	39.9
December	29.1

3.5 Hydrology

The tributaries to the Colorado River of the Grand Valley are highly managed streams that are fed by the headwaters (year-round) and agricultural return flow, which is managed by the GVDD (during the irrigation season). The flow regime is characterized with lower flows from November to March and higher flows from April to October, corresponding to the snowpack melting in the headwaters and agricultural runoff during the irrigation season. Note that the spike in flow in December is due to groundwater flow from the irrigation season, but it is not expected to have similar water quality to the irrigation season months.

Historically, there are five USGS stream gages that collected daily average flow data. The five stream gages and their period of record are:

- USGS 09153290 (Reed Wash near Mack, CO): October 1, 1975 to September 29, 2000
- USGS 09153270 (Big Salt Wash at Fruita, CO): March 1, 1973 to October 5, 1977
- USGS 09152900 (Adobe Creek Near Fruita, CO): April 1, 1973 to October 3, 1983
- USGS 09152650 (Leach Creek at Durham, CO): April 1, 1973 to October 4, 1983
- USGS 09106200 (Lewis Wash near Grand Junction, CO): April 1, 1973 to September 29, 1979 and April 23, 2002 to April 6, 2004

Although the flow data from these stations are relatively old, the WQCD has determined that they are representative of current flows based on the strict regulation of water rights in the watershed.

Figure 6 shows the daily average flow and flow range for each Julian day from water years 1976 to 2000 for USGS 09153290 (Reed Wash near Mack, CO).

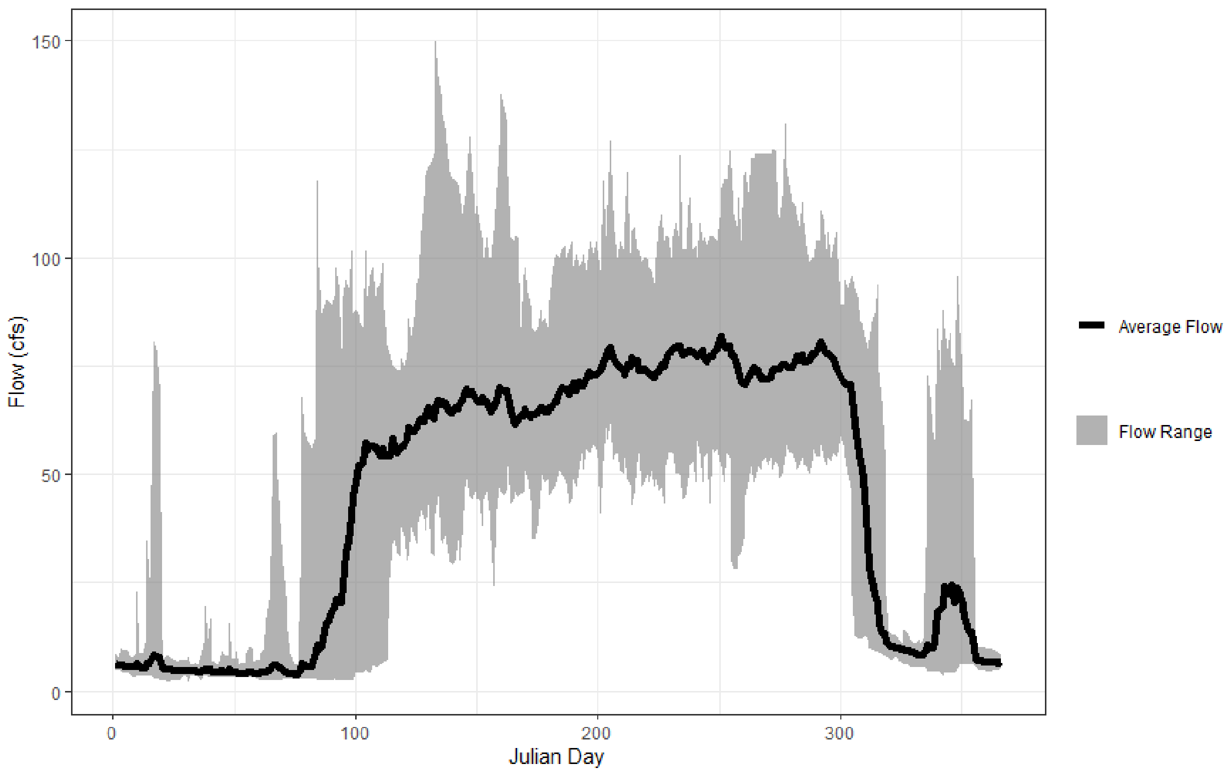

Figure 6. Daily average flow and range of flow values from water years 1976-2000 for USGS 09153290 (Reed Wash near Mack, CO).

Instantaneous flow data has also been collected by various organizations such as the division, USEPA, and USGS along all of the tributaries with paired water quality data. Locations of USGS gage stations are illustrated in **Figure 7** and **Figure 8**.

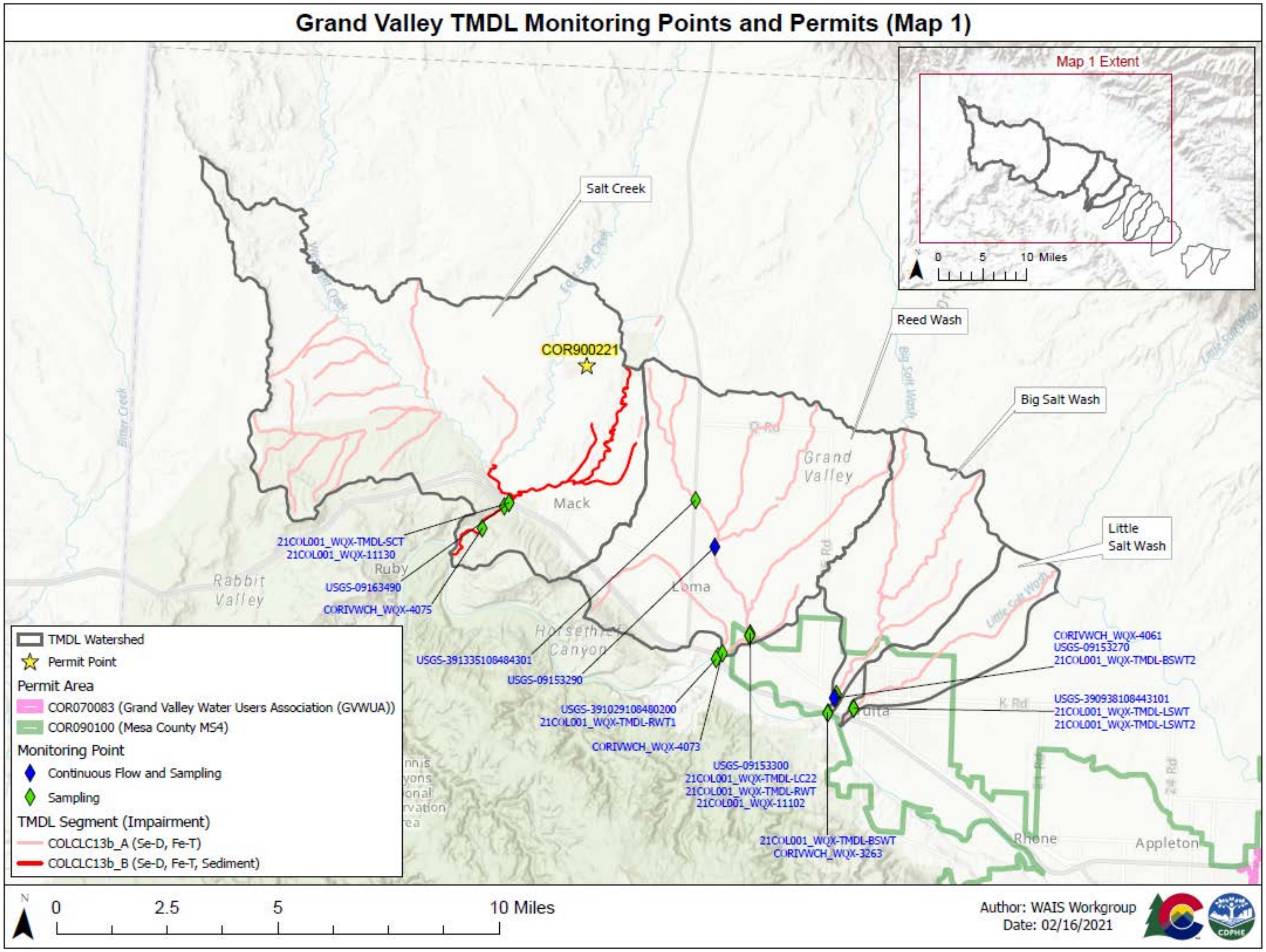

Figure 7. Flow monitoring points and permit locations for Salt Creek, Reed Wash, Big Salt Wash, and Little Salt Wash.

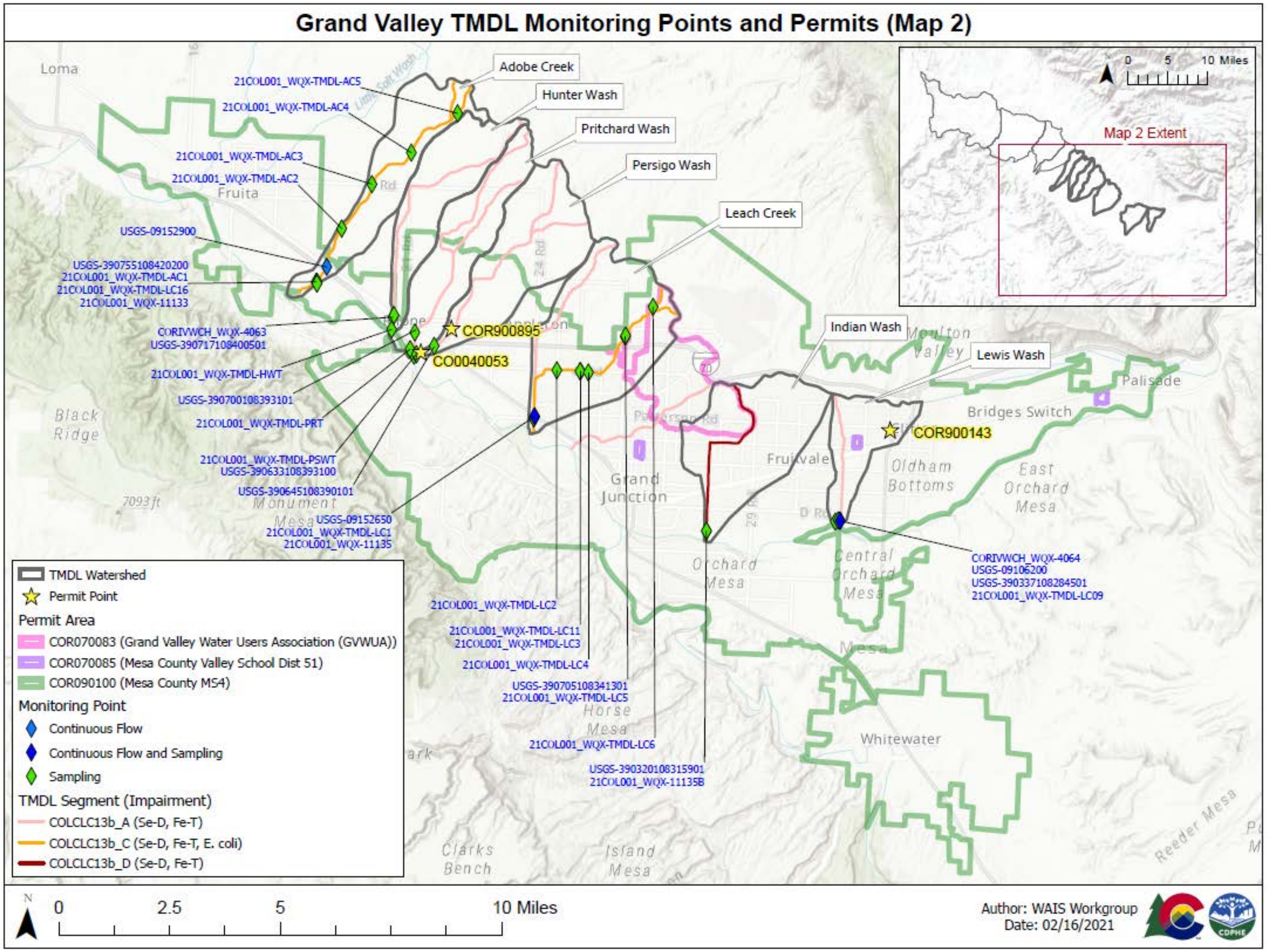

Figure 8. Flow monitoring points and permit locations for Adobe Creek, Hunter Wash, Pritchard Wash, Persigo Wash, Leach Creek, Indian Wash, and Lewis Wash.

3.6 Water Quality

Water quality has been monitored over time by several parties, including the WQCD, USGS, U.S. EPA Region 8, and Colorado River Watch. U.S. EPA, in conjunction with the U.S. Fish and Wildlife Service, have collected samples from multiple tributaries in Segment 13b. Section 4 provides information on sample locations and summary statistics.

3.7 Community Profile

The Grand Valley TMDL watershed area consists of two municipalities (Grand Junction and Fruita). The City of Grand Junction is located primarily within the Indian Wash and Leach Creek TMDL sub-watershed, while the City of Fruita is located primarily within the Little Salt Wash TMDL sub-watershed. **Table 6** summarizes the 2000 and 2010 census populations as well as the percent growth from 2000 to 2010. Although 2020 Census data were not final at the time this report was written, the estimated growth for Grand Junction is 7.7% and for Fruita is 6.2% from 2010 to 2019.

Table 6. Population data for municipalities within the TMDL sub-watershed area.

Municipality	Population (2000)	Population (2010)	Percent change
Grand Junction	41,986	58,566	39.5%
Fruita	6,478	12,646	95.2%

As indicated in **Table 3**, the majority of the land cover in the TMDL watershed is categorized for cultivated crops. The GVDD is a Special District that has existed for over 100 years to manage water for agricultural producers and municipalities. The GVDD system consists of irrigation laterals, over 258 miles of open and piped ditches throughout Mesa County. The GVDD service area includes lands from Palisade to Loma on the north side of the Colorado River. The GVDD has provided input throughout the development of this TMDL document.

4 Source Assessment

Source assessments are a key component of water quality management plans and TMDL development. These analyses are generally used to evaluate the type, magnitude, timing, and location of pollutant loading to a waterbody (U.S. EPA 1999). Source assessment methods vary widely with respect to their applicability, ease of use, and acceptability. The purpose of this section is to identify and evaluate potential sources of dissolved selenium, total recoverable iron and *E. coli* in the TMDL area.

4.1 Technical Approach

The objectives of the technical approach are to (1) identify and assess sources of the pollutants of concern and (2) provide the link between pollutant sources and the observed water quality impairments.

Based on the available dissolved selenium, total recoverable iron and flow data, links between the pollutant sources and observed water quality impairments were assessed for two seasons: an irrigation season lasting from April to October and a non-irrigation season lasting from November to March. For dissolved selenium, these two seasons represented two different load regimes despite selenium concentrations exceeding water quality standards in both cases. The selenium load during the irrigation season is "flow-dominated", wherein the selenium concentration is typically lower than during the non-irrigation season but high flows contribute a greater proportion of the load (recall load is defined as flow multiplied by concentration). The non-irrigation season is more "concentration-dominated", wherein the streamflows are lower but concentrations are significantly higher than during the irrigation season.

Total recoverable iron exhibits a slightly different pattern than selenium. During the irrigation season, the existing and available data indicate exceedances of the water quality standard and that reductions are necessary. During the non-irrigation season, the existing and available data indicate the water quality standard is attained during the non-irrigation season and no reductions are necessary.

Based on the available *E. coli* and flow data available for Adobe and Leach Creeks, it was determined that the observed flows do not correlate to the observed magnitude of the *E. coli* concentration. Therefore, the source assessment was completed over an entire year.

For all three parameters, the characterization of flows and concentrations (based seasonally for dissolved selenium and total recoverable iron and yearly for *E. coli*) were linked to the pollutant sources that exist in each sub-watershed.

4.2 Point Sources

A point source[6] may discharge effluent to a water of the state if the discharge is covered by a National Pollutant Discharge Elimination System (NPDES) or a Colorado Discharge Permit System (CDPS) permit. In Colorado, U.S. EPA issues NPDES permits for point sources on federal property and tribal property (tribal-member owned). WQCD issues CDPS permits for discharges from all other point sources.

U.S. EPA and WQCD issue two types of permits in Colorado: individual and general. Individual permits typically cover the discharges from a single entity, encompass a comprehensive permit application process, and are written site-specifically. General permits cover facilities with similar types of discharges across multiple entities (e.g. Sand and Gravel discharges). General permits contain requirements for all permittees and are not specific to a single entity. The application process for general permits is streamlined in comparison to the application process for an individual permit.

NPDES and CDPS permits are effective for five years, and, within that time, may be modified to account for alterations to the point source. When CDPS and NPDES permits are renewed, they must be consistent with the assumptions and requirements of WLAs for point sources that are developed in the TMDL process. Both NPDES/CDPS permits and TMDLs protect waterbodies from receiving more pollutant loading than the waterbody can assimilate.

[6] A *point source* is defined by CWA section 502(14) as, "any discernible, confined and discrete conveyance, including any ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agriculture stormwater discharges and return flow from irrigated agriculture."

For the purposes of this TMDL, permitted point sources can be categorized by ownership. Typical publicly-owned treatment works include sanitary wastewater treatment plants, MS4, and water treatment plants. Typical privately-owned treatment works include manufacturing plants that discharge process water or cooling water, natural resource extraction activities that discharge stormwater and process water, other industrial facilities that discharge stormwater and process water, and construction sites that discharge stormwater and dewatering water. Features associated with abandoned or legacy mine sites, including waste rock piles, mill tailings, discharging adits and mine dumps, are considered non-permitted point sources and are included within the WLA portion of the TMDL.

Stormwater discharges from MS4s, industrial, and construction sites primarily rely on widespread use of control measures and management practices designed to reduce the pollutants in stormwater. For MS4 permittees, these control measures and management practices should be designed to reduce pollutants to the “maximum extent practicable” (MEP). EPA does not define MEP, rather, MEP is established by the permitting authority. It is an iterative standard that is continually adapted to current conditions and control measure effectiveness.

The remainder of CDPS discharges contain numeric limits for pollutants when they are determined to have a reasonable potential to cause or contribute to an exceedance of a water quality standard, or when a numeric Federal Effluent Limitation Guideline (ELG) has been promulgated by EPA. Stormwater discharges subject to numeric limits may also be required to comply with narrative and practice-based effluent limits to ensure the discharges are controlled as necessary to protect the water quality standards of the associated receiving water.

Seven facilities possess permits in the Grand Valley watershed and discharge directly to the impaired tributaries identified in Section 2; one facility is covered by an individual CDPS permit (**Table 7**) and six facilities are covered by general CDPS permits (**Table 8**). One additional facility covered by an individual permit is allowed to discharge dissolved selenium and total recoverable iron to a segment upstream of the impaired segments. This facility also is listed in **Table 7**. Permitted point sources are shown in Figure 7 and Figure 8.

<u>Individual Permits</u>

The Persigo Wastewater Treatment Facility (WWTF) (CO0040053) currently has a permitted discharge to Persigo Wash (Outfall 001A). A WLA has been identified for this facility for all the pollutants of concern: selenium, iron and *E. coli*. While the facility’s primary discharge location was switched to the mainstem Colorado River (COLCLC03) in 2019 (Outfall 002A), a WLA is assigned to Persigo Wash because an outfall still exists that allows the facility to discharge to Persigo Wash.

McClane Mine (CO0038342) discharges to East Salt Creek Segment COLCLC13a, upstream of Segment COLCLC13b_B (Salt Creek), in Garfield County. The current discharge permit authorizes discharges from the mine from four outfalls (001-004). The discharge permit is protective of downstream water quality standards for dissolved selenium and total recoverable iron. Permit limits were established using federal ELGs applicable for alkaline mine drainage or applying water quality-based effluent limits (WQBELs), whichever is more stringent. A 30-day average of 1000 µg/l applies to outfalls 002, 001, and 004 for total recoverable iron. A qualitative reasonable potential (RP) analysis was completed for dissolved selenium for outfall 002 based on discharge data and a determination that there was a potential to contribute to exceedance of the standard. As it was uncertain if the facility could meet the WQBEL of 4.6 µg/l, the facility was given a compliance schedule. The WQBEL becoming effective June 1, 2018. Outfalls 001 and 004 lacked data to conduct a quantitative RP analysis, and were given report requirements for dissolved selenium. The current permit became effective on September 1, 2015, and the permittee has discharged only one month from outfalls 001 and 004, in December 2018. The permit became administratively continued on September 1, 2020. The selenium concentrations measured for this discharge were both below the standard of 4.6 µg/l (1.6 µg/l for outfall 001 and 2.3 µg/l for outfall 004). A WLA is assigned to this facility in the Salt Creek TMDL sub-watershed.

General Permits - MS4

There is one Phase II MS4 (COG090100 – Mesa County) and two non-standard MS4s (COR070085 - Mesa County School District 51) and (COR070083 - Grand Valley Water Users) permitted in the Grand Valley watershed. The permittees are assigned relevant WLAs for *E. coli*, dissolved selenium, and total recoverable iron. Details on determination of allocations are found in Section 5.2.1.2.

Parts of the Mesa County MS4 area are present in each of the TMDL sub-watersheds to varying degrees. The Mesa County School District 51 permit authorizes discharge from Grand Junction High School, Central High School, and Palisade High School. Palisade High School is located east of the Lewis Wash TMDL sub-watershed and is outside of the scope of this TMDL. The Central High School boundary is within the Lewis Wash drainage, discharging to the City of Grand Junction storm-sewer system. Stormwater from Grand Junction High School drains to the City of Grand Junction storm-sewer system, reaching the Ligrani drainage and finally discharging to segment 3 of the mainstem of the Colorado River. The Ligrani Drainage is located to the West of Indian Wash TMDL and is outside of the scope of this TMDL. The Grand Valley Water Users MS4 is located within two of the TMDL sub-watersheds. The majority of the area is located in the Leach Creek TMDL sub-watershed, but a small portion is located in the Indian Wash TMDL sub-watershed.

General Permit – Non-Extractive Industrial Stormwater (COR900000)

Three non-extractive industrial stormwater permits (COR900143, COR900221, and COR900895) in the area discharge into one of the segments addressed in this TMDL. Each permit was evaluated to see if activities have potential to contribute to the impairments, and if so, were assigned a WLA. The facilities authorized to discharge within the TMDL watershed are summarized in **Table 8**. There are other COR900000 permits within the TMDL watershed; however, they do not discharge to the segments addressed in this TMDL and will not be further discussed.

General Permit - Sand and Gravel Mining Process Water and Stormwater (COG500000)

There are several sand and gravel permits in the Grand Valley. However, all discharge to either the mainstem of the Colorado River, drainage ditches that discharge to the mainstem, or unlisted segments not contributing to these drainages, and therefore are outside of the scope of the TMDL. As such, there are no discharges from sand and gravel permits identified in this document and correspondingly none were given WLAs.

Other Permits

There are a few facilities in the watershed that have no exposure exemptions for stormwater discharges that are included in Table 7. These do not discharge pollutants of concern and will not be further discussed.

There are also many construction stormwater general permits (covered under COR400000 certifications) in the area. These permits are practice-based and require permittees to establish best management practices (BMPs) to control sediment and erosion, thereby minimizing the potential of pollutant loading in streams. As sediment and erosion from these sites are minimized, they are not expected to contribute significantly to the impairments addressed in this TMDL. Therefore, no load will be assigned for permittees covered under the COR400000 permit.

One facility within the Reed Wash TMDL sub-watershed is covered under a groundwater permit (COX634048 – Loma Elementary School). However, due to its small discharge (0.00585 MGD) and proximity to the receiving stream, the WQCD has determined that it is not a significant source for selenium to Reed Wash and will not be further discussed.

There is one facility covered under a concentrated animal feeding operations (CAFO) permit (COA933090 – Colorado Egg, LLC) discharging to Adobe Creek. Under the requirements of the permit, BMPs must be implemented to prevent stormwater from coming into contact with pollutants by diverting clean water around facility processes. In addition, Colorado Egg, LLC is required to capture process-generated wastewater from egg washing and precipitation that comes into contact with their manure/compost in impoundments that are adequately sized, lined, and maintained below a specified level. A permitted discharge would only be allowed from an impoundment spillway in the event that the impoundment was properly maintained before a qualifying storm event occurs. They have not reported a discharge in the past five years. Therefore, no load will be assigned for this permitee for its discharge to Adobe Creek.

There are two facilities that are covered under dewatering permits (COG603022 – Fidelity Mortgage Company and COG603260 – Bank of the West GJ); however they do not discharge to the segments addressed in this TMDL and will not be further discussed.

Table 7. Facilities with individual CDPS permits

NPDES ID	Permittee	Facility	Discharge type	Discharge frequency	Receiving waterbody	Pertinent discharges
CO0040053	Mesa County Grand Junction City of	Persigo WWTF	CO-Individual permit	continuous	Persigo Wash - Colorado River	selenium, iron
CO0038342	McClane Canyon Mining LLC	McClane Canyon Mine	CO-Individual permit	intermittent	East Salt Creek – COLCLC13a_A approximately 11 miles upstream of segment 13b	selenium, iron

*WWTF = wastewater treatment facility

Table 8. Facilities covered by general CDPS permits

NPDES ID	Permittee	Facility	Discharge type	Discharge frequency	Receiving waterbody	Pertinent discharges
COR900143	YRC Inc dba YRC Freight	YRC 894 Grand Junction	General-Industrial stormwater	storm	Price Ditch Lewis Wash - Colorado River	selenium, iron
COR900221	Mack Mesa Airport	Mack Mesa Airport	General-Industrial stormwater	storm	East Salt Creek - Salt Creek	selenium, iron
COR900895	FedEx Freight Inc	FedEx Freight Grand Junction	General-Industrial stormwater	storm	Persigo Wash - Colorado River	selenium, iron
COR070083	Grand Valley Water Users Assn	Grand Valley Water Users MS4	Non-standard MS4 general permit	Storm, continuous	Persigo Wash; Colorado River	*E.coli*, selenium, iron
COR070085	Mesa County Valley School Dist 51	Mesa County Valley School Dist 51 MS4	Non-standard MS4 general permit	Storm, continuous	Colorado River	selenium, iron
COR090100	Mesa County	Mesa County MS4	Standard (Statewide) MS4 general permits	Storm, continuous	Colorado River	*E.coli*, selenium, iron

NPDES ID	Permittee	Facility	Discharge type	Discharge frequency	Receiving waterbody	Pertinent discharges
CONOX0382	Reddy Ice Corp	Reddy Ice Fruita	No exposure certification for exclusion from CDPS stormwater permitting	none	Big Salt Wash - Colorado River	none
CONOX0612	Reynolds Polymer Technology Inc	Reynolds Polymer Technology	No exposure certification for exclusion from CDPS stormwater permitting	none	Colorado River	none
CONOX0643	FedEx Freight Inc	FedEx Freight GJN2	No exposure certification for exclusion from CDPS stormwater permitting	none	Colorado River	none

4.3 Nonpoint Sources

The term *nonpoint source pollution* is defined as any source of pollution that does not meet the legal definition of point source. Nonpoint source pollution "occurs when rainfall, snowmelt, or irrigation water runs over the land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into ground water" (U.S. EPA 1996, p. 1). Additional pathways of nonpoint source pollution include groundwater and direct deposition (e.g., atmospheric, cattle in streams, etc.).

4.3.1 Stormwater Runoff (Unregulated)

Unregulated stormwater runoff is derived from wet weather events (rainfall, snowmelt). In areas with high imperviousness, stormwater cannot infiltrate. Such stormwater can impair streams by transporting pollutants, altering a stream's natural hydrology, and affecting erosion. Most of the following discussions also apply to regulated stormwater covered by NPDES permits.

For a general review of the effects of urbanization and stormwater and references to additional resources, see the CADDIS Urbanization Module (U.S. EPA 2012) and *The Importance of Imperviousness* (Schueler 1994). Stormwater flowing over impervious surfaces can transport pollutants deposited upon those surfaces to nearby streams. The resultant pollutant loads are linked to the land uses and practices in the watershed.

Streams that receive significant stormwater contributions are often flashier with higher peak flows, higher runoff volumes, and lower base flow volumes[7] compared to natural streams. Such altered instream hydrology can directly and indirectly impair beneficial uses. For example, higher stream velocities can stress and overwhelm aquatic insects, directly impairing aquatic life, or more powerful streamflows can degrade instream aquatic habitat, indirectly impairing aquatic life. Lower base flows can reduce access to habitat in the stream channel margins.

Erosion is a natural process that can be exacerbated by anthropogenic activities. The increased peak flows and runoff volumes derived from stormwater tend to increase streambank erosion. Splash, sheet, rill, and gully erosion[8] occur more frequently in areas that lack or have sparse vegetation. Together, bank erosion and scour are referred to as channel erosion[9]; high rates of channel erosion typically indicate that instream flow and sediment dynamics are out of balance. Because soils in this region can contain elevated selenium and iron concentrations, this is a mechanism that should be considered as a potential contribution to loads. In addition, it is possible that dust from selenium and iron-rich soils in the area can be windblown to impervious surfaces, contributing some amount of contamination to the stream during storm events.

[7] Groundwater discharge decreases without infiltration to recharge an aquifer.
[8] Splash erosion is the detachment of soil particles by raindrop impact. Sheet erosion is the transport of soil particles by water flowing overland as a sheet. Rill erosion refers the development of small, ephemeral, concentrated flow-paths. Gully erosion occurs rapidly in narrow channels.
[9] Bank erosion is the wearing away of the banks of a stream or river. Scour is erosion of the stream or river channel bed.

4.3.2 On-Site Wastewater Treatment Systems

"In the modern era, the typical onsite system has consisted primarily of a septic tank and a soil absorption field, also known as a subsurface wastewater infiltration system" (U.S. EPA 2002, p. 1-1). If properly designed, sited, installed, operated, and maintained, on-site wastewater treatment systems (OWTS) will remove suspended solids, biodegradable organic compounds, and fecal coliforms, which include *E. coli* bacteria (U.S. EPA 2002, p.3-22). Such systems should not serve as a source of contamination to surface waters.

However, systems do fail for a variety of reasons. Onsite sewage wastewater treatment systems that do not sufficiently treat wastewater may result in discharges of nitrates, pathogens, and phosphorus (U.S. EPA 2002, p. 3-20). Effects on surface water from OWTS depend on numerous factors, including soil characteristics, topography, hydrography, and proximity to streams.

Characterization of OWTS in the Adobe Creek and Leach Creek drainage areas, the two *E. coli* impaired segments, was conducted by identifying parcels containing a septic system within one mile of the stream. Adobe Creek has 215 parcels containing septic systems, representing 53% of the total parcel area in the sub-watershed. Leach Creek has 470 parcels containing a septic system, corresponding to 27% of the total parcel area in the sub-watershed. An unknown proportion of these septic systems may contribute to *E. coli* loading to the streams if they are not functioning properly or have failed outright. However, because the number of faulty systems is unknown, the contribution currently cannot be quantified.

No information is available from Mesa County regarding the number of failing on-site wastewater treatment systems (OWTS) in the Adobe Creek or Leach Creek subwatersheds. This makes estimating potential loads of *E. coli* from this nonpoint source difficult; however a simple approach can be applied to get an indication of potential loading from failing OWTS. In this attempt, a worst-case scenario is used to develop a load from failing systems.

To consider a failing OWTS as a source, it would need to produce an effluent stream capable of reaching a waterbody in order to provide a significant *E. coli* load. For this to occur, an OWTS would need to be in close proximity to the waterbody to receive overland flow and contribute a load. In the Adobe Creek TMDL subwatershed, only about 30 OWTS are within 250 feet of Adobe Creek. In the Leach Creek TMDL subwatershed, only about 25 OWTS are within 250 feet of Leach Creek. Two hundred fifty feet is a conservative estimate of distance an effluent stream could be expected to persist and reach Leach or Adobe Creek without infiltrating into surface soils or becoming diluted by other means. A somewhat conservative rate of failure for OWTS is from 10-20% (USEPA, 2000). Therefore, it could be assumed that of the 30 OWTS within 250 feet of Adobe Creek, between three to six of these systems might be failing and have the capability of contributing an *E. coli* load. For Leach Creek, it can be assumed that between two and five of the 25 OWTS might be failing and have the capability of contributing an *E. coli* load. Based on factors such as actual location of the OWTS, size of the OWTS, and soil characteristics, the loading from a single OWTS can vary. Therefore, it would be difficult to estimate the total loading for a group of systems to Leach and Adobe Creek.

Subsurface water flow originating from a septic system leach field likely carries some selenium and iron when moving through selenium and iron-rich soils. However, no studies directly linking septic system discharge and selenium and iron fate and transport were found. Since it is impractical to project septic system contributions to selenium and iron loading in the Grand Valley, any selenium and iron that might be associated with OWTSs will not be quantified and will be considered part of the background contribution.

4.3.3 Agriculture

An assortment of hobby farms in the Grand Valley contain various animals, including cows, goats, horses, and pigs. Some of these hobby farms border Adobe Creek and Leach Creek, and likely contribute to the *E. coli* loads in these streams.

In most of the TMDL sub-watersheds, more than 50% of the land use comprises cultivated crops. Alfalfa is the most significant crop grown in the Grand Valley TMDL watershed, but other crops such as corn and winter wheat are also grown in the area. Irrigation of selenium-rich soils for crop production in arid and semi-arid regions of the country can mobilize selenium and move it off-site in surface water runoff or via leaching into ground water (U.S. EPA 2016, p. 4). It is likely that irrigated agriculture represents a significant contribution to selenium loads in the region. It is expected that the mobilization and transport of iron-rich soils in crop production follows a similar path as selenium.

4.3.4 Wildlife

Wildlife such as deer, raccoon, waterfowl, and riparian small mammals (*e.g.* muskrat, beaver) can be sources of pathogenic bacteria. The animal habitat and proximity to surface waters are principal factors that determine if animal waste can be transported to surface waters. Waterfowl and riparian mammals deposit waste directly into streams, while other riparian species deposit waste in the floodplain, which can be transported to surface waters by runoff from precipitation events. Animal waste deposited in upland areas can also be transported to streams and rivers; however, due to the distance from uplands to surface streams, only larger precipitation events can sustain sufficient amounts of runoff to transport upland animal waste to surface waters.

4.3.5 Soils and Geology

Selenium fate and transport is complex due to its complicated biogeochemistry in the aquatic environment (U.S. EPA 1998). These dynamics become more complex when surficial and aquifer hydrological systems are connected with irrigated agricultural systems (Bailey et al. 2014).

The Grand Valley is underlain by Mancos shale, a Cretaceous marine shale, that contains naturally-occurring selenium (U.S. EPA 2016, p. 5). Soils derived from these shales consequently contain high selenium levels. According to the USGS National Geochemical Survey database, the mean selenium concentration in surficial soils and aquatic sediments is 0.455 ppm with a standard deviation of 0.342 ppm.

Two major anthropogenic activities are known to increase selenium mobilization into aquatic systems. The first is the mining of metals, and minerals and refinement and use of fossil fuels; the second is irrigation of selenium-rich soils. Mining activities bring selenium-enriched deposits to the surface, where they are exposed to physical weathering processes. Irrigation of selenium-rich soils for crop production in arid and semi-arid regions of the country can mobilize selenium and move it off-site in surface water runoff or via leaching into ground water (U.S. EPA 2016, p. 4). In the Grand Valley TMDL watershed, irrigation is the primary mode of selenium mobilization and transportation.

"The chemical form of selenium that dominates a location is usually dependent on its sources, effluent treatments, and biogeochemical processes in the receiving waters" (U.S. EPA 2016, p. 6)[10]. Selenate, which is highly toxic, typically dominates in irrigated agricultural systems with marine shales and selenium-rich soils. Besides migrating to shallow soil directly from an aquifer, selenate can also migrate through surface waters that are diverted from native rivers and streams to irrigation canals. Canal seepage and irrigation infiltration both transport selenate into shallow soil where selenate enters plant-soil nutrient cycling. Selenium fate and transport through agricultural soil systems is highly complex[11] and are affected by inter-related factors, including:

- Crop management (*e.g.* plowing, fertilizer/manure application)
- Irrigation (including canal seepage)
- Precipitation
- Crop type (*e.g.* water needs, root mass, Selenium root content)
- Soil characteristics (*e.g.* organic content)
- Soil pore-water characteristics

4.4 Lewis Wash

Impairments listed for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Lewis Wash begins at the Government Highline Canal and flows south to the East Lake within Colorado River Island State Wildlife Area (SWA) and to the Humphrey Backwater portion of the Colorado River. East Lake is hydrologically connected to West Lake which directly discharges to Humphrey Backwater, downstream of the confluence with Lewis Wash. The area of the Lewis Wash TMDL sub-watershed is approximately 3.0 square miles. As discussed in Section 3.5, flow data were available at USGS 09106200 (Lewis Wash near Grand Junction, CO) with a period of record from April 1, 1973 to September 29, 1979 and April 23, 2002 to April 6, 2004. This data were used to represent the flow condition in Lewis Wash.

4.4.1 Ambient Water Quality

Water quality data for Lewis Wash were collected primarily by USGS and the WQCD. Impairments listed for this TMDL sub-watershed include dissolved selenium and total recoverable iron. **Table 9** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 10** and **Table 11** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. Locations of the monitoring sites are shown in **Figure 8**. Lewis Wash exceeds the dissolved selenium water quality standard only during one season

[10] Selenate is typically derived from four anthropogenic activities: (1) agricultural irrigation drainage, (2) treated oil refinery effluent, (3) mountaintop coal mining and valley-fill leachate, and (4) copper mining discharge. Selenite is typically derived from three different anthropogenic activities: (1) oil refinery effluent, (2) fly ash disposal effluent, and (3) phosphate mining overburden leachate. Organoselenium is typically derived from treated agricultural drainage. (U.S. EPA 2016, p. 8).

[11] The following types of chemical reactions are pertinent to such systems: organic matter decomposition, mineralization/immobilization, nitrification, volatilization, heterotrophic chemical reduction, and autotrophic chemical reduction (Bailey et al. 2014, p. 44).

of the year, from November to March. However, the data demonstrate the total recoverable iron water quality standard is attained throughout the entire year.

Table 9. Monitoring sites for Lewis Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	09106200	Lewis Wash near Grand Junction, CO	Dissolved Selenium	3/1991-3/2006	40
USGS	390337108284501	Lewis Wash Inflow to East Pool	Dissolved Selenium	6/1996-4/1997	2
WQCD	TMDL-LC09	Lewis Wash @ 31 Rd	Dissolved Selenium	8/2011-6/2012	4
			Total Recoverable Iron	3/2012-6/2012	2
RIVERWATCH	4064	Lewis Wash – Lewis Wash	Dissolved Selenium, Total Recoverable Iron	12/2003-3/2005	4

Table 10. Ambient dissolved selenium data for Lewis Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	12	4.6	2.0	No
November to March	0.6	4.6	33	Yes

Table 11. Ambient total recoverable iron data for Lewis Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	12	1000	490	No
November to March	0.6	1000	337	No

4.4.2 Potential Sources of Impairment

No permittees with set design flows discharge to Lewis Wash. However, there is one industrial stormwater facility (COR900143 – YRC Inc dba YRC Freight) and the Lewis Wash TMDL sub-watershed does include parts of the Mesa County and the Mesa County Valley School Dist 51 MS4s. As summarized in **Table 4**, approximately 9.9 percent of the land use cover is classified as cultivated crops, 87.5 percent of the land use cover is classified as developed, and 2.6 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features. Note, as indicated in **Table 11**, the ambient iron concentration indicates that the standard is not exceeded for either season. However, due to a limited sample size (n = 6; **Table 9**), it is likely that elevated samples of iron are missing from the dataset. Therefore, a TMDL for iron is still necessary for this segment.

4.4.3 Conclusion

Regulated storm runoff from developed areas, storm runoff exposed to selenium-laden geologic features, and agriculture are the most probable sources of selenium and total recoverable iron loads in Lewis Wash. The sources will be addressed by selenium and iron TMDLs on Lewis Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Lewis Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Lewis Wash sub-watershed will address the sources of selenium and total recoverable iron.

Regulated storm runoff from developed areas are the most probable source of iron loads in Lewis Wash. The sources will be addressed by an iron TMDL on Indian Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Lewis Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Lewis Wash sub-watershed will address the sources of iron.

4.5 Indian Wash

Impairments listed for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Indian Wash begins at the Government Highline Canal and flows south to its confluence with the Colorado River. The area of the Indian Wash TMDL sub-watershed is approximately 7.0 square miles. Flow data were determined using a watershed ratio, derived from a watershed that contains similar land use characteristics. The watershed ratio of the Indian Wash to the Lewis Wash was calculated and multiplied by the flow record synthesized for Lewis Wash. As discussed in Section 3.5, flow data were available at USGS 09106200 (Lewis Wash near Grand Junction, CO) with a period of record from April 1, 1973 to September 29, 1979 and April 23, 2002 to April 6, 2004.

4.5.1 Ambient Water Quality

Ambient water quality for Indian Wash were collected by USGS and the WQCD. **Table 12** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 13** and **Table 14** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. Indian Wash exceeds the water quality standards for dissolved selenium throughout the year, and exceeds the total recoverable iron water quality standard during the period of April to October. **Figure 8** displays the monitoring site locations.

Table 12. Monitoring sites for Indian Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	390320108315901	Indian Wash at C ½ Road	Dissolved Selenium	3/1991-1/1995	6
WQCD	11135B	Indian Wash at C ½ Road Near Mouth	Dissolved Selenium, Total Recoverable Iron	8/2009-6/2012	10

Table 13. Ambient dissolved selenium data for Indian Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	28	4.6	9.2	Yes
November to March	1.3	4.6	110	Yes

Table 14. Ambient total recoverable iron data for Indian Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	28	1000	2200	Yes
November to March	1.3	1000	245	No

4.5.2 Potential Sources of Impairment

Only stormwater permittees discharge to Indian Wash. The Indian Wash TMDL sub-watershed includes part of the Mesa County and the Grand Valley Water Users MS4. As summarized in **Table 3**, approximately 10.1 percent of the land use cover is classified as cultivated crops, 86.4 percent of the land use cover is classified as developed, and 3.5 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.5.3 Conclusion

Regulated storm runoff from developed areas (including industrial stormwater facilities), storm runoff exposed to selenium-laden geologic features, and agriculture are the most probable sources of selenium loads in Indian Wash. The sources will be addressed by a selenium TMDL on Indian Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Indian Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Indian Wash sub-watershed will address the sources of selenium.

Regulated storm runoff from developed areas are the most probable source of iron loads in Indian Wash. The sources will be addressed by an iron TMDL on Indian Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Indian Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Indian Wash sub-watershed will address the sources of iron.

4.6 Leach Creek

Impairments for this TMDL sub-watershed include dissolved selenium, total recoverable iron, and *E. coli*. The impaired portion of Leach Creek begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. The area of the Leach Creek TMDL sub-watershed is approximately 9.0 square miles. As discussed in Section 3.5, flow data were available at USGS 09152650 (Leach Creek at Durham, CO) with a period of record from April 1, 1973 to October 4, 1983. Flow data from this gage were used to represent the flow conditions in Leach Creek.

4.6.1 Ambient Water Quality

Water quality data for Leach Creek were collected by USGS and the WQCD. **Table 15** summarizes the monitoring sites for dissolved selenium, total recoverable iron, and *E. coli*. **Table 16**, **Table 17**, and **Table 18** summarize the ambient data for dissolved selenium, total recoverable iron, and *E. coli*, respectively. Note that, in some instances, same day samples were collected. In these cases, the medians of same day samples are used to calculate ambient data statistics in accordance with 303(d) listing methodology. **Figure 8** displays the monitoring site locations.

Note that for *E. coli*, the ambient concentration was determined using the geomean of all samples rather than the assessment methodology described in Section 2.5 because not enough samples were collected to compute 61-day rolling-geometric means.

Table 15. Monitoring sites for Leach Creek

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	09152650	Leach Creek at Durham, CO	Dissolved Selenium	3/1991-8/1999	50
			Total Recoverable Iron	8/1997	1
USGS	390705108341301	Leach Creek at 26 Road	Dissolved Selenium	2/1992	1
WQCD	11135	Leach Creek Near Mouth	Dissolved Selenium, Total Recoverable Iron	7/2005-6/2011	21
WQCD	TMDL-LC1	Leach Creek at Riverside	Dissolved Selenium, Total Recoverable Iron	6/2016-2/2018	12
			E. coli	6/2016-10/2017	19
WQCD	TMDL-LC2	Leach Creek at G Rd. and 24.5 Rd, D/S Side of Turnabout	Dissolved Selenium, Total Recoverable Iron	6/2016-10/2017	10
			E. coli	6/2016-10/2017	19
WQCD	TMDL-LC3	Leach Creek at G Rd. and 24.5 Rd, U/S Side of Turnabout	Dissolved Selenium, Total Recoverable Iron	6/2016-2/2018	12
			E. coli	6/2016-10/2017	19
WQCD	TMDL-LC4	Leach Creek U/S Grand Valley Canal	Dissolved Selenium, Total Recoverable Iron	6/2016-10/2017	10
			E. coli	6/2016-10/2017	19
WQCD	TMDL-LC5	Leach Creek at 26 Rd.	Dissolved Selenium, Total Recoverable Iron	6/2016-10/2017	10
			E. coli	6/2016-10/2017	19
WQCD	TMDL-LC6	Leach Creek at Summer Hill Drive	Dissolved Selenium, Total Recoverable Iron	6/2016-10/2017	10
			E. coli	6/2016-10/2017	19
WQCD	TMDL-LC11	Leach Creek at 25 Rd.	Dissolved Selenium	8/2011-6/2012	4
			Total Recoverable Iron	3/2012-6/2012	2

Table 16. Ambient dissolved selenium data for Leach Creek

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	45	4.6	16	Yes
November to March	8	4.6	98	Yes

Table 17. Ambient total recoverable iron data for Leach Creek

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	45	1000	1463	Yes
November to March	8	1000	295	No

Table 18. Ambient *E. coli* data for Leach Creek

Month	Median daily average flow (cfs)	*E. coli* TMDL target (cfu/100 ml)	*E. coli* geomean (cfu/100 ml)	Exceeds standard?
Annual	34	126	163	Yes

4.6.2 Potential Sources of Impairment

The only permitted dischargers in the Leach Creek sub-watershed are MS4 permittees. The Leach Creek TMDL sub-watershed includes parts of the Mesa County MS4 and Grand Valley Water Users MS4. As summarized in **Table 3**, approximately 31.3 percent of the land use cover is classified as cultivated crops, 57.3 percent of the land use cover is classified as developed, and 11.5 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features. Potential impairment causes for *E. coli* include human-caused sources such as agricultural return flows, septic system failures, and pet waste, and naturally occurring nonpoint sources such as wildlife, naturalized sources of bacteria, and resuspension of sediment in the stream.

4.6.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Leach Creek. The sources will be addressed by a selenium TMDL on Leach Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Leach Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Leach Creek sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable source of iron loads in Leach Creek. The sources will be addressed by an iron TMDL on Indian Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Leach Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Leach Creek sub-watershed will address the sources of iron.

Agriculture and regulated and unregulated storm runoff of wildlife and pet waste are the most probable sources of *E. coli* loads in Leach Creek. The sources will be addressed by an *E. coli* TMDL on Leach Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Leach Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Leach Creek sub-watershed will address the sources of *E. coli*.

4.7 Persigo Wash

The impaired portion of Persigo Wash begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The area of the Persigo Wash TMDL sub-watershed is approximately 6.7 square miles. Flow data were determined using a watershed ratio. The watershed ratio of the Persigo Wash to the Adobe Creek was calculated and multiplied by the flow record synthesized for Adobe Creek because the two sub-watersheds have similar land use and soil characteristics. As discussed in Section 3.5, flow data were collected at USGS 09152900 (Adobe Creek near Fruita, CO) with a period of record from April 1, 1973 to October 3, 1983. Therefore, a flow record for Persigo Wash was determined for the period of record from April 1, 1973 to October 3, 1983.

4.7.1 Ambient Water Quality

Ambient water quality for Persigo Wash were collected by USGS and the WQCD. Note that both USGS 390645108390101 (Persigo Wash at River Road) and WQCD-TMDL-PSWT (Persigo Wash) are located at the mouth of Persigo Wash, which is located downstream of the Persigo WWTF. As the Persigo WWTF no longer discharges into the Persigo Wash, the mass balance equation was used to determine the selenium and iron concentrations without the contributions of the Persigo WWTF based on DMR data submitted by the facility. As the Persigo WWTF rarely exceeded the selenium or iron standard, the calculated upstream selenium and iron concentrations were higher than the observed downstream concentrations. **Table 19** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 20** and **Table 21** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. Persigo Wash exceeds the dissolved selenium water quality standard throughout the year, however the total recoverable iron is exceeded only during the April to October season. Note that, in some instances, same day samples were collected. In these cases, the medians of same day samples are used to calculate ambient data statistics in accordance with 303(d) listing methodology. **Figure 8** displays the monitoring site locations.

Table 19. Monitoring sites for Persigo Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	390645108390101	Persigo Wash at River Road	Dissolved Selenium	3/1991-3/2006	19
USGS	390633108393100	Persigo Wash at Mouth Nr Fruita, CO	Dissolved Selenium	11/2004	1
WQCD	TMDL-PSWT	Persigo Wash	Dissolved Selenium, Total Recoverable Iron	8/2012-2/2018	14

Table 20. Ambient dissolved selenium data for Persigo Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	46	4.6	15	Yes
November to March	3.3	4.6	86	Yes

Table 21. Ambient total recoverable iron data for Persigo Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	46	1000	1886	Yes
November to March	3.3	1000	193	No

4.7.2 Potential Sources of Impairment

The Persigo WWTF is authorized to discharge to Persigo Wash; however, it has changed its primary discharge outfall to the Colorado River. Note that the analysis of the load in this document was completed without the including the Persigo WWTF, but a load will still be provided to the facility based on the design flow and the standards in case the facility discharges into Persigo Wash. There is one industrial stormwater facility (COR900895 – FedEx Freight Grand Junction) and the Persigo Wash TMDL sub-watershed includes part of the Mesa County MS4. As summarized in **Table 3**, approximately 64.0 percent of the land use cover is classified as cultivated crops, 18.3 percent of the land use cover is classified as developed, and 17.8 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.7.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Persigo Wash. The sources will be addressed by a selenium TMDL on Persigo Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Persigo Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Persigo Wash sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Persigo Wash. The sources will be addressed by an iron TMDL on Persigo Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Persigo Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Persigo Wash sub-watershed will address the sources of iron.

4.8 Pritchard Wash

Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Pritchard Wash begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. The area of the Pritchard Wash TMDL sub-watershed is approximately 5.4 square miles. Flow data were determined using a watershed ratio. The watershed ratio of the Pritchard Wash to the Adobe Creek was calculated and multiplied by the flow record synthesized for Adobe Creek because the two sub-watersheds have similar land use and soil characteristics. As discussed in Section 3.5, flow data were collected at USGS 09152900 (Adobe Creek near Fruita, CO) with a period of record from April 1, 1973 to October 3, 1983. Therefore, a flow record for Pritchard Wash was determined for the period of record from April 1, 1973 to October 3, 1983.

4.8.1 Ambient Water Quality

Ambient water quality for Pritchard Wash were collected by USGS and the WQCD. **Table 22** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 23** and **Table 24** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. Water quality standards were exceeded for both selenium and iron throughout the whole year. **Figure 8** displays the monitoring site locations.

Table 22. Monitoring sites for Pritchard Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	390700108393101	Pritchard Wash at River Road	Dissolved Selenium	8/1991-2/1992	3
WQCD	TMDL-PRT	Pritchard Tributary Upstream of Colorado River	Dissolved Selenium, Total Recoverable Iron	10/2015-2/2018	12

Table 23. Ambient dissolved selenium data for Pritchard Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	37	4.6	12	Yes
November to March	2.7	4.6	25	Yes

Table 24. Ambient total recoverable iron data for Pritchard Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	37	1000	2,700	Yes
November to March	2.7	1000	1,190	Yes

4.8.2 Potential Sources of Impairment

Only stormwater permittees discharge to Pritchard Wash. The Pritchard Wash TMDL sub-watershed includes part of the Mesa County MS4. As summarized in **Table 3**, approximately 57.2 percent of the land use cover is classified as cultivated crops, 32.7 percent of the land use cover is classified as developed, and 10.1 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.8.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Pritchard Wash. The sources will be addressed by a selenium TMDL on Pritchard Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Pritchard Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Pritchard Wash sub-watershed will address the sources of selenium.

Agriculture and regulated storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Pritchard Wash. The sources will be addressed by an iron TMDL on Pritchard Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Pritchard Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Pritchard Wash sub-watershed will address the iron sources.

4.9 Hunter Wash

Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Hunter Wash begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. The area of the Hunter Wash TMDL sub-watershed approximately is 4.9 square miles. Flow data were determined using a watershed ratio. The watershed ratio of the Hunter Wash to the Adobe Creek was calculated and multiplied by the flow record synthesized for Adobe Creek because the two sub-watersheds have similar land use and soil characteristics. As discussed in Section 3.5, flow data were collected at USGS 09152900 (Adobe Creek near Fruita, CO) with a period of record from April 1, 1973 to October 3, 1983. Therefore, a flow record for Hunter Wash was determined for the period of record from April 1, 1973 to October 3, 1983.

4.9.1 Ambient Water Quality

Ambient water quality for Hunter Wash were collected by USGS and the WQCD. **Table 25** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 26** and **Table 27** summarize the ambient data for dissolved selenium and total recoverable iron respectively. **Figure 8** displays the monitoring site locations.

Table 25. Monitoring sites for Hunter Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	390717108400501	Hunter Wash at River Road	Dissolved Selenium	3/1991-9/1993	6
RIVERWATCH	4063	Hunter Wash 2	Dissolved Selenium, Total Recoverable Iron	3/2002-12/2007	12
WQCD	TMDL-HWT	Hunter Wash Upstream of the Colorado River	Dissolved Selenium, Total Recoverable Iron	8/2012-2/2018	18

Table 26. Ambient dissolved selenium data for Hunter Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	34	4.6	8.9	Yes
November to March	2.4	4.6	50	Yes

Table 27. Ambient total recoverable iron data and allowable load for Hunter Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	34	1,000	2,810	Yes
November to March	2.4	1,000	189	No

4.9.2 Potential Sources of Impairment

Only stormwater permittees discharge to Hunter Wash. The Hunter Wash TMDL sub-watershed includes part of the Mesa County MS4. As summarized in **Table 3**, approximately 75.3 percent of the land use cover is classified as cultivated crops, 13.7 percent of the land use cover is classified as developed, and 11 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.9.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Hunter Wash. The sources will be addressed by a selenium TMDL on Hunter Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Hunter Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Hunter Wash sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Hunter Wash. The sources will be addressed by an iron TMDL on Hunter Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Hunter Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Hunter Wash sub-watershed will address the sources of iron.

4.10 Adobe Creek

Impairments for this TMDL sub-watershed include dissolved selenium, total recoverable iron, and *E. coli*. The impaired portion of Adobe Creek begins at the Government Highline Canal and flows southwest until its confluence with the Colorado River, which is located east of the City of Fruita. The area of the Adobe Creek TMDL sub-watershed is approximately 5.2 square miles. As discussed in Section 3.5, flow data were available at USGS 09152900 (Adobe Creek near Fruita, CO) with a period of record from April 1, 1973 to October 3, 1983. Flow data from this gage were used to represent the flow conditions in Adobe Creek.

4.10.1 Ambient Water Quality

Ambient water quality for Adobe Creek were collected by USGS and the WQCD. **Table 28** summarizes the monitoring sites for dissolved selenium, total recoverable iron, and *E. coli*. **Table 29**, **Table 30**, and **Table 31** summarize the ambient data for dissolved selenium, total recoverable iron, and *E. coli*, respectively. Note that, in some instances, same day samples were collected. In these cases, the medians of same day samples are used to calculate ambient data statistics in accordance with 303(d) listing methodology. **Figure 8** displays the monitoring site locations.

Note that for *E. coli*, the ambient concentration was determined using the geomean of all samples rather than the assessment methodology described in Section 2.5 because not enough samples were collected to compute 61-day rolling-geometric means.

Table 28. Monitoring sites for Adobe Creek

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	390755108420200	Adobe Creek at 19 Rd Nr Fruita, CO	Dissolved Selenium	1/2005	1
WQCD	11133	Adobe Creek Near Mouth	Dissolved Selenium, Total Recoverable Iron	7/2005-6/2011	24
			E. coli	6/2005-6/2010	20
WQCD	TMDL-AC1	Adobe Creek Near Mouth at 19 Rd	Dissolved Selenium, Total Recoverable Iron	6/2016-2/2018	12
			E. coli	6/2016-10/2017	14
WQCD	TMDL-LC16	Adobe Creek @ 19 Rd Nr Mouth	Dissolved Selenium, Total Recoverable Iron	8/2011-6/2012	4
WQCD	TMDL-AC2	Adobe Creek at J and 19.5 Rd	*E. coli*	6/2016-10/2017	14
WQCD	TMDL-AC3	Adobe Creek at K Rd	*E. coli*	6/2016-10/2017	14
WQCD	TMDL-AC4	Adobe Creek U/S Highline Canal at 21 Rd	*E. coli*	6/2016-10/2017	14
WQCD	TMDL-AC5	Adobe Creek at 22 Rd	*E. coli*	6/2016-10/2017	14

Table 29. Ambient dissolved selenium data and allowable load for Adobe Creek

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	36	4.6	13	Yes
November to March	2.6	4.6	43	Yes

Table 30. Ambient total recoverable iron data and allowable load for Adobe Creek

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	36	1000	3200	Yes
November to March	2.6	1000	160	No

Table 31. Ambient *E. coli* data for Adobe Creek

Month	Annual median daily flow (cfs)	*E. coli* TMDL target (cfu/100 ml)	*E. coli* geomean (cfu/100 ml)	Exceeds standard?
Annual	28	126	577	Yes

4.10.2 Potential Sources of Impairment

Only stormwater permittees discharge to Adobe Creek. The Adobe Creek TMDL sub-watershed includes part of the Mesa County MS4. As summarized in **Table 3**, over 72.2 percent of the land use cover is classified as cultivated crops, 13.9 percent of the land use cover is classified as developed, and 13.9 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features. Potential impairment causes for *E. coli* include human-made sources such as agricultural return flows, septic system failures, and pet waste, and naturally occurring nonpoint sources such as wildlife, naturalized sources of bacteria, and resuspension of sediment in the stream.

4.10.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable source of selenium loads in Adobe Creek. The sources will be addressed by a selenium TMDL on Adobe Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Adobe Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Adobe Creek sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Adobe Creek. The sources will be addressed by an iron TMDL on Adobe Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Adobe Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Adobe Creek sub-watershed will address the sources of iron.

Agriculture and regulated and unregulated storm runoff of wildlife and pet waste are the most probable sources of *E. coli* loads in Adobe Creek. The sources will be addressed by an *E. coli* TMDL on Adobe Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Adobe Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Adobe Creek sub-watershed will address the sources of *E. coli*.

4.11 Little Salt Wash

Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Little Salt Wash begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. The area of the Little Salt Wash TMDL sub-watershed is approximately 6.9 square miles. Flow data were determined using a watershed ratio. The watershed ratio of the Little Salt Wash to the Adobe Creek was calculated and multiplied by the flow record synthesized for Adobe Creek because the two sub-watersheds have similar land use and soil characteristics. As discussed in Section 3.5, flow data were collected at USGS 09152900 (Adobe Creek near Fruita, CO) with a period of record from April 1, 1973 to October 3, 1983. Therefore, a flow record for Little Salt Wash was determined for the period of record from April 1, 1973 to October 3, 1983.

4.11.1 Ambient Water Quality

Ambient water quality for Little Salt Wash were collected by USGS and the WQCD. **Table 32** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 33** and **Table 34** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. **Figure 7** displays the monitoring site locations.

Table 32. Monitoring sites for Little Salt Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	390938108443101	Little Salt Wash at Hwy 50, at Fruita	Dissolved Selenium	3/1991-2/1992	3
WQCD	TMDL-LSWT	Little Salt Wash Upstream of the Colorado River	Dissolved Selenium, Total Recoverable Iron	7/2016-2/2018	9
WQCD	TMDL-LSWT2	Little Salt Wash Above Hwy 50 and Above Stormwater Outfall	Dissolved Selenium, Total Recoverable Iron	5/2017-6/2017	2

Table 33. Ambient dissolved selenium data for Little Salt Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	47	4.6	6.9	Yes
November to March	3.4	4.6	23	Yes

Table 34. Ambient total recoverable iron data for Little Salt Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	47	1000	2200	Yes
November to March	3.4	1000	360	No

4.11.2 Potential Sources of Impairment

Only stormwater permittees discharge to Little Salt Wash. The Little Salt Wash TMDL sub-watershed include part of the Mesa County MS4. As summarized in **Table 3**, approximately 65.6 percent of the land use cover is classified as cultivated crops, 22.7 percent of the land use cover is classified as developed, and 11.7 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.11.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Little Salt Wash. The sources will be addressed by a selenium TMDL on Little Salt Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Little Salt Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Little Salt Wash sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Little Salt Wash. The sources will be addressed by an iron TMDL on Little Salt Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Little Salt Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Little Salt Wash sub-watershed will address the sources of iron.

4.12 Big Salt Wash

Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Big Salt Wash begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. The area of the Big Salt Wash TMDL sub-watershed is approximately 12.6 square miles. As discussed in Section 3.5, flow data were available at USGS 09153270 (Big Salt Wash at Fruita, CO) with a period of record from April 1, 1973 to October 5, 1977. To elongate the period of record, a regression analysis was conducted for this gage and USGS 09153290 (Reed Wash), which is appropriate because the sub-watersheds have similar land use and soil characteristics. Flow data until September 29, 2000 were predicted, with an R^2 of observed data of 0.8923. This modified flow record was used to represent the flow conditions in Big Salt Wash.

4.12.1 Ambient Water Quality

Ambient water quality for Big Salt Wash were collected by USGS and the WQCD. **Table 35** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 36** and **Table 37** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. Note that the medians of same day samples are used to calculate ambient data statistics. **Figure 7** displays the monitoring site locations.

Table 35. Monitoring sites for Big Salt Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	09153270	Big Salt Wash at Fruita, CO	Dissolved Selenium	3/1991-3/1999	31
			Total Recoverable Iron	8/1997	1
RIVERWATCH	3263	Big Salt Wash – Salt Wash 2	Dissolved Selenium, Total Recoverable Iron	8/1993-8/2007	3
RIVERWATCH	4061	Big Salt Wash – Abv Conf Colorado R	Dissolved Selenium, Total Recoverable Iron	10/2001-11/2006	10
WQCD	TMDL-BSWT	Big Salt Wash at I-70 Bridge	Dissolved Selenium, Total Recoverable Iron	9/2012-7/2017	9
WQCD	TMDL-BSWT2	Big Salt Wash Above Hwy 50	Dissolved Selenium, Total Recoverable Iron	5/2017-2/2018	7

Table 36. Ambient dissolved selenium data for Big Salt Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	84	4.6	15	Yes
November to March	13	4.6	43	Yes

Table 37. Ambient total recoverable iron data for Big Salt Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	84	1000	3345	Yes
November to March	13	1000	369	No

4.12.2 Potential Sources of Impairment

Only stormwater permittees discharge to Big Salt Wash. The Big Salt Wash TMDL sub-watershed includes part of the Mesa County MS4. As summarized in **Table 3**, approximately 66.4 percent of the land use cover is classified as cultivated crops, 8.5 percent of the land use cover is classified as developed, and 25.1 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.12.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Big Salt Wash. The sources will be addressed by a selenium TMDL on Big Salt Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Big Salt Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Big Salt Wash sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Big Salt Wash. The sources will be addressed by an iron TMDL on Big Salt Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Big Salt Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Big Salt Wash sub-watershed will address the sources of iron.

4.13 Reed Wash

Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Reed Wash begins at the Government Highline Canal and flows southwest toward its confluence with the Colorado River. The area of the Reed Wash TMDL sub-watershed is approximately 5.4 square miles. As discussed in Section 3.5, flow data for Reed Wash were collected at USGS 09143290 (Reed Wash near Mack, CO) with a period of record from October 1, 1975 to September 29, 2000. This data were used unmodified to determine the flow conditions of Reed Wash.

4.13.1 Ambient Water Quality

Ambient water quality for Reed Wash were collected by USGS and the WQCD. **Table 38** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 39** and **Table 40** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. Note that, in some instances, same day samples were collected. In these cases, the medians of same day samples are used to calculate ambient data statistics in accordance with 303(d) listing methodology. **Figure 7** displays the monitoring site locations.

Table 38. Monitoring sites for Reed Wash

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	09153290	Reed Wash Near Mack, CO	Dissolved Selenium	9/1991-9/1998	54
USGS	09153300	Read Wash Near Loma, CO	Dissolved Selenium	8/1991-3/1999	54
			Total Recoverable Iron	8/1997	1
USGS	391029108480200	Reed Wash Near Fruita, CO	Dissolved Selenium	3/1991	1
USGS	391335108484301	Reed Wash at 13 RD	Dissolved Selenium	3/1992	1
WQCD	11102	Reed Wash @ Hwy 6	Dissolved Selenium	7/2000-9/2000	2
WQCD	TMDL-LC22	Reed Wash @ US Hwy 50 Nr Gilsonite	Dissolved Selenium	11/2011-6/2012	3
			Total Recoverable Iron	3/2012-6/2012	2
WQCD	TMDL-RWT	Reed Wash at US Hwy 50	Dissolved Selenium, Total Recoverable Iron	8/2013-2/2018	15
WQCD	TMDL-RWT1	Reed Wash at US Hwy 6	Dissolved Selenium, Total Recoverable Iron	9/2012	1
RIVERWATCH	4073	Reed Wash	Dissolved Selenium, Total Recoverable Iron	10/2001-3/2004	5

Table 39. Ambient dissolved selenium data for Reed Wash

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	68	4.6	21	Yes
November to March	5.7	4.6	110	Yes

Table 40. Ambient total recoverable iron data for Reed Wash

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	68	1000	4670	Yes
November to March	5.7	1000	191	No

4.13.2 Potential Sources of Impairment

Only stormwater permittees discharge to Reed Wash. The Reed Wash TMDL sub-watershed includes a small portion of the Mesa County MS4. As summarized in **Table 3**, approximately 65.5 percent of the land use cover is classified as cultivated crops, 7.9 percent of the land use cover is classified as developed, and 26.6 percent is classified as natural. The majority of the developed land cover are split between the unincorporated communities of Mack, Colorado and Loma, Colorado which do not have MS4 permit coverage. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.13.3 Conclusion

Agriculture, storm runoff from developed areas (both regulated and unregulated), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Reed Wash. The sources will be addressed by a selenium TMDL on Reed Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Reed Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Reed Wash sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (both regulated and unregulated) are the most probable sources of iron loads in Reed Wash. The sources will be addressed by an iron TMDL on Reed Wash at the outlet to the Colorado River, which is located at the most downstream monitoring site in Reed Wash. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Reed Wash sub-watershed will address the sources of iron.

4.14 Salt Creek

Impairments for this TMDL sub-watershed include dissolved selenium and total recoverable iron. The impaired portion of Salt Creek begins at the Government Highline Canal and flows south and southwest toward its confluence with the Colorado River. The area of the Salt Creek TMDL sub-watershed is approximately 59.2 square miles. Flow data were determined using a watershed ratio between Salt Creek and Reed Wash because the two sub-watersheds have similar land use and soil characteristics. Therefore, a flow record for Salt Creek was determined for the period of record from April 1, 1973 to September 29, 2000.

4.14.1 Ambient Water Quality

Ambient water quality for Salt Creek were collected by USGS and the WQCD. **Table 41** summarizes the monitoring sites for dissolved selenium and total recoverable iron. **Table 42** and **Table 43** summarize the ambient data for dissolved selenium and total recoverable iron, respectively. **Figure 7** displays the monitoring site locations.

Table 41. Monitoring sites for Salt Creek

Organization	Site ID	Site name	Parameter	Period of record	n
USGS	09163490	Salt Creek Nr Mack, CO	Dissolved Selenium	3/1991-8/1997	37
			Total Recoverable Iron	3/1991	1
WQCD	TMDL-SCT	Salt Creek at I-70	Dissolved Selenium, Total Recoverable Iron	9/2012-10/2015	5
WQCD	11130	Salt Creek at I-70	Dissolved Selenium, Total Recoverable Iron	10/2000	1
RIVERWATCH	4075	Salt Cr – Salt Creek	Dissolved Selenium, Total Recoverable Iron	10/2001-3/2004	5

Table 42. Ambient dissolved selenium data for Salt Creek

Month	Median daily average flow (cfs)	Se-D TMDL target (µg/l)	85th percentile Se-D (µg/l)	Exceeds standard?
April to October	113	4.6	10	Yes
November to March	9.4	4.6	63	Yes

Table 43. Ambient total recoverable iron data for Salt Creek

Month	Median daily average flow (cfs)	Fe-Trec TMDL target (µg/l)	50th percentile current Fe-Trec (µg/l)	Exceeds standard?
April to October	113	1000	2105	Yes
November to March	9.4	1000	483	No

4.14.2 Potential Sources of Impairment

Only one permitted discharge contributes to Salt Creek, which is an industrial stormwater facility (COR900221 – Mack Mesa Airport). As summarized in **Table 3**, approximately 21.1 percent of the land use cover is classified as cultivated crops, 4.1 percent of the land use cover is classified as developed, and 74.9 percent is classified as natural. Thus, the potential impairment causes for dissolved selenium and total recoverable iron include agricultural return flow, storm runoff from developed areas, and storm runoff exposed to selenium-laden geologic features.

4.14.3 Conclusion

Agriculture, storm runoff from developed areas (including industrial stormwater facilities and unregulated urban runoff), and storm runoff exposed to selenium-laden geologic features are the most probable sources of selenium loads in Salt Creek. The sources will be addressed by a selenium TMDL on Salt Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Salt Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Salt Creek sub-watershed will address the sources of selenium.

Agriculture and storm runoff from developed areas (including industrial stormwater facilities and unregulated urban runoff) are the most probable sources of iron loads in Salt Creek. The sources will be addressed by an iron TMDL on Salt Creek at the outlet to the Colorado River, which is located at the most downstream monitoring site in Salt Creek. The implementation of this TMDL through installation of agricultural BMPs and urban stormwater BMPs in the Salt Creek sub-watershed will address the sources of iron.

5 TMDLs and Allocations

A TMDL is the total amount of a pollutant that a receiving waterbody can assimilate while still achieving water quality standards. TMDLs can be expressed in terms of load (*i.e.* mass per unit time) or by other appropriate measures. TMDLs are composed of the sum of wasteload allocations (WLAs) for point sources and load allocations (LAs) for NPS and natural background sources. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody. When future growth is a concern and can be quantified, it is also included and is referred to in this report as the *reserve capacity* (RC). Conceptually, the TMDL is defined by the following equation:

$$TMDL = \sum WLA + \sum LA + MOS + RC$$

The TMDL was calculated at the target, which is typically the most conservative numeric criterion for a given constituent, multiplied by the flow and converted to appropriate load units. For example, the selenium TMDL for a hypothetical waterbody at median flow (10 cfs) would be calculated as

TMDL = (median daily average flow*) x (TMDL target) x (conversion factors)
= (10 cfs) x (4.6 µg/l) x (86,400 sec/day) x (28.3168 L/ft^3) x (2.205 x 10^{-9} lb/ug)
= 4.32 lb/d

*irrigation/non-irrigation season median daily average flow for selenium and iron; annual median daily average flow for *E. coli*

All loads are reported on a daily time-scale. For the allocation tables, TMDLs are calculated using irrigation season and non-irrigation season median daily average flows (for selenium and iron) and annual median daily average flows (for *E. coli*). Note that selenium and iron TMDLs are calculated for both the irrigation season and non-irrigation season because the criteria apply-year round; however, reductions are not necessarily required for each season.

5.1 Methodology

WLAs and LAs are allocated in order to meet the water quality targets listed in Section 2.4. Specifically, in this TMDL, WLAs for the Grand Valley sub-watersheds are allocated for facilities covered under individual CDPS permits, stormwater discharges covered by general CDPS permits, and agricultural and natural background sources, which may be conveyed into an MS4 and then discharged to the waterbody. Before WLAs and LAs are allocated to the point and nonpoint sources, an MOS is subtracted from the TMDL. After the MOS was subtracted from the TMDL, WLAs are then assigned to point sources with a designated design flow (i.e. permits with a flow permit limit). The remainder of the TMDL is then distributed as a percentage of land area to stormwater point sources, nonpoint sources, and an RC for future growth, which is based on the projected change from natural to urban land cover from 2020 to 2030 as discussed in Section 5.2.3.

5.2 Allocations

5.2.1 Wasteload Allocations

WLAs were calculated using several methodologies based upon the type of CDPS permit and the authorizations within the NPDES permits.

5.2.1.1 Facilities Covered by Individual CDPS Permits

For facilities covered by individual CDPS permits that contain design flows and selenium, iron, and *E. coli* limits, the WLA is calculated by multiplying the design flow by concentration limit and converting to appropriate units. For example, at the Persigo WWTF that discharges to Persigo Wash with a permitted design flow (12,500,000 gallons per day) and selenium limit (4.6 µg/l), the WLA would be calculated as:

WLA = (design flow) x (TMDL target) x (conversion factors)
(12,500,000 gal/day) x (4.6 µg/l) x (3.78541 L/gal) x (2.205 x 10^{-9} lb/ug) =
0.5 lb/d

Two facilities covered by individual CDPS permits are authorized to discharge effluent containing selenium and iron within or upstream of the TMDL sub-watersheds. Note that the facilities do not discharge to a waterbody listed for *E. coli*. Individual WLAs were calculated for each facility for dissolved selenium and total recoverable iron (**Table 44**).

5.2.1.2 Stormwater Discharges Covered by General CDPS Permits

For industrial facilities authorized to discharge stormwater through the non-extractive industrial stormwater permit (COR900000), WLAs are calculated using an apportionment of the TMDL based upon land area. The WLA for an industrial stormwater discharge is calculated as the percentage (based on permitted area) of the quantity of the TMDL less the MOS, RC, and WLAs determined for individual CDPS permits. The WLAs for non-extractive industrial stormwater permits vary by irrigation and non-irrigation season for selenium and iron and are presented in **Table 45**.

For MS4s authorized to discharge stormwater through either the statewide MS4 general permit (COR090000) or non-standard MS4 general permit (COR070000), a categorical WLA is calculated using an apportionment of the TMDL based upon land area. The WLA for MS4 stormwater discharge is calculated as the percentage (based on urban area) of the quantity of the TMDL less the MOS, RC, and WLAs determined for individual CDPS permits. The categorical WLAs for MS4 general permits vary by irrigation and non-irrigation season for selenium and iron and are presented in the TMDL tables listed in Section **5.4**.

Table 44. Selenium and Iron WLAs for facilities covered by individual CDPS permits

NPDES ID	Permittee	Facility	TMDL sub-watershed	Design flow (mgd)	Limit (µg/l)	WLA (lb/d)
CO0040053*	City of Grand Junction and Mesa County	Persigo WWTF	Persigo Wash	**Outfall 001A:** 12.5	Se (Dis) = 4.6 Fe (TR) = 1000	**Outfall 001A:** Se (Dis) = 0.5 Fe (TR) = 104
CO0038342	McClane Canyon Mining LLC	McClane Canyon Coal Mine	Salt Creek	**Outfall 001:** 0.216 **Outfall 002:** 0.216 **Outfall 004:** 0.216	Se (Dis) = 4.6 Fe (TR) = 1000	**Outfall 001:** Se (Dis) = 0.008 Fe (TR) = 1.8 **Outfall 002:** Se (Dis) = 0.008 Fe (TR) = 1.8 **Outfall 004:** Se (Dis) = 0.008 Fe (TR) = 1.8

*WLA applies when discharging from outfall 001A (to Persigo Wash). When the facility discharges from outfall 001B (to Colorado River), the WLA applied for Persigo Wash is 0 lb/d for the Persigo Wash.

Table 45. Selenium and Iron WLAs for stormwater covered by the general CDPS permits

NPDES ID	Permittee	TMDL sub-watershed	Site Area (sq. mi.)	Percent Area of TMDL sub-watershed (%)	Irrigation Season TMDL (lb/d)	Non-Irrigation Season TMDL (lb/d)
COR900895	FedEx Freight Inc	Persigo Wash	0.01	0.15%	Se (Dis) = 0.0015 Fe (TR) = 0.34	Se (Dis) = 0.0002
COR900221	Mack Mesa Airport	Salt Creek	0.04	0.08%	Se (Dis) = 0.006 Fe (TR) = 1.6	Se (Dis) = 0.0005
COR900143	YRC Inc dba YRC Freight	Lewis Wash	0.012	0.4%	Fe (TR) = 0.20	Se (Dis) = 0.0001

5.2.2 Load Allocation

The LA is the load contribution from human-caused NPS pollution sources and natural background levels. The natural background LA is the product of the natural background concentrations and the percentage of flow contributing from natural land cover (the median flow for the entire TMDL sub-watershed multiplied by NLCD percentage for natural land cover). Natural background concentrations were determined from regional sampling locations located upstream of any agricultural or urban influences. **Table 46** summarizes monitoring locations used to calculate background concentration for selenium, iron, and *E. coli*. An 85th percentile of 1.7 µg/l, which is based on all available data, was used as the background concentration selenium for both seasons. A median of 132 µg/l, which is based on all available data, was used as the background concentration iron for both seasons. A geomean of 16 cfu/100 ml, which is based on all available data, was used as the annual background concentration for *E. coli*. For selenium and iron, the agriculture LA was calculated as the percentage (based on land area) and the remainder of the load from the loading capacity less the WLAs, MOS, RC, and natural background LA. For *E. coli*, the NPS LA was calculated as the percentage (based on land area) and the remainder of the load from the loading capacity less the WLAs, MOS, RC, and natural background LA. Note that the land area used to calculate the LA for natural background levels are based on the 2030 projected NCLD land cover area because the RC has been defined as the projected change in NLCD land cover area as described in Section **5.2.3**.

Table 46. Background Concentration Monitoring Locations

Organization	Site ID	Site Name	Parameter	Period of Record	n
USGS	392031108503701	East Salt Creek at Mitchell Road	Dissolved Selenium	5/1992-5/2000	6
WQCD	11110	Big Salt Creek below Ruby Lee Reservoir	Dissolved Selenium	10/1995-7/1996	6
			Total Recoverable Iron	10/1995-7/1996	10
Riverwatch	4067	Mack Wash 2-Below Highline Lk	Total Recoverable Iron	10/2001-12/2007	7
USGS	09095529	Camp No. 7 Spillway near Mack, CO	*E. coli*	8/2000-9/2003	19

5.2.3 Reserve Capacity

An RC for urban growth was added for all TMDL sub-watersheds to a certain degree. A percentage of the 2016 NLCD natural land use was reserved and was set aside as reserve capacity for potential development. For Lewis Wash, Indian Wash, Reed Wash, and Salt Creek, the RC was set equal to 1% of the TMDL less the MOS. For all other TMDL sub-watersheds, the RC was set equal to 2.5% of the TMDL less the MOS. A lower percentage was used for Lewis Wash and Indian Wash because these watersheds are more heavily urbanized than the other TMDL sub-watersheds (see **Table 3**), with a lower likelihood of further growth. A lower percentage for Reed Wash and Salt Creek was used because the Mesa County MS4 area is only a very small portion in these TMDL sub-watersheds with less likelihood of further growth. Based on a comparison between the NLCD 2001 and NLCD 2016 for Reed Wash and Salt Creek, the growth of the developed area was much less for these TMLD sub-watersheds than for the others. **Table 47** summarizes the projected 2030 land cover percentages for each TMDL sub-watershed. Note that the cultivated crops is assumed to remain constant from 2016 to 2030; therefore, the increase in developed land cover percentage results in a decrease in the natural land cover of the same percentage.

Table 47. Projected 2030 Land Cover Percentages (with changes from 2016 in parenthesis)

	Land Cover		
TMDL Sub-watershed	Natural	Developed	Cultivated Crops
Lewis Wash	1.6% (-1%)	88.5% (+1.0%)	9.9% (-)
Indian Wash	2.5% (-1%)	87.4% (+1.0%)	10.1% (-)
Leach Creek	9.0% (-2.5%)	59.8% (+2.5%)	31.3% (-)
Persigo Wash	15.2% (-2.5%)	20.8% (+2.5%)	64% (-)
Pritchard Wash	7.6% (-2.5%)	35.2% (+2.5%)	57.2% (-)
Hunter Wash	8.5% (-2.5%)	16.2% (+2.5%)	75.3% (-)
Adobe Creek	11.4% (-2.5%)	16.4% (+2.5%)	72.2% (-)
Little Salt Wash	9.2% (-2.5%)	25.2% (+2.5%)	65.6% (-)
Big Salt Wash	22.6% (-2.5%)	11.0% (+2.5%)	66.4% (-)
Reed Wash	25.6% (-1%)	8.9% (+1.0%)	65.5% (-)
Salt Creek	73.8% (-1%)	5.1% (+1.0%)	21.1% (-)

5.2.4 Margin of Safety

Section 303(d) of the CWA and U.S. EPA regulations at 40 CFR 130.7 require that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numeric water quality standards with seasonal variations and a MOS which accounts for any lack of knowledge concerning the relationship between limitations and water quality." U.S. EPA guidance explains that the MOS may be implicit (*i.e.* incorporated into the TMDL through conservative assumptions in the analysis) or explicit (*i.e.* expressed in the TMDL as loadings set aside for the MOS). An explicit 10% MOS was applied for each parameter in all TMDL sub-watersheds. There is no consistent MOS value for TMDLs, but the 10% criterion is the most used value for TMDLs throughout the United States (Nunoo et al. 2020).

5.3 Critical Conditions and Seasonal Variation

The CWA requires that TMDLs consider critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. Critical conditions will depend upon the characteristics of the impaired waterbody, the applicable water quality standards, the sources of pollution, and the characteristics of the pollutant. Critical conditions may have spatial and temporal aspects (*e.g.* summer low flows in small headwaters streams). When the source(s) of pollution include point sources, critical conditions need to be considered when allocating WLAs. In addition, the CWA and U.S. EPA's implementing regulations require TMDLs to be established with consideration of seasonal variations.

Selenium TMDLs were calculated for the irrigation (April to October) and non-irrigation (November to March) seasons at the mouth of each sub-watershed. Calculating loads for these two seasons captures two different flow regimes: (1) a period of higher flow but lower concentration during the irrigation season and (2) a period of lower flow with a higher concentration during the non-irrigation season. The seasonal breakdown allowed analyses of load reductions for a load dominated by a higher flow (irrigation season) and a load dominated by a higher concentration (non-irrigation season). By calculating the load at the mouth of each sub-watershed, it is possible to analyze the load from all potential sources.

Iron TMDLs were also calculated for the irrigation (April to October) and non-irrigation (November to March) seasons at the mouth of each sub-watershed. By using these seasons, it was determined that the critical season for most of the sub-watersheds was the irrigation season. One of the TMDL sub-watersheds (Pritchard Wash) also showed iron exceedances during the non-irrigation season and therefore a TMDL was included for both seasons. By calculating the load at the mouth of each sub-watershed, it is possible to analyze the load from all potential sources.

E. coli TMDLs were calculated year-round at the mouth of each sub-watershed. By calculating the load at the mouth of each sub-watershed, it is possible to analyze the load from all potential sources. It was not necessary to calculate loads for an irrigation or non-irrigation season because there was no correlation between flows and concentrations (*i.e.* high or low concentrations of *E. coli* occurred at any flow level).

5.4 TMDLs and Reductions

E. coli WLAs and LAs for Adobe and Leach Creeks are summarized in **Table 48**. Dissolved selenium WLAs and LAs for each AUID are presented in **Table 49** to **Table 52**. Total recoverable iron WLAs and LAs for each AUID are presented in **Table 53** to **Table 56**. Because the Persigo WWTF has two discharge outfalls, TMDL and reduction scenarios were evaluated for when the facility discharges to Persigo Wash and for when it discharges to the Colorado River. Because the discharge from the McClane Canyon Coal Mine is intermittent, TMDL and reduction scenarios were evaluated for when the facility discharges to East Salt Creek and when it does not discharge to East Salt Creek. As the current conditions for Persigo Wash and Salt Creek were determined without the influence of the two facilities, the calculated TMDL load was added to the current condition loads in the scenarios in which Persigo WWTF discharges to Persigo Wash and McClane Canyon Coal Mine discharges to East Salt Creek. Note that the TMDLs for these facilities are deducted from the current condition loads prior to the rest of the allocations.

Pollutant reductions are necessary to achieve TMDLs. They are calculated as the difference between the observed load and TMDL, relative to the observed load.

$$\text{Necessary reduction} = (\text{Load}_{\text{Observed}} - \text{Load}_{\text{TMDL}}) \;/\; \text{Load}_{\text{Observed}}$$

The observed load ($\text{Load}_{\text{observed}}$) is calculated using the same equation described in the beginning of Section 5. In this calculation, the flows and conversion factors are the same; however the TMDL target concentration is replaced by the corresponding listing methodology statistic for each parameter (e.g. 85^{th} percentile for chronic dissolved selenium, 50^{th} percentile for total recoverable iron, and geomean for *E. coli*).

Table 48. *E. coli* WLAs and LAs for Adobe and Leach Creeks (AUID COLCLC13b_C)

Stream	Current condition (giga-cfu/d)	TMDL (giga-cfu/d)	MOS (giga-cfu/d)	Background LA (giga-cfu/d)	Nonpoint LA (giga-cfu/d)[a]	MS4 WLA (giga-cfu/d)[b]	Reserve capacity (giga-cfu/d)	Percent reduction (%)
Leach Creek	136	105	10.5	1.227	33	60	0.342	23%
Adobe Creek	395	86	8.6	1.29	64	12	0.282	78%

[a]The nonpoint sources include, but are not limited to, OWTS, hobby farms, and grazing activities.
[b]The MS4 WLA for Leach Creak is composed of the Mesa County MS4 (COR090100), Grand Valley Water Users Association (COR070083), and unregulated stormwater. The MS4 WLA for Adobe Creek is composed of the Mesa County MS4 (COR090100) and unregulated stormwater entities.

Table 49. Selenium WLAs and LAs for AUID COLCLC13b_A

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Lewis Wash	Irrigation	0.13	0.30	0.03	0.0011	0	0.0017	0.027	0.24	0.0011	0
	Non-Irrigation	0.11	0.015	0.0015	0.0001	0	0.0001	0.0013	0.012	0.00005	86%
Persigo Wash[b]	Irrigation	3.7	1.1	0.11	0.0017	0	0.063	0.74	0.21	0.010	69%
	Non-Irrigation	1.5	0.082	0.0082	0.0001	0	0.0045	0.053	0.015	0.0007	95%
Persigo Wash[c]	Irrigation	4.2	1.6	0.11	0.0017	0.48	0.063	0.74	0.21	0.010	69%
	Non-Irrigation	2.0	0.56	0.0082	0.0001	0.48	0.0045	0.053	0.015	0.0007	95%
Pritchard Wash	Irrigation	2.3	0.92	0.092	0	0	0.025	0.50	0.29	0.0084	60%
	Non-Irrigation	0.36	0.067	0.0067	0	0	0.0019	0.037	0.021	0.0006	81%
Hunter Wash	Irrigation	1.6	0.84	0.084	0	0	0.026	0.61	0.11	0.0077	48%
	Non-Irrigation	0.65	0.06	0.006	0	0	0.0018	0.043	0.008	0.0005	91%
Little Salt Wash	Irrigation	1.8	1.2	0.12	0	0	0.039	0.74	0.26	0.011	34%
	Non-Irrigation	0.42	0.084	0.0084	0	0	0.0028	0.054	0.019	0.0008	80%
Big Salt Wash	Irrigation	6.9	2.1	0.21	0	0	0.17	1.5	0.19	0.019	70%
	Non-Irrigation	3.0	0.32	0.032	0	0	0.027	0.23	0.030	0.0029	89%
Reed Wash	Irrigation	7.6	1.7	0.17	0	0	0.16	1.2	0.15	0.0061	78%
	Non-Irrigation	3.4	0.14	0.014	0	0	0.0132	0.10	0.012	0.0005	96%

[a]The MS4 WLA for Lewis Wash is composed solely of the Mesa County MS4 (COR090100). The MS4 WLA for all other streams is composed of the Mesa County MS4 (COR090100) and unregulated stormwater.
[b]This load evaluation scenario applies when the Persigo WWTF (CO0040053) discharges to the Colorado River.
[c]This load evaluation scenario applies when the Persigo WWTF (CO0040053) discharges to Persigo Wash.

Table 50. Selenium WLAs and LAs for AUID COLCLC13b_B

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Salt Creek[b,c]	Irrigation	6.1	2.8	0.28	0.0056	0.0000	0.75	1.5	0.28	0.010	54%
	Non-Irrigation	3.2	0.23	0.023	0.0005	0.0000	0.063	0.12	0.023	0.0008	93%
Salt Creek[b,d]	Irrigation	6.1	2.8	0.28	0.0056	0.025	0.75	1.5	0.28	0.010	54%
	Non-Irrigation	3.2	0.26	0.023	0.0005	0.025	0.063	0.12	0.023	0.0008	93%

[a]The MS4 WLA is composed solely of unregulated stormwater.
[b]The Salt Creek sub-watershed includes tributary segments that are a portion of AUID COLCLC13b_A. The loads calculated also address these tributary segments as they are sources to AUID COLCLC13b_B.
[c]This load evaluation scenario applies when there is no discharge from CO0038342 (McClane Canyon Mining LLC).
[d]This load evaluation scenario applies when there is discharge from CO0038342 (McClane Canyon Mining LLC).

Table 51. Selenium WLAs and LAs for AUID COLCLC13b_C

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Leach Creek[b]	Irrigation	3.9	1.1	0.11	0	0	0.036	0.34	0.62	0.010	71%
	Non-Irrigation	4.2	0.20	0.020	0	0	0.0065	0.060	0.11	0.0018	95%
Adobe Creek	Irrigation	2.5	0.89	0.089	0	0	0.037	0.64	0.12	0.0081	65%
	Non-Irrigation	0.61	0.1	0.0065	0	0	0.0027	0.046	0.009	0.0006	89%

[a]The MS4 WLA for Leach Creak is composed of the Mesa County MS4 (COR090100), Grand Valley Water Users Association (COR070083), and unregulated stormwater. The MS4 WLA for Adobe Creek is composed of the Mesa County MS4 (COR090100) and unregulated stormwater entities.
[b]The Leach Creek sub-watershed includes a tributary segment that is a portion of AUID COLCLC13b_A. The load calculated also addresses this tributary segment as it is a source to AUID COLCLC13b_C.

Table 52. Selenium WLAs and LAs for AUID COLCLC13b_D

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Indian Wash	Irrigation	1.4	0.69	0.069	0	0	0.0063	0.065	0.55	0.0025	50%
	Non-Irrigation	0.77	0.032	0.0032	0	0	0.0003	0.0030	0.026	0.0001	96%

[a]The MS4 WLA for Indian Wash is composed of the Mesa County MS4 (COR090100) and Grand Valley Water Users Association (COR070083).

Table 53. Iron WLAs and LAs for AUID COLCLC13b_A

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Lewis Wash	Irrigation	32	65	6.5	0.24	0	0.1367	5.9	52	0.0854	0%
	Non-Irrigation	1.1	3.2	0.32	0.012	0	0.0068	0.29	2.6	0.00427	0%
Persigo Wash[b]	Irrigation	468	248	25	0.40	0	5.5	169	48	0.33	47%
	Non-Irrigation	3.4	18	1.8	0.028	0	0.39	12	3.4	0.023	0%
Persigo Wash[c]	Irrigation	572	352	25	0.40	104	5.5	169	48	0.33	47%
	Non-Irrigation	108	122	1.8	0.028	104	0.39	12	3.4	0.023	0%
Pritchard Wash	Irrigation	539	200	20	0	0	2.4	113	64	0.26	63%
	Non-Irrigation	17	15	1.5	0	0	0.17	8	4.7	0.019	16%
Hunter Wash	Irrigation	515	183	18	0	0	2.4	137	25	0.24	64%
	Non-Irrigation	2.4	13	1.3	0	0	0.17	9.7	1.8	0.017	0%
Little Salt Wash	Irrigation	558	254	25	0	0	3.6	167	58	0.33	55%
	Non-Irrigation	6.6	18	1.8	0	0	0.26	12	4.2	0.024	0%
Big Salt Wash	Irrigation	1516	453	45	0	0	14	348	45	0.60	70%
	Non-Irrigation	26	70	7.0	0	0	2.2	54	6.9	0.093	0%
Reed Wash	Irrigation	1713	367	37	0	0	12	283	34	0.48	79%
	Non-Irrigation	5.9	31	3.1	0	0	1.0	24	2.9	0.041	0%

[a]The MS4 WLA for Lewis Wash is composed solely of the Mesa County MS4 (COR090100). The MS4 WLA for all other streams is composed of the Mesa County MS4 (COR090100) and unregulated stormwater.
[b]This load evaluation scenario applies when the Persigo WWTF (CO0040053) discharges to the Colorado River.
[c]This load evaluation scenario applies when the Persigo WWTF (CO0040053) discharges to Persigo Wash.

Table 54. Iron WLAs and LAs for AUID COLCLC13b_B

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Salt Creek[b,c]	Irrigation	1283	609	61	1.6	0	59	409	78	0.80	52%
	Non-Irrigation	24	51	5.1	0.1	0	4.9	34	6.5	0.1	0%
Salt Creek[b,d]	Irrigation	1288	615	61	1.6	5.4	59	409	78	0.80	52%
	Non-Irrigation	30	56	5.1	0.1	5.4	4.9	34	6.5	0.1	0%

[a]The MS4 WLA is composed solely of unregulated stormwater.
[b]The Salt Creek sub-watershed includes tributary segments that are a portion of AUID COLCLC13b_A. The loads calculated also address these tributary segments as they are sources to AUID COLCLC13b_B.
[c]This load evaluation scenario applies when there is no discharge from CO0038342 (McClane Canyon Mining LLC).
[d]This load evaluation scenario applies when there is discharge from CO0038342 (McClane Canyon Mining LLC).

Table 55. Iron WLAs and LAs for AUID COLCLC13b_C

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Leach Creek[b]	Irrigation	355	243	24	0	0	3.4	76	139	0.32	32%
	Non-Irrigation	13	43	4.3	0	0	0.6	13	25	0.057	0%
Adobe Creek	Irrigation	621	194	19	0	0	3.3	144	28	0.26	69%
	Non-Irrigation	2.2	14	1.4	0	0	0.2	10.4	2.0	0.0	0%

[a]The MS4 WLA for Leach Creek is composed of the Mesa County MS4 (COR090100), Grand Valley Water Users Association (COR070083), and unregulated stormwater. The MS4 WLA for Adobe Creek is composed of the Mesa County MS4 (COR090100) and unregulated stormwater entities.
[b]The Leach Creek sub-watershed includes a tributary segment that is a portion of AUID COLCLC13b_A. The load calculated also addresses this tributary segment as it is a source to AUID COLCLC13b_C.

Table 56. Iron WLAs and LAs for AUID COLCLC13b_D

Stream	Season	Current condition (lb/d)	TMDL (lb/d)	MOS (lb/d)	Industrial stormwater WLA (lb/d)	Individual permit WLA (lb/d)	Background LA (lb/d)	Agriculture LA (lb/d)	MS4 WLA (lb/d)[a]	Reserve capacity (lb/d)	Percent reduction (%)
Indian Wash	Irrigation	332	151	15	0	0	0.50	14	121	0.20	55%
	Non-Irrigation	1.7	7.0	0.70	0	0	0.023	0.66	5.6	0.0093	0%

[a]The MS4 WLA for Indian Wash is composed of the Mesa County MS4 (COR090100) and Grand Valley Water Users Association (COR070083).

6 TMDL Implementation

Implementation of this TMDL will require a combined effort from point and nonpoint sources. For point sources, implementation will be carried out through the permits process. For nonpoint sources, implementation will be carried out through the Grand Valley Watershed Plan and other local and areawide initiatives.

6.1 Point Sources

For Persigo WWTF (CO0040053), the WLAs calculated in **Table 44** should be applied in the permit for Outfall 002A. For the McClane Canyon Coal Mine (CO0038342), the WLAs calculated in **Table 44** should be applied in the permit for Outfalls 001, 002, 004. New outfalls should receive WLAs based on the equation described in Section 5.2.1.1. These new WLAs should then be added to the Current conditions, TMDL, and Individual permit WLA columns of the TMDL for the load calculations based on the addition of a new outfall. Selenium and iron load limitations from this TMDL should be included along with selenium and iron limits implemented by the permits section based on site specific analyses during the renewal process.

For non-extractive industrial stormwater permittees (COR900000), the potential for specific pollutants varies widely among types of industries. The permit includes requirements for structural and non-structural control measures that comprehensively address pollutants in runoff. Permit writers may therefore make qualitative or quantitative reasonable potential determinations on a facility-specific basis to determine whether additional controls, monitoring, or limits are required.

For MS4 permittees, compliance with CWA Section 402(p) requires pollutants in stormwater discharges to be reduced to the Maximum Extent Practicable (MEP). Permittees develop stormwater management programs as a framework to comply with their stormwater discharge permit requirements. MEP is therefore assessed through compliance with the program description documentation. MEP is iterative, and permits will continually reduce pollutants over time to progress towards achieving the WLA. Permits must incorporate the numeric WLA with the TMDL. However, MS4s typically have complex interconnections, contributions from multiple regulated MS4s and other regulated and non-regulated stormwater sources. As a result, permit writers may use discretion on how the WLA is translated into limits and how compliance with the WLA is determined. Where existing permit limits representing MEP are insufficient to achieve the WLA, permits may include additional control measures or treatment techniques to achieve further reductions. If feasible, permits may also include thresholds based on water quality targets or concentrations derived from the TMDL WLAs. Translations into thresholds or limits may involve conversions to concentration, loading, percentage or other methodologies that align with the TMDL.

Control measures may be designed to target discrete sources (i.e., sources on land that become transported through the MS4, such as illicit discharges, pet wastes, increased flows from exposed soils) or specific land uses (e.g., areas of high development, older portions of MS4) and other specific sources identified by permittees. Using an iterative approach, control measures and other non-numeric requirements may be established in different phases over multiple permit terms. For example, permits may address pollutants for dry weather conditions before addressing wet weather conditions. Dry weather monitoring is an effective way to determine the significance of dry weather sources versus wet weather sources. Wet weather monitoring, on the other hand, may be designed to assess problematic drainage areas and assess control measure effectiveness over time.

The division may assess compliance with the WLA based on successful implementation of program requirements alone, or in combination with monitoring data. Permits may require site specific monitoring or may allow representative types of monitoring, such as regional monitoring, performance monitoring, industry studies, calculations of pollutant reductions, etc., to assess compliance with the WLA. The division encourages coordination and cooperation among MS4s in implementing control measures and monitoring for TMDL pollutants.

6.2 Non Point Sources

EPA guidelines that are in place for states' use of Clean Water Act Section 319 (Section 319) funding (Nonpoint Source Program and Grants Guidelines for States and Territories, 2013) state:

"Because implementation of the load allocations established by these TMDLs is not enforceable under the Clean Water Act, for waters impaired solely or partly by nonpoint sources, the primary implementation mechanism is generally the state NPS management program coupled with state, local, and federal land management programs and authorities. Thus, the § 319 program is an important mechanism to implement TMDLs and restore the impaired waters listed under § 303(d) where NPS pollution is a contributor to the water quality impairment. EPA believes that implementation of these TMDLs can best be achieved through the development of WBPs that incorporate information from TMDLs that have been developed in the watershed. The implementation of WBPs has been and continues to be one of EPA's highest priorities for the use of § 319 funds."

Consistent with this discussion in EPA's guidelines, one of the primary ways for addressing the nonpoint source recommendations made in this TMDL report will be through the Section 319-funded Grand Valley Watershed Plan update that is in progress and will be completed in April of 2022. Section 319 funds were used to assist with watershed group development in the Grand Valley and outreach to the watershed group completing the watershed plan, as well as other potentially affected stakeholders, was conducted throughout the development of this report. The report discusses potential nonpoint sources and analyzes the loads necessary to bring the watershed back into attainment. The primary nonpoint sources identified include (but are not limited to) agriculture, failing on-site wastewater treatment systems (OWTS), and natural sources. Tables 48-56 provide the LAs and reductions necessary to bring the watershed back into attainment. Loads for the natural sources were separated from anthropogenic sources; however, as the relative source contribution from different nonpoint source categories is unknown, it is at the discretion of local government, non governmental organizations, and private groups to determine the appropriate implementation analyses and strategies for carrying out this TMDL based on their prioritized needs and a more robust evaluation of nonpoint sources within the watershed which will be the focus of the watershed plan update.

Planning at the watershed scale is needed to provide a comprehensive analysis of the causes and sources of pollution and to identify critical areas (i.e., those that generate the most pollution) in which to give priority to support implementation. In addition to selecting and applying practices that will be effective in addressing the pollutants of concern, implementation is dependent on local willingness to adopt and maintain these practices. The watershed-based planning approach will identify implementation activities that address the nonpoint source water quality problems, and then prioritize these activities based on their relative contributions to nonpoint source pollutant loads and the likelihood that they will be adopted and maintained by local partners. Existing analysis documents, such as the Grand Valley TMDL, will serve as valuable building blocks for the watershed-based plan and will be incorporated by reference in the plan, but must be flexible enough to allow local planning and prioritization to occur without contradicting the local priorities that develop under the watershed-based plan.

The division's Nonpoint Source Program has a long-standing history of working with local partners in the Grand Valley area to reduce nonpoint source pollution and will continue to do so to support the implementation of this TMDL through technical assistance and funding assistance (contingent on funding availability). Below are 319-funded projects that utilized approximately $1,077,920 in nonpoint source funds to address selenium and/or *E.coli* in the Grand Valley area dating back to 2003, although project history in this area dates back even further than the years detailed here.

Year	Amount/Source	Brief Project Description
2017	$88,009 - NPS 319 funds $38,000 - Other Federal funds $19,444 - State funds $82,650 Local matching funds $17,400 Local In-kind	**Updating the Grand Valley portion of the 2012 Lower Gunnison River Basin Watershed Plan (ongoing)** • The purpose of this project is to revise the existing Selenium Watershed Management Plan Update Lower Gunnison River Basin and Grand Valley, Colorado (2012) to reflect upcoming watershed and water quality characterization activities in the Grand Valley specific to mitigation of the selenium and *E. coli* impaired streams. The Selenium Task Force and stakeholders in the Lower Gunnison Basin have actively monitored and reduced the selenium concentrations and loadings along the mainstem of the Colorado River through the implementation of their identified projects. The lessons learned and information from these efforts needs to be transferred to the Grand Valley area to mitigate existing water quality in the tributaries and prevent new selenium loadings. This project will also include information that aligns with other statewide and regional planning efforts such as the current TMDL development, Colorado Water Plan, Colorado Basin Implementation Plan (BIP), and Stream Management Planning (also referred to as Integrated Water Planning).
2016	$4,980 - NPS 319 funds $3,320 - Local matching funds	**Mini-Grant supporting Outreach, Education, & Grand Valley TMDL Integration** • The purpose of this mini-grant was to educate stakeholders about the watershed, water quality issues, and pending Selenium and *E. coli* Total Maximum Daily Load (TMDL) development and process.

2010	$26,171 - NPS 319 funds $3,400- Other Federal funds $20,666 Local matching funds	**Supporting Selenium Control Efforts in the Lower Gunnison River Basin through Data Collection** • The project identified significant data gaps needed to fully characterize selenium loading in the Lower Gunnison Basin, develop a plan to address them, and subsequently fill them in order to support U.S. Geological Survey (USGS) efforts to optimize a predictive model of selenium loading in the North Fork and lower Gunnison River basins.
Various (2007 parent file)	$800,000 - NPS 319 funds $760,461 - Other Federal Funds $645,269 -Local matching funds	**Selenium Control Project: Loutzenhizer Lateral Piping** • The goal of this project was to reduce selenium and salt loading to the lower Gunnison and Colorado River systems. This project helped bring several selenium-impaired 303(d) listed segments into compliance by replacing 6.5 miles of open ditch laterals with closed pipe in a highly seleniferous and saline area. This effort reduced 171 pounds of selenium loading/year and controlled 2,138 tons of salt per year. This lateral piping project was one component of a larger Integrated Phased Piping Project in the Loutzenhizer Arroyo sub-basin where approximately 11.9 miles of open ditch laterals were replaced with closed pipe resulting in an estimated 262 to 328 pounds of selenium and 3,275 tons of salt reduced.
2004	$97,200 - NPS 319 funds	**Grand Valley Selenium Assessment** • The goal of this project was to quantify selenium loading and characterize sources in Grand Valley tributaries (tracer studies, water-quality sampling). The collection of this information will support TMDL development and implementation for selenium remediation planning.
2003 & 2006 (parent file)	$32,479 - NPS 319 funds $25,102 - Local matching funds	**Lower Gunnison River Basin Watershed Plan Update (2012)** • To improve water quality within the Lower Gunnison Basin by developing an effective watershed plan.
2003	$29,081 - NPS 319 funds $19,389 - local matching funds	**Grand Valley Selenium Task Force Coordinator (part-time over 3 years)** • The overall goal of this project was to enable the Grand Valley Selenium Task (GVSTF) to continue its mission of addressing selenium loading from 303(d)-listed nonpoint sources to segments of the lower Colorado River. The coordinator served as a bridge between the GVSTF and the Gunnison Basin Selenium

		Task Force (GBSTF) to ensure that group activities complimented and did not duplicate one another.

For priorities identified in the watershed plan, Section 319 funds can be used for projects that address agricultural nonpoint sources through implementation of best management practices (BMPs) such as: irrigation method changes, irrigation scheduling changes, buffer strips, exclusion fencing, lining or piping of canals and ponds, soil health practices (reduced/no-tillage, cover crops) or stormwater BMPs outside of municipal separate storm sewer system permit coverage areas.

Beyond implementation activities associated with the state's Section 319 nonpoint source program, there are other programs and mechanisms in place to assist with implementation of the load allocation discussed in this report. For example, permitting and ensuring compliance with local OWTS regulation in the Grand Valley watershed is conducted by the Mesa County Health Department. In addition to working with Mesa County, owners of OWTS may receive funding assistance for maintenance and failure issues from the Colorado Department of Local Affairs' Community Development Block Grant (CDBG) Program, CDPHE's Water Pollution Control Revolving Fund Loan Program, Rural Community Assistance Corporation's (RCAC) Environmental Infrastucture Loans, and the United States Department of Agriculture Rural Development Program.

In addition there are a number of active stakeholder groups associated with areawide programmatic efforts to address both selenium and salinity. For example, the Gunnison Basin & Grand Valley Selenium Task Forces are stakeholder groups with missions to reduce selenium loading to local waterways while maintaining the agricultural heritage and economic viability of the area and the related Selenium Management Program being facilitated by the US Bureau of Reclamation. The Colorado River Basin Salinity Control Forum, while focused on salinity, provides ancillary benefit for selenium control through both engaging stakeholders in actions to protect water quality in the Colorado River Basin and through on-the-ground implementation activities that reduce nonpoint sources of a number of different pollutants. The Natural Resources Conservation Service provides support for selenium control through its Environmental Quality Incentives Program and funded a water quality improvement project in the Lower Gunnison through the Regional Conservation Partnership Program which has lessons learned that are applicable across the broader geographic area (project title: Modernizing Agricultural Water Management in the Lower Gunnison River Basin: A Cooperative Approach to Increased Water Use Efficiency and Water Quality Improvement).

7 Public Participation

Several stakeholder meetings were held, from February 2017 to March 2021. Two larger stakeholder meetings were held to educate the general public about the TMDL process in March 2017, October 2018, and March 2021. From the larger stakeholder meetings, a technical advisory committee (TAC) was formed in order to discuss the technical aspects for the TMDL. Two TAC meetings were held in August 2019 and June 2020.

7.1 Public Notice Process

This draft TMDL report will be made available for public review and comment during a 30-day public notice period April 2, 2021 through May 3, 2021. Announcement of the public notice of the draft TMDL will be made in the *Water Quality Information Bulletin*. Interested parties may submit comments during this time. The division will respond and incorporate appropriate changes, resulting in a final TMDL document. The final report will be made available for an additional public review during a 30-day public notice period as required by Regulation 21 (WQCC, April 2017). Following this final public notice period, the report will be submitted to EPA.

7.2 Appeals Process

Once a TMDL draft has gone through a 30-day public notice process, which allows for public review and comment, the WQCD will address any comments received and then publish the final TMDL in the *Water Quality Information Bulletin* for a second 30 days. Public comments are not accepted during this period, but rather this time allows for any concerned parties to appeal the final TMDL to the WQCC (Reg 21.18). Per the requirements in Regulation 21, any appeal shall be made in writing to the office of the Administrator of the Commission and must be postmarked no later than 30 days after the date of publication of a final TMDL in the *Bulletin*. If no such appeal is filed within the 30-day publication date, no further appeals will be considered and the WQCD may submit the final TMDL to U.S. EPA Region 8 for approval.

8 References

Green, G.N.. The Digital Geologic Map of Colorado in ARC/INFO Format: U.S. Geological Survey Open-File Report 92-0507, 9 p. Available online at the following link: https://mrdata.usgs.gov/geology/state/state.php?state=CO.

Homer, Collin G., Dewitz, Jon A., Jin, Suming, Xian, George, Costello, C., Danielson, Patrick, Gass, L., Funk, M., Wickham, J., Stehman, S., Auch, Roger F., Riitters, K. H.. Conterminous United States land cover change patterns 2001–2016 from the 2016 National Land Cover Database: ISPRS Journal of Photogrammetry and Remote Sensing, v. 162, p. 184–199. Available online at the following link: https://www.mrlc.gov/data/nlcd-land-cover-conus-all-years.

Kaur, N., S. Sharma, S. Kaur and H. Nayyar. 2014. Selenium in agriculture: a nutrient or contaminant for crops? Archives of Agronomy and Soil Science, 60(12), 1593-1624

Nunoo, R., P. Anderson, S. Kumar and J. Zhu. 2020. Margin of safety in TMDLs: natural language processing-aided review of the state of practice. Journal of Hydrologic Engineering 25(4): 04020002.

Schueler, T. 1994. The Importance of Imperviousness. Watershed Protection Techniques 1(3):100–111.

Stephan, C. 1994. Aquatic Life Criterion for Selenium. U.S. EPA, Office of Research and Development, Environmental Research Laboratory, Duluth, MN. September 9, 1994.

WQCD. 2019. *Section 303(d) Listing Methodology. 2020 Listing Cycle*. Colorado Department of Public Health and the Environment, WQCD. March 2019. https://drive.google.com/file/d/1CE5GDswZ_qIwcKRRPTYxLQtOGqPiEONq/view. Accessed April 27, 2018.

———. 1991. *Guidance for Water Quality-based Decisions: The TMDL Process*. EPA 440-4-91-001. U.S. EPA, Office of Water (WH-553). April 1991.

———. 1996. *Pointer No. 1. Nonpoint Source Pollution: The Nation's Largest Water Quality Problem*. EPA-841-F-96-004A. U.S. EPA, Office of Water (4503F). Washington, D.C. March 1996. 2 pp. https://nepis.epa.gov/Exe/ZyPDF.cgi/20004PZG.PDF?Dockey=20004PZG.PDF. Accessed May 31, 2018.

———. 1998. *Report on the Peer Consultation Workshop on Selenium Aquatic Toxicity and Bioaccumulation*. EPA-822-R-98-007. U.S. EPA, Office of Water (4304). Washington, D.C. Prepared by Eastern Research Group, Inc. September 1998.

———. 1999. *Protocol for Developing Nutrient TMDLs*. EPA 841-B-99-007. U.S. EPA, Office of Water (4503F). Washington, D.C. 135 pp.

———. 2000. *Matter of Revision to the Basic Standards and Methodologies for Surface Water, Regulation #31 (5 CCR 1002-31)*. Colorado Department of Public Health and Environment, WQCD. June 2000.

———. 2001. *Protocol for Developing Pathogen TMDLs*. EPA 841-R-00-002. U.S. EPA, Office of Water, Washington, D.C.

———. 2002. *Onsite Wastewater Treatment Systems Manual*. EPA-625-R00-08. U.S EPA, Office of Water, Office of Research and Development, Washington, D.C.

———. 2016. Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2016. EPA 822-R-16-006. U.S. EPA, Office of Water. Washington, D.C. June 2016. https://www.epa.gov/sites/production/files/2016-07/documents/aquatic_life_awqc_for_selenium_-_freshwater_2016.pdf. Accessed February 20, 2019.

U.S. Department of Agricultures. 2020. CropScape – Cropland Data Layer. National Agricultural Statistics Service. https://nassgeodata.gmu.edu/CropScape/

U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Survey Staff. Web Soil Survey. Available online at the following link: http://websoilsurvey.sc.egov.usda.gov/.

U.S. EPA. 1998. Report on the Peer Consultation Workshop on Selenium Aquatic Toxicity and Bioaccumulation. EPA 822-R-98-008. U.S. EPA, Office of Water. Washington, D.C. September 1998.

———. 2017. Causal Analysis/Diagnosis Decision Information System (CADDIS). https://www.epa.gov/caddis. OFFICE OF Research and Development, Washington DC.

Vuori, K. 1995. Direct and Indirect Effects of Iron on River Eco Systems. Annales Zoologici Fennici 32(3): 317-329.