

Learning By Doing 2018 Aquatic Resource Monitoring Plan

Contents

Program Purpose and Objectives	1
2017 Monitoring Summary.....	2
Station Normalization	2
Monitoring Summary Overview	4
2018 Stream Temperature Monitoring Plan.....	5
Existing Temperature Monitoring Network.....	5
New Temperature Site Maintenance.....	10
2018 Substrate Sampling Plan	11
Monitoring Sites and Sampling Frequency.....	11
Site Maps.....	13
Funding	14
2018 Macroinvertebrate Monitoring Plan	15
Monitoring Sites and Sampling Frequency.....	15
Criteria for Determining Sampling Frequency	16
Existing Monitoring Programs	21
Map of 2018 Macroinvertebrate Monitoring Sites	23
Denver Water, Subdistrict Monitoring and Northern Baseline Monitoring	27
2018 Fraser Flats River Habitat Project Monitoring Plan	28
Program Objectives.....	28
Scope of 2018 Monitoring Program Proposal	28
Monitoring Program Components.....	28
2018 303(d) and Monitoring and Evaluation List Monitoring Plan.....	36
2018 Review of Impaired Segments	37
2018 CPW Fish Monitoring Plan.....	39
2018 Riparian Areas and Wetlands Monitoring Plans.....	40
Revegetation on Ranch Creek	40
Northern Water’s Municipal Subdistrict Riparian Vegetation Monitoring	40
2018 ILVK Monitoring Program.....	42
ILVK Proposed Monitoring Plan.....	42

Monitoring of Constructed Improvements 42

Monitoring Aquatic Species and Habitat..... 43

River Temperature and Water Levels 43

Fish Population Surveys 44

Macroinvertebrates..... 44

2018 Connectivity Channel Monitoring 46

References 47

Appendix A – 2017 Monitoring Sites with River Mile and Entity Station Name

Appendix B – 2017 Monitoring Summary

Program Purpose and Objectives

The cooperating partners of Learning By Doing (LBD) are committed to *“implement a monitoring plan to identify undesirable changes in, and agree upon desired modifications to, the aquatic environment, and to measure the effectiveness of actions taken to protect or improve the aquatic environment.”* Further, this plan sets agreed-upon goals that *“rely on existing data and new data gathering under existing programs to provide the primary source of information for designing the management goals and for prioritizing those goals and reaches where the goals will be applied.”* (IGA, 2012)

This annual Aquatic Resource Monitoring Plan (Plan) was developed utilizing the Aquatic Resource Monitoring Planning Process (Learning By Doing Monitoring Committee, 2017) and is applicable to the Cooperative Effort Area (the Colorado, Fraser and Williams Fork River Basins, upstream of the Colorado River confluence with the Blue River) or CEA. The objectives of the 2018 Plan are to:

- Compile and summarize existing monitoring activities
- Maintain a comprehensive temperature monitoring network
- Maintain substrate sample collection in support of the Grand County Stream Management Plan
- Assess the existing state of macroinvertebrate communities
- Assess the impacts of the Fraser Flats River Habitat Project
- Ensure adequate monitoring in stream segments that are currently listed on Colorado’s 303(d) List of Impaired Waters
- Assess the state of the fisheries
- Support restoration efforts on the Colorado River by Irrigators Living in the Vicinity of Kremmling (ILVK)
- Document riparian vegetation monitoring in the CEA
- Assess aquatic life habitat surrounding Windy Gap Reservoir prior to connectivity channel construction

A 2018 sampling plan for each objective follows.

2017 Monitoring Summary

A summary of all monitoring efforts in Grand County was prepared for monitoring that took place in 2017. This summary was used to inform and propose plans for 2018 monitoring. 2017 monitoring efforts from several entities were compiled including:

- Bureau of Land Management (BLM)
- Colorado Parks and Wildlife (CPW)
- Colorado River Water Conservancy District (River District)
- Denver Water
- East Grand Water Quality Board (EGWQB)
- Grand County
- Grand County Water Information Network (GCWIN)
- Learning By Doing
- Northern Water
- Northern Water Municipal Subdistrict (Subdistrict)
- Trout Unlimited (TU)
- US Geological Survey (USGS)

The 2017 monitoring summary shows what sampling was done and where flow data were collected in 2017 based on information provided by the entities. Changes can occur in timing and frequency of sampling events, and sites may be added or removed during the sampling season. Assumptions made in the summary include:

- Denver Water collects quarterly and bi-annual samples at several sites. The quarterly samples were put into the matrix in January, April, July and October. The biannual sampling was put into the matrix in June and September.
- CPW collects fish data bi-annually and annually. The bi-annual sampling was put into the matrix in April and September; the annual in September.
- The fish survey sites in the summary were based CPW Fish Survey reports.

Previous years monitoring plans can be different from and could also include other entities who may have collected data compared to the 2017 summary. For example, in some years the Colorado Division of Water Quality collects data in Grand County for review of water quality standards.

Station Normalization

There were originally 203 stations in the sampling summary. In effort to normalize and streamline sampling efforts, each sampling station was assigned a river mile ID. This was done using the coordinates provided by the sampling entities and mapping the sites using a center river line. This allowed for sites located in the same place but sampled by different entities to be grouped together as a single site. After grouping the sites by river mile ID, there were 106 stations in the summary.

The river mile ID is composed of abbreviated text representing the water body followed by a numeric value representing the river mile. For example, the river mile ID for the Colorado River at river mile 10 is CR-10. River mile zero is located at the most downstream portion of a waterbody, generally the confluence with a larger river. For the Colorado River, river mile zero is at LBD Cooperative Effort Area (CEA) boundary line which is the confluence with the Blue River. The river miles increase at upstream sites.

The following abbreviations are used when assigning the River Mile ID's:

Table 1 - River Mile Abbreviations

River Name	Site Abbreviation	Group
Arapaho Creek	AC	Upper Co
Bobtail Creek	BC	Williams Fork
Cabin Creek	CB	Fraser
<i>Cabin Creek North Channel</i>	CBN	Fraser
<i>Cabin Creek South Channel</i>	CBS	Fraser
<i>Little Cabin Creek</i>	LCB	Fraser
Church Creek	CH	Upper Co
Colorado River	CR	Colorado
<i>North Fork of Colorado</i>	NF	Upper Co
Crooked Creek	CC	Fraser
East Inlet	EI	Upper Co
Elk Creek	EC	Fraser
Fraser River	FR	Fraser
Grand Lake	GL	Upper Co
Granby Reservoir	GR	Upper Co
<i>Granby Pump Canal</i>	GRP	Upper Co
Herd Creek	HC	Fraser
McQuery Creek	MQC	Williams Fork
Meadow Creek	MC	Fraser
North Inlet	NI	Upper Co
Ranch Creek	RC	Fraser
<i>Ranch Creek Canal</i>	RCC	Fraser
Reeder Creek	RDC	Lower Co
Roaring Fork	RF	Upper Co
Shadow Mountain Reservoir	SM	Upper Co
Saint Louis Creek	STC	Fraser
Steelman Creek	SC	Williams Fork
Stillwater Creek	ST	Upper Co
Trail Creek	TR	Upper Co
Vasquez Creek	VC	Fraser
<i>Vasquez Creek Canal</i>	VCC	Fraser
<i>Little Vasquez Creek</i>	LVC	Fraser
Williams Fork	WF	Williams Fork
<i>Upper South Fork Williams Fork</i>	USF	Williams Fork
<i>South Fork Williams Fork</i>	SWF	Williams Fork
Willow Creek Reservoir	WC	Upper Co
<i>Willow Creek Pump Canal</i>	WCP	Upper Co
Windy Gap Reservoir	WG	Middle Co
<i>Windy Gap Pump Canal</i>	WGP	Upper Co

A complete list of all 203 sites with the Entity ID and corresponding River Mile ID is found in Appendix A.

Monitoring Summary Overview

The monitoring matrix is geographically sectioned into the following:

1. Colorado River – Blue River to Williams Fork
2. Colorado River -Williams Fork to Windy Gap
3. Colorado River - Upstream of Windy Gap to Headwaters
4. Fraser River and Tributaries
5. Williams Fork and Tributaries

There are four general categories used to group the type of sampling done at a site:

1. Water Quality – Includes analysis done at a laboratory (metals, nutrients, ions, etc.). This also includes measurements taken in the field (pH, temperature, flow, etc.).
2. Temperature – Time series data collected with a sensor placed in the stream.
3. Habitat – This includes macroinvertebrate, fish, sediment, and riparian area data collection.
4. Flow – Sites where there is a gaging station.

There are four parts included with each geographic section:

1. Map – The map shows the sites in the section labeled with the river mile ID and indicates what type of sampling is done at each site.
2. Station List – A list of the stations which includes the river mile ID, the entity ID, a site description, the entity, and what type of data are collected at that site.
3. Parameter List – A table of parameter groups which are collected specific to the geographic location. The parameter groups are specific to the sampling entity. The group names are an abbreviation of the sampling entity followed by a number, which is a count of how many different groups that entity samples. Details are provided specific to each parameter list.
4. Monitoring Plan – The sampling schedule which shows when each parameter list is collected at each site. The plan is on a weekly schedule to account for bi-weekly sampling carried out by some entities. There is highlighting to indicate when temperature sensors are installed at applicable sites.

The monitoring summary is in Appendix B.

2018 Stream Temperature Monitoring Plan

This section describes the results of the LBD analysis of the 2017 temperature monitoring network and subsequent 2018 Stream Temperature Monitoring Plan in the CEA. LBD's stream temperature monitoring program is intended to supplement the existing stream temperature monitoring network within the CEA.

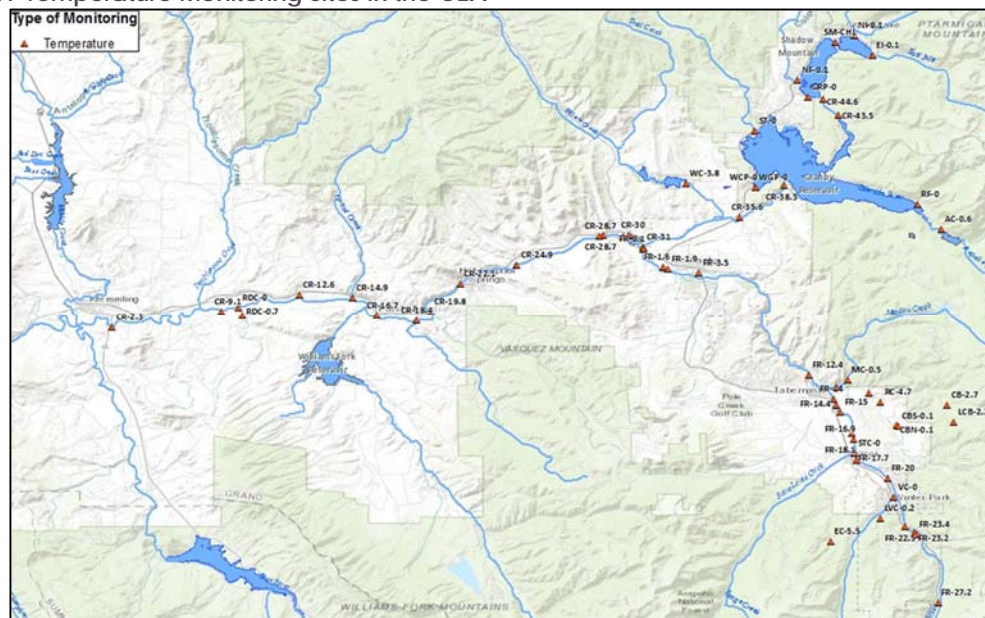
The LBD stream temperature monitoring program objectives are to:

- Complement existing stream temperature monitoring efforts;
- Provide the LBD operations subcommittee with timely data to make informed decisions about releases of environmental water;
- Provide stream temperature data to evaluate effectiveness of environmental water releases;
- Identify critical stream reaches for water temperature;
- Assess compliance with Colorado's stream temperature standards;
- Monitor and assess impacts of restoration efforts performed by LBD.

Existing Temperature Monitoring Network

In 2017, there were 61 temperature monitoring sites in the CEA. Several entities maintain these sites: BLM, GCWIN, Northern Water and the USGS. Stakeholders that support the existing program include LBD members as well as non-LBD members. A map of the 2017 monitoring sites is shown in Figure 1 and details of the program are included in the 2017 Monitoring Summary in Appendix B.

Figure 1 - 2017 Temperature Monitoring Sites in the CEA



2018 Changes in Temperature Monitoring Plan

The existing stream temperature monitoring network was analyzed for data gaps with respect to timeliness of data availability, impaired waters designation, spatial coverage, diversions, and baseline data needs. Based on these assessments, changes were made to the 2018 stream temperature monitoring plan.

Changes in Timeliness of Data Transmission

There are key sites within the LBD CEA where receiving data on a frequent basis will be helpful in guiding the LBD Operations Subcommittee on where environmental water releases (when available) would be the most beneficial in terms of maintaining temperatures that fall below the regulatory limits. To accommodate this, changes were made on the timeliness of data transmission at these sites for the 2018 monitoring season:

- STC-0 (Saint Louis Creek at the confluence of Fraser River) - One of the locations in the Moffat Collection System where Denver Water can release environmental water is Saint Louis Creek, but the Operations Subcommittee has not had the benefit of timely temperature data at that location to understand if releases would be beneficial in that drainage. To remedy this, GCWIN (who currently maintains this temperature station) will download and deliver stream temperature data on a weekly basis, when conditions allow, from this site and deliver it to the LBD Operations Subcommittee from July through September to support LBD operations and decision making.
- FR-3.5 (Fraser River at Hwy 40 in Granby) - This site has been monitored by GCWIN since 2005 and provides the necessary baseline data to demonstrate that temperature exceedances do exist in the Fraser River before it reaches the Colorado River. GCWIN (who currently maintains this temperature station) will download and deliver stream temperature data on a weekly basis, when conditions allow, from this site and deliver it to the LBD Operations Subcommittee from July through September to support LBD operations and decision making.
- CR-22.1 (Colorado River upstream of Hot Sulphur) and CR-16.7 (Colorado River upstream of Williams Fork confluence) - In addition to Northern Water's Municipal Subdistrict's (Subdistrict) real-time temperature gauge at CR-28.7 (Colorado River downstream of Windy Gap Reservoir) the Subdistrict has installed two new real-time stream temperature gauges in the Colorado River, a requirement of the Windy Gap Firing Project 401 Certification. Graphs of the most recent 30-days of data compared to the relevant temperature standards are available on Northern Water's website and available to the LBD Operations Subcommittee support LBD operations and decision making.

Review of Baseline Data Needs

Assessment of data needs was conducted on sites that were installed to collect pre- and post-restoration temperature data for the Fraser Flats River Habitat Project.

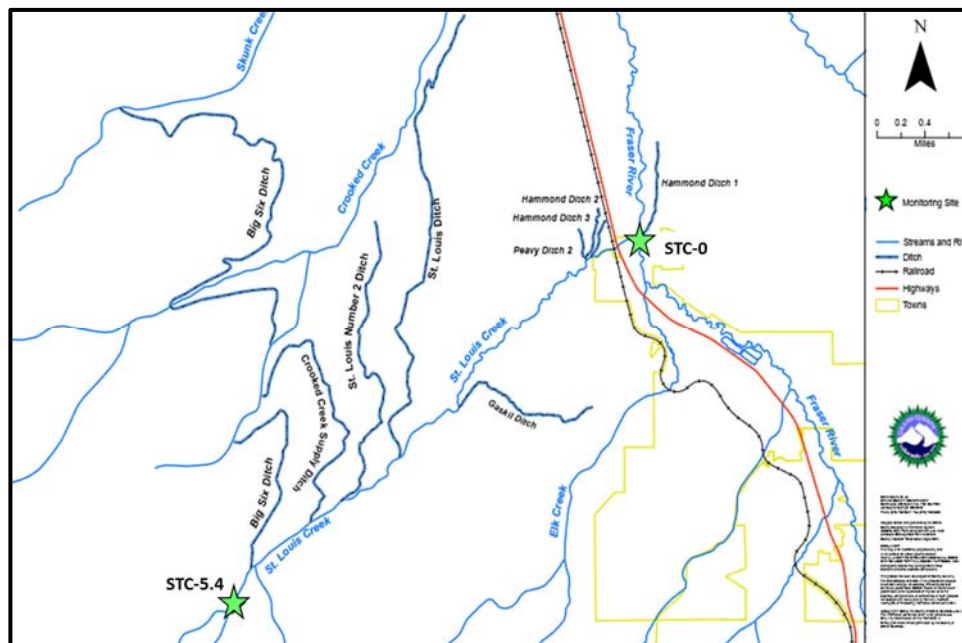
- FR-15 (Fraser Flats River Habitat Project Upstream) and FR-14.4 (Fraser Flats River Habitat Project Downstream) - GCWIN has maintained temperature loggers since 2015 at the upstream Fraser Flats project boundary (Devil's Thumb Ranch property) and the lower Fraser Flats project boundary (Grand County Water and Sanitation District #1 property). GCWIN will maintain these stream temperature stations in 2018 to continue to monitor the effects of the Fraser Flats River Habitat Project.

Review of Spatial Distribution of Temperature Sites

A review was done on the spatial distribution of the 2017 temperature monitoring network. This resulted in the addition of four new sites:

1. STC-5.4 – This site is in the Saint Louis Creek at the USGS Streamflow Gauge near Fraser Experimental Forest Headquarters. It is upstream of GCWIN's existing Saint Louis Creek temperature site (STC-0), as well as upstream of several irrigation diversions (Figure 2). Collection of temperature data at this site will facilitate better understanding of thermal patterns in this tributary.

Figure 2 – New and Existing Temperature Sites in Saint Louis Creek



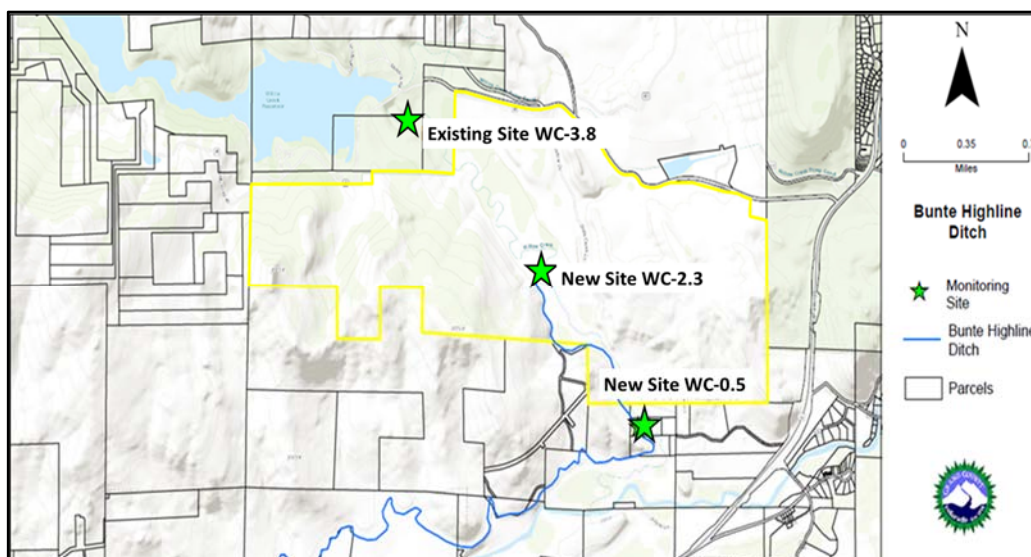
Northern Water owns a parcel of land below Willow Creek Reservoir (outlined in yellow in Figure 3). Part of this land, which includes approximately three miles of Willow Creek, will be opened for public use per Section IV. D. of the Windy Gap Firming Project IGA (IGA, 2012):

Public Access. Upon execution of this WGFP IGA, the Subdistrict will make arrangements with Northern Water to provide public access to that portion of Willow Creek located on Northern Water's lands for as long as Northern Water owns the lands adjacent to Willow Creek, if and to the extent that the public access will be managed by the Colorado Division of Parks and Wildlife or other entity acceptable to Northern Water.

Colorado Parks and Wildlife has indicated a willingness to manage the property as early as 2018. To gain a better understanding of temperature regimes in this section of Willow Creek, two temperature sites were added in 2018. Northern Water maintains a stream temperature site immediately below the dam on Willow Creek Reservoir, there is not a site that shows what warming occurs in Willow Creek from the dam to the confluence with the Colorado River. The Bunte Highline Ditch, which is between the dam and the confluence, can take a significant amount of water from Willow Creek; to see the effects of this diversion there is a site located upstream and downstream of the diversion.

2. WC-2.3 – This site is in Willow Creek downstream Willow Creek Reservoir and upstream of the Bunte Highline Ditch (Figure 3).
3. WC-0.5 – This site is in Willow Creek upstream of the Colorado River confluence and downstream of the Bunte Highline Ditch (Figure 3).

Figure 3 - New and Existing Temperature Sites on Willow Creek



4. WF-5.5 – This site is located in Williams Fork upstream of Williams Fork Reservoir (Figure 4) Denver Water will be doing a river restoration project in Fall 2018 in this reach above the reservoir. The rationale for this site includes: baseline data are lacking, a temperature site would complement temperature data gathered from BLM in 2016, and it could be beneficial to establish a baseline prior to construction of the river restoration project to discern any changes over time.

Figure 4 – New Temperature Site on Williams Fork



Table 2 - Summary of Changes to the 2018 Temperature Monitoring Network

River Mile ID	Station Description	Latitude	Longitude	Monitoring Frequency
STC-0	Saint Louis Creek at the confluence of the Fraser River	39.951154	-105.81557	Weekly (July 2-Sept.15)
STC-5.4	Saint Louis Creek at the USGS Streamflow Gauge near Fraser Experimental Forest Headquarters	39.909971	-105.87832	Bi-weekly
FR-3.5	Fraser River at Hwy 40 in Granby	40.081027	-105.9312	Weekly (July 2-Sept.15)
WC-2.3	Willow Creek downstream of Willow Creek Reservoir and upstream of the Bunte Highline Ditch	40.137035	-105.92904	Bi-weekly
WC-0.5	Willow Creek upstream of the Colorado River confluence and downstream of the Bunte Highline Ditch	40.125010	-105.91491	Bi-weekly
WF-5.5	Williams Fork upstream of the Williams Fork Reservoir	40.000139	-106.17983	Bi-weekly

New Temperature Site Maintenance

The four new sites are maintained by GCWIN. In order to remain consistent with historical GCWIN stream temperature data, the following protocols are followed:

- GCWIN utilizes HOBO Water Temp Pro v2 Data-loggers (Part # U22-001, Onset Computers, Inc., Bourne, Massachusetts) All sensors are calibrated using a 2-point water bath method. Sensors outside of the range including +/- 0.1 °C annual drift will not be used.
- Sensors with a battery voltage below 2.4 V are be used.
- All sensors use the same shuttle for downloading data to a computer – Onset’s Hobo Optic USB Base Station U-4.
- Sensors are set to record data every 15 minutes, i.e. at 0:00, 0:15, 0:30, and 0:45 minutes on the hour. They record temperature in °C as well as recording battery voltage.
- For sensors not deployed year-round, place in river before May 1st.
- Ideally, sensor is placed in the thalweg, or mid-50% of stream width, assuming these locations are in flowing water. Above all, sensor needs to be located in flowing, deep water.
- If sensor is not in the thalweg/mid 50%, it needs to be placed in a minimum of 18” of flowing water, preferably in the river “bubble line”. The water needs to be sufficiently flowing so silt does not accumulate on sensor and flow is comparable to that seen in thalweg.
- Data handling includes download, QA/QC, post-processing, storage, and distribution of temperature data.

2018 Substrate Sampling Plan

Monitoring of river substrate began in 2010 “to document the habitat quality of select trout spawning bars along the Fraser and Colorado Rivers within Grand County in response to the annual stream flow regimes. The primary goal was to evaluate the draft flushing flow recommendations contained in the SMP. These recommendations were based on maintenance of the structure and function of these important spawning habitats.” (Tetra Tech and HabiTech, 2018)

In 2018, the objectives of the monitoring include:

- Evaluate flushing flows in key reaches within the SMP project area;
- Report on physical conditions in the riffles at more recently added macroinvertebrate monitoring locations.

Substrate monitoring consists of three components: core sampling, 100-count pebble counts, and Riffle Stability Index (RSI) measurements.

Core sampling is used to measure particle size distributions, and particularly percent fines. Data from core sampling can be compared to applicable state standards for trout spawning bar habitat quality. Several years of core samples in higher flow years with similar results have resulted in a recent focus on core sampling only during low flow years.

Pebble counts document surficial substrate particle size, the degree of embeddedness, and the presence/absence of aquatic vegetation. Pebble counts are conducted using a modified 100-count Wolman Pebble Count method. Pebble counts have been collected using this methodology since 2010 providing continuity in the dataset. Pebble counts are used to assess spawning bars and macroinvertebrate habitats.

Riffle Stability Index (RSI) evaluations will be made at each site during the sampling period to help determine whether spring flows have been enough to mobilize coarse bed particles and facilitate bar dynamics.

Monitoring Sites and Sampling Frequency

In 2018, the Colorado River was anticipated to contain 80% of average flows. Therefore, core samples will be collected on the Colorado for the first time in several years at three sites in the CR4, CR5, and CR6 reaches (Table 3). Core samples will not be collected on the Fraser River and Ranch Creek since both streams exceeded flushing flow recommendations during runoff. Six core samples will be collected in each reach. Pebble counts will also be conducted at the three core sample sites for assessment of the spawning habitat.

Table 3 – LBD Core Sampling Reaches

Reach Designation	Site Description
CR4	Paul Gilbert or Pioneer Park site depending on site conditions
CR5	Downstream of Williams Fork confluence and Parshall
CR6	Downstream of KB Ditch

In 2018, pebble counts will be collected to accompany all macroinvertebrate sampling sites, regardless of whether the macroinvertebrate site is part of a permit requirement, part of an existing monitoring program, or a new site as recommended by the LBD monitoring committee. These sites are shown in Table 4. For maps and details on new sites see 2018 Macroinvertebrate Monitoring Plan.

Table 4 - LBD Pebble Count Sites Associated with Macroinvertebrate Sites

River Mile ID	Former Station Name	Station Description
FR-23.2	FR-abvWPSD	Fraser River above Winter Park Sanitation District
FR-20	FR-Rendezvous	Fraser River at Rendezvous Bridge
FR-15	FR-FrSpProj	Fraser River upstream of Fraser Flats restoration
FR-14	FR-CR83	Fraser River at Tabernash below bridge on CR83
RC-1.1	RC-blwMC	Ranch Creek below Meadow Creek
FR-27.2	New	Fraser River upstream of Jim Creek and Mary Jane entrance
STC-0	New	Saint Louis Creek at Fraser River
CR-31	CR-WGU	Colorado River upstream from Windy Gap
CR-28.7	CR-WGD	Colorado River downstream of Windy Gap
CR-22.9	CR-HSU	Colorado River at Pioneer Park upstream of Hot Sulfur Springs
CR-16.7	CR-WFU	Colorado River upstream of Williams Fork
CR-9.1	CR-KBD	Colorado River at CR39 Bridge at KB Ditch
CR-7.4	New	Colorado River downstream of Troublesome Creek
CR-1.7	New	Colorado River upstream of the Blue

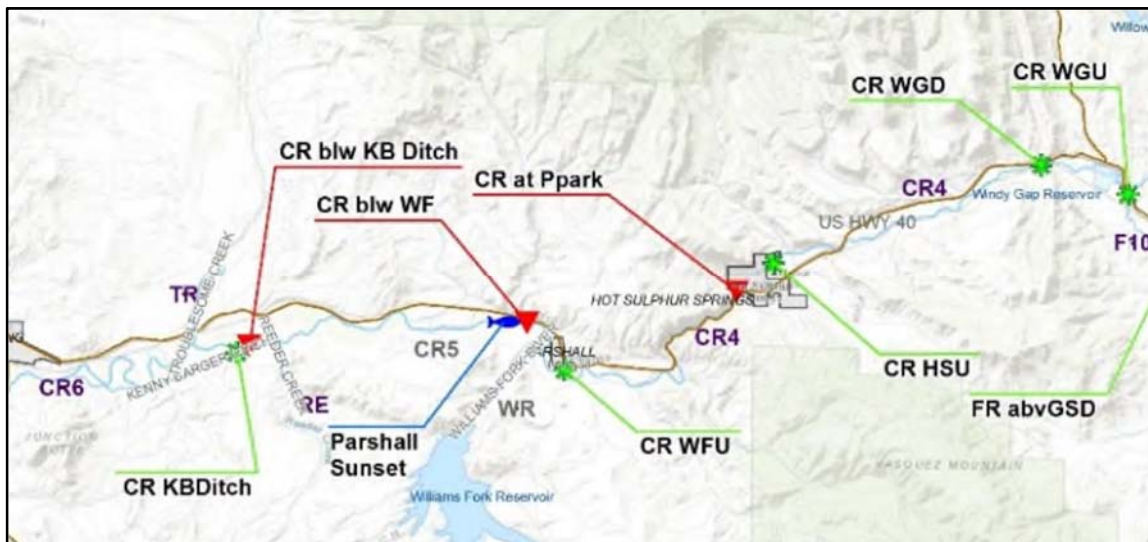
All sampling will be conducted in the early fall.

Site Maps

Figure 5 – CR4 Paul Gilbert Core Sample Site



Figure 6 – CR5 and CR6 Core Sample Sites at Pioneer Park, below Williams Fork, and below KB-Ditch



Funding

Costs for the 2018 substrate monitoring will be shared among some LBD partners. The partners have agreed to pay a percentage of the total cost based on their contributions in 2017. The cost distribution is for 2018 is:

LBD Partner	Contribution %
Grand County	28%
Denver Water	27%
Northern Water/Subdistrict	22%
River District	10%
TU	8%
LBD	5%

In addition, ILVK will fund 50% of the monitoring costs for the two new sites in the Colorado River that are associated with the ILVK restoration project (CR-7.4 and CR-1.7). The remaining costs at these two sites will be covered by the LBD partners at their respective contribution percentage.

2018 Macroinvertebrate Monitoring Plan

Macroinvertebrate (aquatic organisms) communities are a good indicator of overall stream health. Macroinvertebrate communities are sensitive to a wide range of environmental disturbances and pollution. While water quality monitoring provides a snapshot of conditions at a specific time, it can fail to capture changes in water quality that may occur between sampling events. The effects of changes in water quality on macroinvertebrate communities can linger, making macroinvertebrate monitoring a good tool for detecting fluctuating environmental conditions. Changes in macroinvertebrate communities can signal impacts from urban development and changes in land use, the riparian habitat or stream channel. Community diversity and presence (or absence) of certain sensitive species are indicators of the biological and ecological integrity of the rivers.

The following is a summary the LBD 2018 Macroinvertebrate Monitoring Plan within the CEA. The objectives of the 2018 LBD macroinvertebrate monitoring program are to:

- Complement existing monitoring efforts;
- Assess the existing state of macroinvertebrate communities in the CEA;
- Monitor trends and changes to the health of the macroinvertebrate communities;
- Assess compliance with Colorado's aquatic life standard;
- Monitor and assess impacts of restoration efforts performed by Learning by Doing.

A summary of existing monitoring efforts, Denver Water's, the Subdistrict's and Northern Water's Baseline 2018 macroinvertebrate monitoring programs within the CEA, is included under the *Existing Monitoring Programs* section.

Data collected through this program are assessed using the Colorado Water Quality Control Division's (Division's) Multi Metric Index (MMI) to determine compliance with Colorado's aquatic life standard (Colorado Department of Public Health and Environment, 2010). LBD has elected to compute additional standard metrics as a part of this program to provide a complete assessment of the macroinvertebrate community. The methods utilized are consistent with the Division's protocols for collection and analysis of macroinvertebrates.

The program is reviewed annually.

Monitoring Sites and Sampling Frequency

In 2018, the LBD macroinvertebrate monitoring program consists of 12 sites; 3 sites in the Colorado River, 4 sites in the Fraser River, 2 sites in Fraser River tributaries (Ranch Creek and Saint Louis Creek) and 3 sites in Williams Fork. The monitoring frequency is site specific and varies from annual sampling to sample collection every 2 – 3 years. Several of the sampling locations are sites that will be monitored long-term to provide a baseline of data to track changes. Other sites are specific to restoration or anticipated restoration projects and may only be monitored for the duration of the project.

Table 5 lists the 2018 LBD macroinvertebrate sites, indicates sampling frequency at each site, when the site was last monitored, and which sites are project specific. Some sites are new as of 2018 and monitoring frequency has not yet been established.

Table 5 - LBD Macroinvertebrate Sampling Sites

River Mile ID	Station Description	Monitored in 2018	Monitoring Frequency	Year Last Monitored	Project Specific Site
FR-27.2	Fraser River upstream of Jim Creek and Mary Jane entrance	Yes	TBD	New	No
FR-15	Fraser River upstream of Fraser Flats restoration	Yes	Annually	2017	Yes
FR-12.4	Fraser River upstream of Fraser Canyon	No	1x per 2-3 years	2017	No
FR-1.9	Fraser River upstream of Granby Sanitation District	No	1x per 2-3 years	2017	No
STC-0	Saint Louis Creek at Fraser River	Yes	TBD	New	No
RC-1.1	Ranch Creek downstream of Meadow Creek	Yes	Annually	2017	No
CR-9.1	Colorado River at CR39 Bridge at KB Ditch	Yes	1x per 2-3 years	2017	Both
CR-7.4	Colorado River downstream of Troublesome Creek	Yes	TBD	New	Yes
CR-1.7	Colorado River upstream of the Blue River	Yes	TBD	New	Yes
WF-13.1	Williams Fork downstream of Henderson Mill	Yes	TBD	New	No
WF-5.5	Williams Fork upstream of Williams Fork Reservoir	Yes	TBD	New	Yes
WF-2	Williams Fork downstream of Williams Fork Reservoir	Yes	TBD	New	Yes

Criteria for Determining Sampling Frequency

Changes in macroinvertebrate communities can occur as a result of a variety of factors such as land-use changes, pollution, hydrology, stream restoration, agricultural diversions, highway maintenance activities, and natural events such as droughts, floods and wildfire. Knowledge and understanding of activities taking place in the watershed should therefore inform the need for and frequency of sampling at any given site. Some amount of inter-annual variability is to be expected due to varying hydrology even at sites subject to stable watershed influences.

The following guidelines can be used to inform monitoring decisions:

- Sites that are attaining state aquatic life standards as assessed with the MMI and have no known/identified stressors likely to adversely impact macroinvertebrate communities can be sampled every two to three years.
- When available, historical data should be reviewed to evaluate potential changes or lack thereof. Sites displaying no changes in MMI scores can be sampled every two to three years. Sites displaying various MMI scores should be sampled annually.

- Where impacts from changes in land-use, known stressors or restoration, are expected, samples should be collected annually.

2018 Changes to Monitoring Sites and Sampling Frequency

Generally, monitoring sites are intended to provide a long-term record. It is anticipated that only minor changes in the location of the sites would occur from one year to the next. During the annual review of the monitoring program, sites may be added or removed, especially in the short-term. As the macroinvertebrate monitoring program for LBD is evolving, changes may need to take place in the list of sites to better meet the objectives of the program. Sites that are established specifically to assess the effectiveness of restoration projects might be monitored on a short-term basis and have reduced sampling frequency or be discontinued once a post project baseline is established.

In 2018, there were several changes made to the LBD monitoring sites and sampling frequency:

- Three long-term sites were changed from sampling on an annual basis to sampling every one time every 2-3 years.
- Seven of the monitoring sites included as part of the 2017 LBD macroinvertebrate monitoring program are now considered part of Denver Water and the Subdistrict's existing monitoring programs. These programs are discussed in the detail in the *Existing Monitoring Programs* section.
- Seven new monitoring sites were added to the program.

Changes to Sampling Frequency

Based on the criteria for determining sampling frequency, three long-term sites were changed from sampling on an annual basis to sampling every one time every 2-3 years:

1. FR-12.4 - The MMI scores have varied over the last 3 years, but the 2017 MMI score was well above the attainment threshold. Additionally, Denver Water collects annual macroinvertebrate samples at a site located 1.6 river miles upstream (FR-14) as part of the existing monitoring program. Macroinvertebrate data from FR-14 will be a good indicator of conditions at FR-12.4; if MMI scores are low here, sampling will occur at FR-12.4 the following year.
2. FR-1.9 - The MMI scores from 2011-2017 were all well above the attainment threshold. Additionally, Northern Water will collect macroinvertebrate samples at a site located approximately 1.8 rivermiles downstream (FR-0.1) in 2018.

3. CR-9.1 - The MMI scores from 2011-2017 were all above the attainment threshold. This site as a long-term site will be monitored at a reduced frequency. This site is also the upstream site of the Irrigators in Lands in the Vicinity of Kremmling (ILVK) restoration project; for the duration of this project monitoring will be done annually.

New Monitoring Sites

After reviewing the spatial distribution of the 2017 and 2018 site locations, seven sites were added to the 2018 LBD macroinvertebrate sampling program:

1. FR-27.2 – This site is in the Fraser River upstream of Jim Creek. It is located in stream segment COUCUC10a_C, which is listed impaired for aquatic life use on the Colorado 303d list. Aquatic life use is assessed by the MMI score. The addition of a site in this segment allows monitoring of changes in the listed segment.
2. STC-0 – This site is in the Saint Louis Creek at confluence with the Fraser River. There are not any historic data available in this tributary to provide a baseline of macroinvertebrate health. The addition of this site will provide insight into current conditions and establish a baseline to assess changes over time. The site is located in the general vicinity of the existing GCWIN temperature monitoring site.
3. CR-7.4 – This site is in the Colorado River downstream of Troublesome Creek. Troublesome Creek contributes a significant amount of sediment to the Colorado River. ILVK has planned restoration work in the Colorado River from downstream of the confluence with Williams Fork to upstream of the confluence with the Blue River. The restoration includes reconstructed bank and channel features and revegetation in the riparian area. Macroinvertebrate monitoring pre-restoration will provide a baseline of data to assess the effectiveness of the project over time.
4. CR-1.7 – This site is in the Colorado River upstream of the Blue River. ILVK has planned restoration work in the Colorado River from downstream of the confluence with Williams Fork to upstream of the confluence with the Blue River. The restoration includes reconstructed bank and channel features and revegetation in the riparian area. This site is located downstream of two constructed riffles. Macroinvertebrate monitoring pre-restoration will provide a baseline of data to assess the effectiveness of the project over time.
5. WF-13.1 – This site is in the Williams Fork downstream of the Henderson Mill. It was added to address a gap in spatial coverage in the monitoring network. In July of 2016, BLM's "AIM" program conducted sampling at this location and generated an MMI score of 43.80. Although the sample was collected too early in the season for the data to be used to compute a valid MMI score, there is concern about potential

impairment. The MMI score falls in the grey area requiring further assessment using the Hilsenhoff Biotic Index and/or the Shannon Diversity Index to determine whether the site was in attainment. Monitoring at this site will help characterize potential impacts to the aquatic habitat due to runoff from the Henderson Mill.

6. WF-5.5 – This site is in the Williams Fork upstream of Williams Fork Reservoir. It was added to provide baseline data where Denver Water anticipates restoration work to be done. As a part of the mitigation required for the Moffat Expansion Project, Denver Water will be conducting stream restoration on a stretch of river upstream from the Williams Fork Reservoir. Macroinvertebrate monitoring at this location is not a permit requirement but would provide a baseline of data to measure the effectiveness of the restoration project over time. In addition, this site's location which is further downstream from WF-13.1, will demonstrate if there is any impact from or longitudinal recovery with distance traveled downstream from the Henderson Mill.
7. WF- 2 – This site is in the Williams Fork downstream of Williams Fork Reservoir. It was added to provide baseline data where Denver Water anticipates restoration work to be done. As a part of the mitigation required for the Moffat Project, Denver Water will be conducting stream restoration on a stretch of river downstream from the Williams Fork Reservoir. Macroinvertebrate monitoring at this location is not a permit requirement but would provide a baseline of data to help to measure the effectiveness of the restoration project over time.

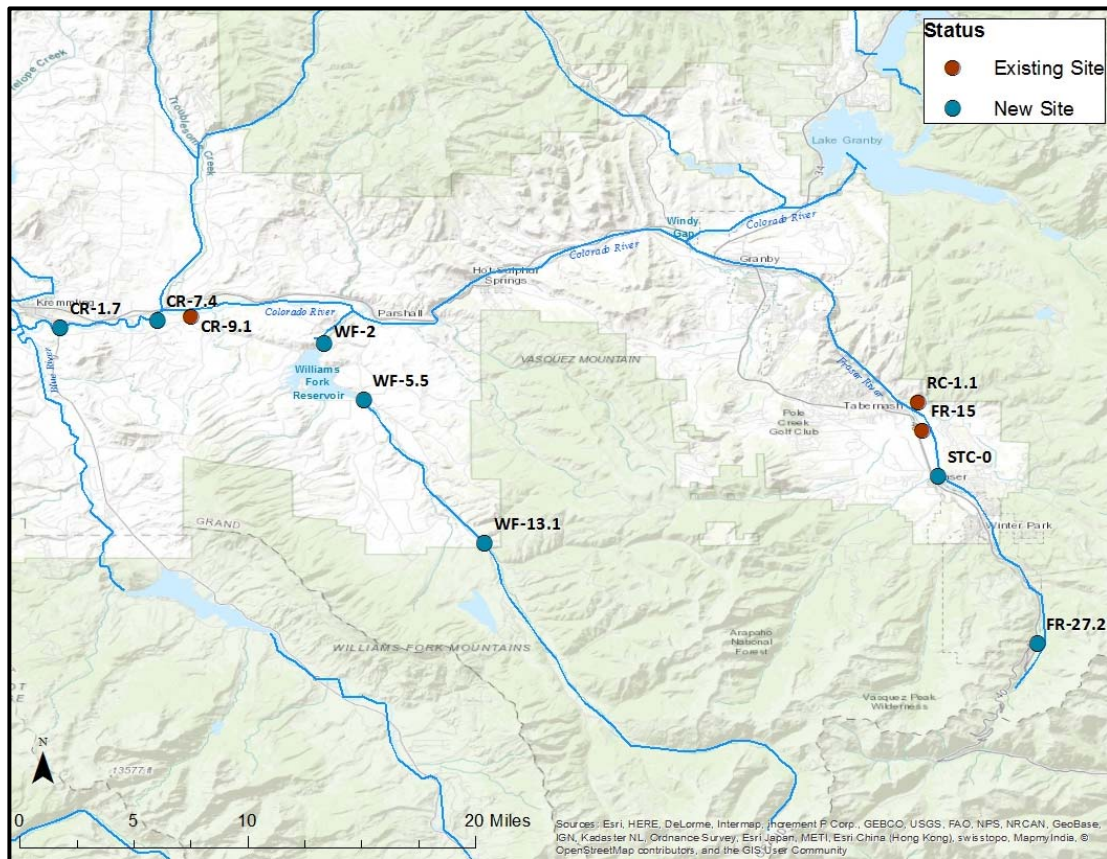
2018 Monitoring Sites

After adjusting the frequency of monitoring at select locations and the addition of new sites, macroinvertebrate sampling will be conducted at 10 out of the 12 LBD sites in 2018. The locations of these sites are shown in Table 6 and mapped in Figure 7. The locations of the new sites are approximate; the exact location will be determined at the time of sampling and will be based on where representative samples can be collected.

Table 6 - 2018 LBD Macroinvertebrate Monitoring Sites

River Mile ID	Station Description	Latitude	Longitude	New Site
FR-27.2	Fraser River upstream of Jim Creek and Mary Jane entrance	39.84536	-105.75177	Yes
FR-15	Fraser River upstream of Fraser Flats restoration	39.9813	-105.8249	No
STC-0	Saint Louis Creek at Fraser River	39.95175	-105.81471	Yes
RC-1.1	Ranch Creek downstream of Meadow Creek	39.9991	-105.8275	No
CR-9.1	Colorado River at CR39 Bridge at KB Ditch	40.05377	-106.28945	No
CR-7.4	Colorado River downstream of Troublesome Creek	40.0509	-106.3112	Yes
CR-1.7	Colorado River upstream of Blue River	40.0465	-106.3730	Yes
WF-13.1	Williams Fork downstream of Henderson Mill	39.9092	-106.1029	Yes
WF-5.5	Williams Fork upstream of Williams Fork Reservoir	40.0004	-106.17975	Yes
WF-2	Williams Fork downstream of Williams Fork Reservoir	40.036201	-106.204893	Yes

Figure 7 - Map of 2018 LBD Macroinvertebrate Monitoring Sites



Existing Monitoring Programs

This section summarizes existing macroinvertebrates monitoring programs that take place independently from LBD in 2018. This information is provided as the LBD macroinvertebrate monitoring program is intended to supplement existing monitoring efforts.

Moffat Project and WGFP 401 Certification Compliance Monitoring

Denver Water and the Subdistrict are both required to conduct annual macroinvertebrate monitoring at 7 sites in the LBD CEA to comply with the Moffat Project and Windy Gap Firing Project 401 Certifications (Colorado Department of Public Health and Environment, Water Quality Control Division, Moffat, 2016) (Colorado Department of Public Health and Environment, Water Quality Control Division, WGFP, 2016).

Beginning in 2018, Denver Water's requirements include 3 sites in the Fraser River and one site on Vasquez Creek, upstream of Winter Park.

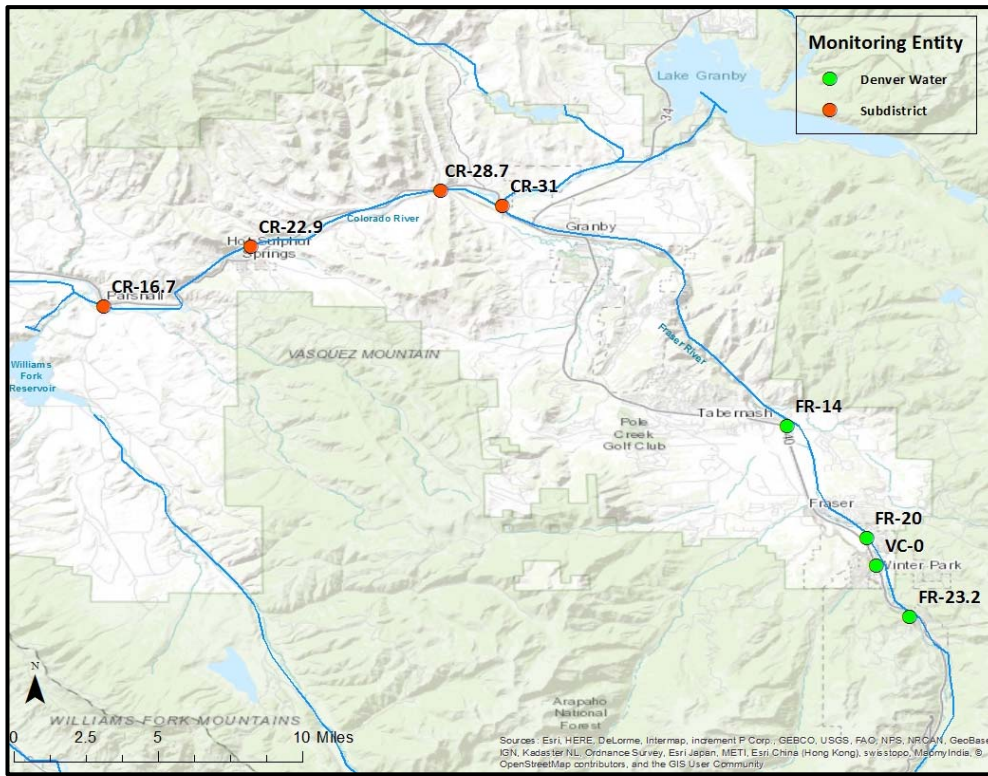
The WGFP 401 Certification requires sampling at 3 sites on the Colorado River. The Subdistrict also annually monitors an additional site that is not part of the 401 Certification requirements but that was deemed important to provide contextual information for the other 3 sites.

Seven of these sites were monitored in 2017 and were included as part of the LBD monitoring program. One additional site (Vasquez Creek) was added in 2018 by Denver Water in order to comply with its 401 Certification requirements. Eight sites are included in the combined 2018 monitoring programs for Denver Water and the Subdistrict shown in Table 7 and Figure 8.

Table 7 - 2018 Denver Water and Northern Water's Subdistrict's Macroinvertebrate Monitoring Sites

River Mile ID	Station Description	Entity	New Site	Permit Required
FR-23.2	Fraser River upstream of Winter Park San District	Denver Water	No	Yes
FR-20	Fraser River at Rendezvous Bridge	Denver Water	No	Yes
FR-14	Fraser River upstream of Tabernash	Denver Water	Yes	Yes
VC-0	Vasquez Creek at the town of Winter Park	Denver Water	Yes	Yes
CR-31	Colorado River upstream of Fraser and Windy Gap	Subdistrict	No	Yes
CR-28.7	Colorado River downstream of Windy Gap	Subdistrict	No	Yes
CR-22.9	Colorado River upstream of Hot Sulfur Springs	Subdistrict	No	Yes
CR-16.7	Colorado River upstream of Williams Fork	Subdistrict	No	No

Figure 8 - Map of 2018 Denver Water and Northern Water's Subdistrict's Macroinvertebrate Monitoring Sites



Northern Water's Baseline Macroinvertebrate Monitoring

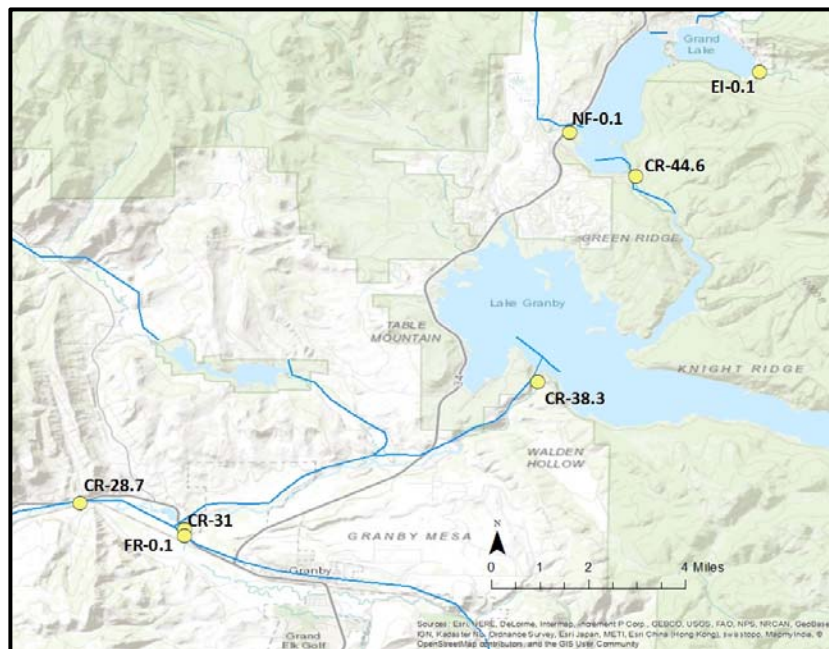
In addition to the macroinvertebrate monitoring that the Subdistrict carries out in the Colorado River to comply with the WGFP 401 Certification, Northern Water conducts baseline macroinvertebrate monitoring for the C-BT and Windy Gap Projects every 3-5 years.

The baseline monitoring includes 7 sites on the West Slope. Five sites are in the Colorado River from the North Fork of the Colorado River to downstream of Windy Gap Reservoir; one site is located in the Fraser River upstream of Windy Gap Reservoir; and one site is located in the East Inlet to Grand Lake. Site locations are shown in Table 8 and Figure 9. Samples are collected in the spring and fall. Northern Water's baseline macroinvertebrate monitoring is scheduled in 2018. *Note: two of the sites (CR-31 and CR-28.7) in Northern Water's Baseline Macroinvertebrate Monitoring Program are sites also monitored as part of the Subdistrict's 401 Certification compliance monitoring.*

Table 8 - Locations of Northern Water's Baseline Macroinvertebrate Monitoring Sites

River Mile ID	Station Description	Latitude	Longitude
EI-0.1	East Inlet upstream of Grand Lake	40.2369	-105.8010
NF-0.1	North Fork of Colorado River upstream of Shadow Mountain Reservoir	40.2190	-105.8577
CR-44.6	Colorado River downstream of Shadow Mountain Reservoir	40.2059	-105.8380
CR-38.3	Colorado River downstream of Granby Reservoir	40.1444	-105.8672
CR-31	Colorado River upstream of Windy Gap Reservoir and the Fraser River	40.1003	-105.9726
CR-28.7	Colorado River downstream of Windy Gap Reservoir	40.1082	-106.0037
FR-0.1	Fraser River upstream of Colorado River Confluence	40.0984	-105.9727

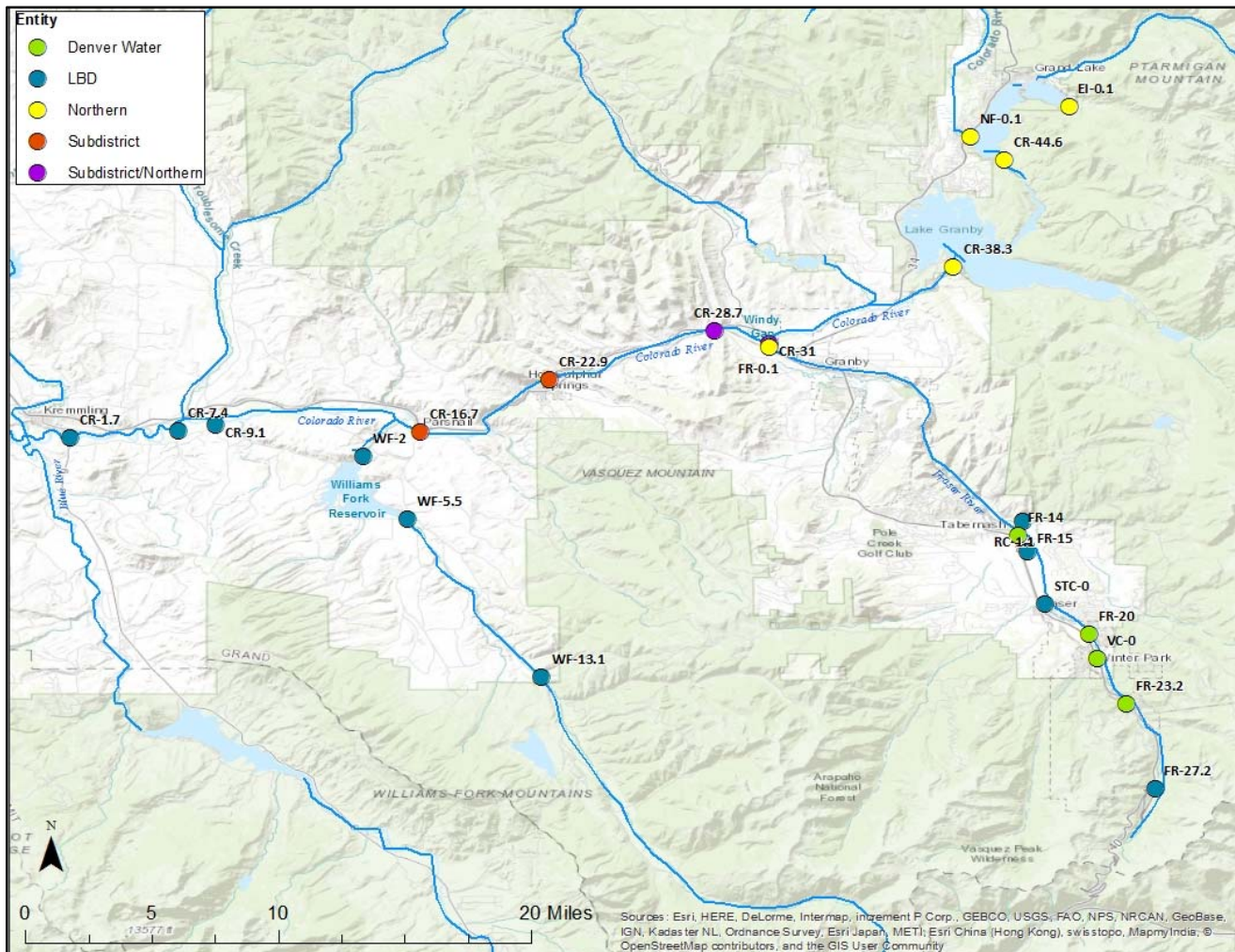
Figure 9 - Northern Water's Baseline Macroinvertebrate Monitoring Sites



Map of 2018 Macroinvertebrate Monitoring Sites

Figure 10 is a map of all of the locations where macroinvertebrate monitoring will occur within the CEA in 2018: the LBD monitoring sites, Denver Water and the Subdistrict's 401 Certification required sites, and Northern Water's Baseline Monitoring Program sites. Note: the CPW will likely be collecting additional macroinvertebrate samples as part of their work for the Windy Gap Connectivity Channel, which are not included on Figure 10.

Figure 10 - 2018 Macroinvertebrate Monitoring Sites in the CEA



Sample Collection and Macroinvertebrate Analysis

Results obtained by consistent sampling practices and accurate identifications provide valuable information regarding short and long-term changes in aquatic conditions. In addition, using analytical procedures that result in quantitative data (counting all bugs in a sample) provides an accurate and dependable dataset that makes changes more apparent. Quantitative data are especially useful when evaluating the effectiveness of restoration projects and/or mitigation of known stressors.

In addition, changes in data collection methods introduce inconsistencies in a dataset and make it difficult to perform trend analyses or compare data between sites sampled through separate programs.

In order to preserve the integrity of the dataset being developed by LBD and to allow integration with and comparison to Denver Water's, the Subdistrict's and Northern Water's

2018 macroinvertebrate monitoring, the 2018 LBD macroinvertebrate sampling method will remain the same as in 2017:

- Sampling occurs during the period from late September to early October (fall) to target macroinvertebrate communities during annual periods of high density. This sampling period is consistent with the Colorado Water Quality Control Division's methodology for macroinvertebrate sampling (Colorado Department of Public Health and Environment, 2010).
- Timberline Aquatics collects the samples utilizing protocols approved by the Division's *Section 303(d) Listing Methodology 2018 Listing Cycle* (Colorado Department of Public Health and Environment, Water Quality Control Division, March 2017). Three quantifiable Hess samples will be taken from riffle habitat at each of the sites. Each sample is taken from an area of similar size substrate and velocity (if possible) to avoid any bias from these physical parameters when making comparisons among sites.



Figure 11 - Sample Collection with a Hess Sampler

- Timberline Aquatics performs the macroinvertebrate analysis for all samples.
 - Identification and enumeration is done for the entire sample (i.e. all macroinvertebrates in the sample are counted).
 - Macroinvertebrates are identified to the lowest practical taxonomic level consistent with the Operational Taxonomic Unit (OTU) developed by the Division, which consists of genus or species for mayflies, stoneflies, caddisflies, and many dipterans. Chironomidae will be identified to the genus level.
 - As part of the quality control protocols at Timberline Aquatics, all sorted macroinvertebrate samples and approximately 10% of identifications are checked by another qualified taxonomist.

Laboratory Reports

Final data from Timberline Aquatics are provided in Excel files to the LBD Monitoring Committee. The files include a species list and count of all identified macroinvertebrates for each sample at each site. Ten metrics are calculated for each site and included in the excel file. The metrics are shown in Table 9.

In 2018 two MMI scores will be provided; one for MMI version 3 (which was used in 2017) and one for the updated tool, MMI version 4. The Sediment Tolerance Indicator Value (TIV_{sed}) was added to the list of metrics in 2018 as a biological indicator that assesses impacts of fine sediments.

Table 9 – Timberline Aquatics Reported Metrics and Description

Metric	Description
Multi-Metric Index (MMI)	Colorado Division of Water Quality assessment tool. Provides a score which determines health of aquatic community.
% Chironomidae (MMI Metric)	MMI score based on percent composition of chironomidae taxa. Chironomidae are tolerant to stress, a high score indicates a stressed environment.
% EPT excluding Baetis (MMI Metric)	MMI score based on a classification of species specific to Colorado which are sensitive to zones that transition from pristine to anthropogenic. Based on community composition rather than the richness of sensitive taxa.
Ephemeroptera Plecoptera Trichoptera (EPT)	Total number of distinguishable taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera.
Hilsenhoff Biotic Index (HBI)	Indicator of nutrient enrichment as well as other stressors. A widely used indicator of organic pollution. High values of the index indicate a predominance of tolerant organisms (i.e., the sensitive species have been lost).
Shannon Diversity	Indicator of macroinvertebrate community structure and balance.
Total Taxa Richness	Total number of identifiable taxa, indicator of general community health and stability.
Pteronarcys Californica Density	Pteronarcys Californica abundance, mean number per square meter.
Tolerance Indicator Value (TIV_{sed})	A biological indicator of impacts by excess fine sediments. The TIV_{sed} reflects both the reduction in relative abundance of sediment-sensitive taxa and the increase in relative abundance of sediment-tolerant taxa.
Total Density	Macroinvertebrate abundance mean number per square meter.

Funding

Costs for the 2018 macroinvertebrate monitoring will be shared among some LBD partners. The partners each pay a percentage of the total cost based on their contributions in 2017. The cost distribution is for 2018 is:

LBD Partner	Contribution %
Grand County	28%
Denver Water	27%
Northern Water/Subdistrict	22%
River District	10%
TU	8%
LBD	5%

In addition, ILVK will fund 50% of the monitoring costs for the two new sites in the Colorado River that are associated with the ILVK restoration project (CR-7.4 and CR-1.7). The remaining costs at these two sites will be covered by the LBD partners at their respective contribution percentage.

Denver Water, Subdistrict Monitoring and Northern Baseline Monitoring

Denver Water, the Municipal Subdistrict and Northern Water will fully fund sampling for the Moffat Project and WGFP 401 Certification Compliance Monitoring and Northern Water's Baseline Monitoring Program.

2018 Fraser Flats River Habitat Project Monitoring Plan

The following plan has been approved by the LBD Management Committee for 2018 monitoring of the Fraser Flats River Habitat Project. While not required as part of its 404 Permit for the project, LBD has voluntarily elected to create a temporary monitoring program, which will follow the measures in the *Monitoring at-a-Glance* table at the end of this section.

Program Objectives

The objectives of the Fraser Flats River Habitat Project monitoring program include documentation of the following parameters:

- Aquatic habitat features and substrate conditions
- Benthic macroinvertebrate abundance and diversity
- Trout population estimates and quality trout
- Riparian woody habitat
- Instream temperature monitoring

Construction of the project was completed in September 2017. This temporary monitoring program will be performed annually for at least 3 years post-project according to the program's guidelines finalized on October 20, 2017¹.

Scope of 2018 Monitoring Program Proposal

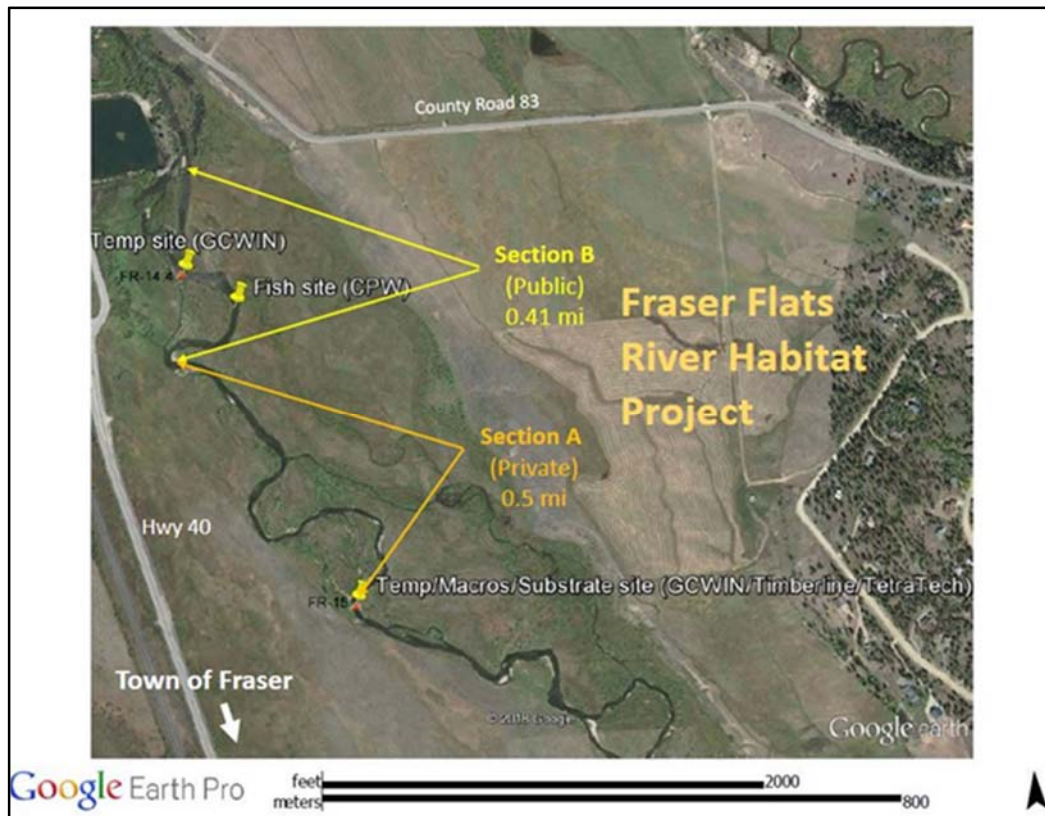
The scope of the 2018 monitoring program is to document and compare the 2018 conditions with the pre-construction (baseline) conditions of the project site.

Monitoring Program Components

The following describes the sampling and/or monitoring for 2018. A map showing the locations of the sampling sites is provided in Figure 12.

¹ LBD Monitoring Subcommittee, 2017. Fraser Flats River Habitat Project Monitoring Program Guidelines. Revised October 20, 2017 based on the August 16, 2016 monitoring plan.

Figure 12 - Map of 2017 Fraser Flats Monitoring Sites



Aquatic Habitat and Substrate Conditions

1.0 Aquatic Habitat Features Data Collection

The purpose of this task is to compare the number and condition of the aquatic habitat features present in the project reach to pre-project conditions. This task can be approached one of two ways, either by field observations or by actual field measurements (options 1 and 2). For 2018 monitoring, a blend of both options 1 and 2 will be performed, as resources and time allow. The laser level survey equipment required in option 2 has been approved for purchase by the LBD Management Committee and will be obtained prior to the field sampling.

Option 1 – Field Observations only. This option does not require sampling; however, a site visit will occur in late summer/early fall of 2018 during low flow conditions to conduct field observations of the aquatic habitat features in the project reach. This field visit will be performed by members of the Subcommittee.

Prior to the field visit, the 2017 pre-project conditions documented in Freestone Aquatics' design drawings² will be used to quantify the aquatic habitat features present before the project was constructed. This pre-project inventory will include the number of riffles and pools in the project reach. Photographs, field notes, and the design drawings will be used to assess the pre-project condition of these features.

During the 2018 field visit, the as-built design drawings³, as-built photographs, and aerial photography (if available from Lighthawk) will be used to identify the location of the aquatic habitat features in the project reach. An inventory of the number of riffles, runs, and pools in the project reach will be documented in the field. Field notes and photographs will be used to record the condition of these aquatic habitat features and any changes from the as-built design drawings, if applicable.

Photo points capturing visible aquatic habitat features in the project reach may be established for visual comparison year to year.

Option 2 – Field Measurements only. This option includes performing field measurements using survey equipment to capture cross-sections of the project reach. A set of 5 or 6 cross sections would be established at locations along the project reach based on the pre-project (baseline) cross-sections performed by Tetra Tech and refined by Freestone Aquatics. A laser level will be used to measure the condition of width-to-depth ratios of habitat features and the depth of pools in each cross-section. Jon Ewert (CPW) offered to collect the cross-section field measurements and he may be assisted by members of the Subcommittee.

These measurements will be used to compare the conditions of the cross-sections to the as-built design drawings to evaluate whether any changes are occurring over time such as shifts in the width-to-depth ratios of habitat features or sedimentation of pools filling in.

1.1 Substrate Conditions Data Collection

The purpose of this task is to compare the substrate conditions of the project reach to pre-project conditions. Field sampling of pebble counts (i.e. material

² Freestone Aquatics, 2017. Fraser Flats Aquatic Habitat Restoration Project. January 20, 2017.

³ Freestone Aquatics, 2017. Fraser Flats Aquatic Habitat Restoration Project As-Built Set. September 29, 2017.

sizes, presence of fines, and embeddedness) will be performed by Tetra Tech in late summer/early fall of 2018 during low flow conditions.

The pre-project pebble count data will be extracted from Tetra Tech's 2017 report prepared for LBD to be used to compare to the 2018 data measured in the project reach.

1.2 Summary Table

A table summarizing the field data on aquatic habitat features and substrate conditions will be created to provide a concise comparison between the 2017 pre-project and 2018 post-project conditions. This table will be used to document progress made with regards to *Objective #1 - An increase in aquatic habitat features and improved substrate conditions.*

2.0 Macroinvertebrates

2.1 Macroinvertebrate Sampling Data Collection

The purpose of this task is to compare the macroinvertebrate community present in the project reach to pre-project conditions. The macroinvertebrate field sampling will be performed by Timberline in fall of 2018.

The pre-project sampling results on macroinvertebrate abundance and diversity will be extracted from Timberline's 2017 data prepared for LBD to be used to compare to the 2018 macroinvertebrate sampling results.

2.2 Summary Table

A table summarizing the field data on abundance and diversity of macroinvertebrates will be created to provide a concise comparison between the 2017 pre-project and 2018 post-project data. This table will be used to document progress made with regard to *Objective #2 - An increase in benthic macroinvertebrate abundance and diversity.*

3.0 Fish

3.1 CPW Electrofishing Survey Data Collection

The purpose of this task is to compare the fish community present in the project reach in terms of trout population estimates and density of quality trout (defined as greater than 14 inches) to pre-project conditions. An electrofishing survey will be performed by Colorado Parks and Wildlife (CPW) in fall of 2018. Members of the Subcommittee may participate in the fish survey.

CPW will monitor the project reach with the goal of documenting changes in⁴:

- o biomass (pounds per surface acre of water),
- o density of trout greater than 14 inches, and
- o expected densities of sculpin.

The 2018 fish survey will be performed at CPW's established electrofishing site in Section B (Grand County Water and Sanitation District #1 property) of the project reach. Accurate estimates of sculpin are difficult to measure owing to several factors, such as: the skills and experience of the volunteer field crew, and the fact that sculpin lack an air bladder so they don't float after being stunned by the arc of the electrofishing probe, which causes them to fall beneath rocks where they are often unable to be netted. For these reasons, a review of the number of sculpin captured in the fish survey each year will be evaluated according to the density of sculpin expected to be seen based on the conditions of the stream and trout population present.

The pre-project survey results quantifying fish biomass, density of trout greater than 14 inches, and number of sculpin will be extracted from CPW's 2016 and 2017 data to be used to compare to the 2018 fish survey results.

Comparisons of fish species composition and age class may also be considered in the assessment of pre- and post-project data.

3.2 Summary Table

A table summarizing the fish survey results quantifying fish biomass, density of trout greater than 14 inches, and number of sculpin will be created to provide a concise comparison between the 2016 and 2017 pre-project data and the 2018 post-project data. This table will be used to document progress made with regard to *Objective #3 - An increase in fish counts and quality trout.*

4.0 Riparian Woody Habitat

4.1 Riparian Woody Vegetation Survey Data Collection

The purpose of this task is to compare the riparian woody habitat present in the project reach to pre-project conditions. The canopy of willow and cottonwood stakes planted in the revegetated areas in May 2017 is expected to mature over

⁴ LBD Monitoring Subcommittee, 2017. Fraser Flats River Habitat Project Monitoring Program Guidelines. Revised October 20, 2017 based on the August 16, 2016 monitoring plan.

time to provide bank stabilization and increased shade cover, which will benefit the river by helping to provide cool instream habitat.

A field visit to conduct woody stem counts in the revegetated areas will be conducted by the Trout Unlimited Colorado Headwaters Chapter in the summer of 2018. Members of the Subcommittee may participate in the survey. Prior to the field visit, the riparian revegetation design plan prepared by Anna Drexler-Dreis⁵ will be reviewed to determine the locations of the revegetated areas and the numbers of willow and cottonwood stakes planted in each area in 2017.

During the 2018 field visit, photographs will be taken at the established photo points documented in the revegetation plan. Woody stem counts will be performed in the revegetated areas. Field notes on the condition and survival rate of the plantings will be recorded.

The pre-project and post-project revegetation data will be evaluated in two ways: (i) spatially using aerial photographs (if available) and photos taken at the established photo points for year to year comparisons of the canopy re-establishment; and (ii) quantifying the number and condition of the willow and cottonwood plantings for year to year comparisons of the survival rate and health of the vegetation community.

4.2 Summary Table

A table summarizing the field data on the riparian woody habitat will be created to provide a concise comparison between the 2017 pre-project and 2018 post-project data. This table will be used to document progress made with regard to *Objective #4 - An increase in riparian woody habitat.*

5.0 Stream Temperature

5.1 Stream Temperature Data Collection

The purpose of this task is to compare instream temperatures with pre-project conditions with the goal of documenting changes in instream temperatures over time. GCWIN maintains temperature loggers at the upstream project boundary on Section A (Devil's Thumb Ranch property) and the lower project boundary on Section B (Grand County Water and Sanitation District #1 property). GCWIN will collect stream temperature data at these locations in 2018.

⁵ Drexler-Dreis, Anna. 2017. Fraser Flats River Habitat Project Vegetation Plan. Approved by the LBD Governance Committee on September 28, 2016. Updated on March 8, 2017.

The pre-project stream temperature results from GCWIN's 2015-2017 data will be used to compare with the 2018 stream temperature results.

5.2 *Summary Table*

A table summarizing the stream temperature data at the upstream and downstream sites from the project reach will be created to provide a concise comparison between the pre-project and 2018 post-project data. This table will be used to document progress made towards *Objective #5 - Instream Temperature Monitoring (to evaluate reductions in stream temperature)*.

Monitoring At-A-Glance⁶

	Method	Agency	Frequency & duration	Sample Season	Site Location	Notes
Benthic macro-invertebrates	NAMC* protocol	Timberline Aquatics	annual for 3 years post construction	September of each year	1) New site in restoration area 2) County Road 83	Reach-based approach, 8 samples per site, composited, subsampled to 300. Metrics are calculated from these results.
Fish count surveys	electro-fishing	CPW	annual for 3 years post construction	September of each year	1) In restoration area 2) Fraser Safeway 3) Fraser, Kaibab Park in Granby	All trout species & sculpin will be totaled, and trout biomass (pounds per acre), fish >14" per surface acre, and >6" per mile will be reported.
Riparian survey	photos and woody stem counts	Trout Unlimited	every 3-5 years for 10 years.	First two years post construction	1) In restoration area	Include: percentage of woody canopy and riparian plant species, monumented photo points and photos.
Substrate conditions	pebble counts	Tetra Tech	annual for 3 years post construction	September of each year	1) New site in restoration area 2) County Road 83	Document bar material sizes, presence of fines and embeddedness.
Aquatic habitat features	photo points	LBD/CPW	annual for 3 years post construction	Low flow	To be determined	pre- and post-construction monitoring using photographs and the inventory of # riffles, runs, pools in project reach.
Stream Temperature	temperature loggers	GCWIN**	15-minute interval time-series; annual	Annually during ice off	1) Upstream project boundary 2) downstream project boundary	Measurable results as a result of the project are not anticipated because temperature depends upon several factors, and this is a relatively short, low gradient reach.

*Bureau of Land Management/Utah State University National Aquatic Monitoring Center

**Grand County Water Information Network

⁶ This Monitoring At-A-Glance table is based on the 2016 Monitoring Plan guidelines developed by LBD. Some of the agency names and sampling methods may change, and if so, the Subcommittee will evaluate accordingly when comparing year to year data results of the program.

2018 303(d) and Monitoring and Evaluation List Monitoring Plan

LBD evaluates impairments identified in Regulation #93 – Colorado’s Section 303(d) List of Impaired Waters and Monitoring and Evaluation (M&E) List (Colorado Department of Public Health and Environment, Water Quality Control Commission. Reg #93., 2018) within the CEA to ensure that adequate monitoring is being done in segments where there are impairments.

Regulation #93 consists of 3 components:

1. The list of Water-Quality-Limited Segments Requiring TMDLs fulfills requirements of section 303(d) of the federal Clean Water Act which requires that states submit to the U.S. Environmental Protection Agency a list of those waters for which technology-based effluent limitations and other required controls are not stringent enough to implement water quality standards.
2. Colorado’s Monitoring and Evaluation List identifies water bodies where there is reason to suspect water quality problems, but there is also uncertainty regarding one or more factors, such as the representative nature of the data. Water bodies that are impaired, but it is unclear whether the cause of impairment is attributable to pollutants as opposed to pollution, are also placed on the Monitoring and Evaluation List. This Monitoring and Evaluation list is a state-only document that is not subject to EPA approval.
3. The list of Water-Quality-Limited Segments Not Requiring a TMDL identifies segments where data is available that indicates that at least one classified use is not being supported, but a TMDL is not needed.

Program Objectives

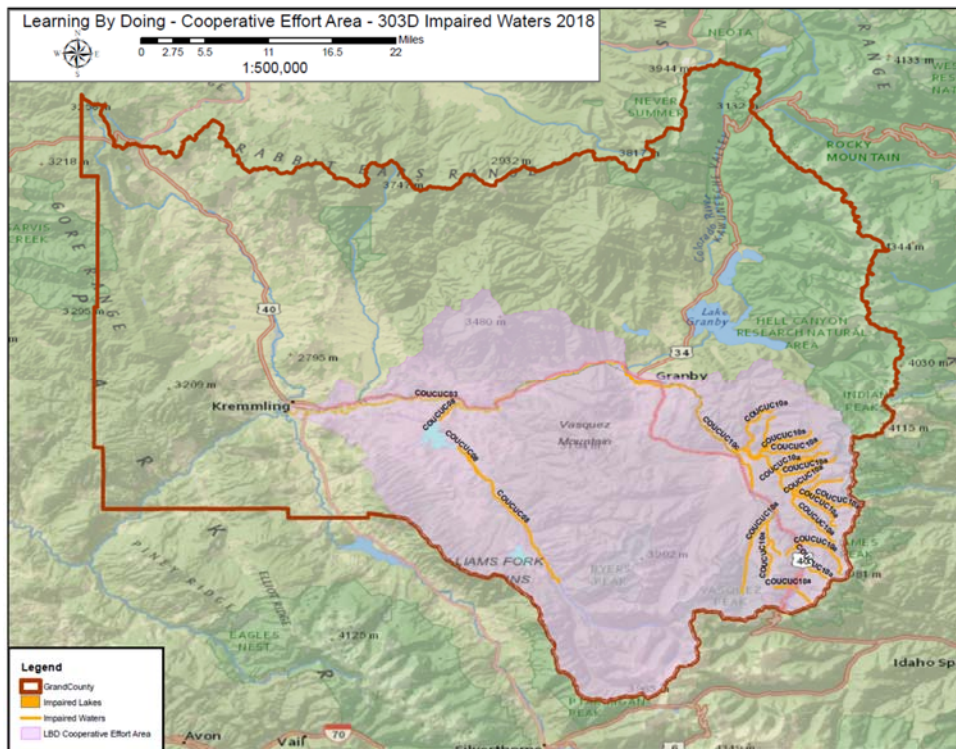
The objectives of the 303(d) monitoring program are to:

- Evaluate the current 303(d) and M&E listed water bodies within the CEA;
- Evaluate current water quality sampling programs being conducted by various agencies to determine if 303(d) listed waters are being monitored appropriately;
- Develop monitoring plan for segments which are determined to need additional sampling.

2018 Review of Impaired Segments

The most current 303(d) and M&E list showed that 10 stream segments currently listed as impaired within Grand County; only 4 of these segments are located within the LBD CEA and are shown in Figure 13. Of the 4 listed segments within the LBD CEA, the impaired uses are for Water Supply and Aquatic Life Use. The primary analytes of concern are arsenic (total), iron (dissolved), manganese (dissolved), copper (dissolved), stream temperature, and macroinvertebrates.

Figure 13 - Map of Segments on the 2018 303(d) List



Below is a detailed breakdown of the listed segment portions, analytes, and listing classifications:

1. **COUCUC03 - Mainstem of the Colorado River from the outlet of Lake Granby to the confluence with Roaring Fork River.**

- COUCUC03_B Colorado River from Windy Gap Reservoir to 578 Road Bridge.
Water Supply use – Arsenic – M&E List
Aquatic Life Use – Macroinvertebrates – M&E List
- COUCUC03_C Colorado River from 578 Road Bridge to Gore Canyon.
Water Supply use – Arsenic – M&E List
Aquatic Life Use – Macroinvertebrates – M&E List
Aquatic Life Use – Temperature – 303(d)

2. **COUCUC08 - Mainstem of the Williams Fork River, including all tributaries and wetlands from the source to the confluence with the Colorado River, except for those tributaries listed in Segment 9.**
 - COUCUC08_B Mainstem of Williams Fork River below Kinney Creek.
Aquatic Life Use – Copper – M&E List

3. **COUCUC10a - Mainstem of the Fraser River from the source to a point immediately below the Rendezvous Bridge. All tributaries to the Fraser River, including wetlands, from the source to the confluence with the Colorado River, except for those tributaries included in Segment 9.**
 - COUCUC10a_B - Ranch Creek and its tributaries.
Aquatic Life Use – Temperature – 303(d)
 - COUCUC10a_C - Fraser River tributaries at and above Jim Creek
Aquatic Life Use – Macroinvertebrates (provisional) – 303(d)
 - COUCUC10a_D - Vasquez Creek and its tributaries.
Aquatic Life Use – Macroinvertebrates (provisional) – 303(d)
Aquatic Life Use – Copper – 303(d)

4. **COUCUC10c - Mainstem of the Fraser River from a point immediately below the Hammond Ditch to the confluence with the Colorado River.**
 - COUCUC10c_A - Fraser River from below the Hammond Ditch in Town of Fraser to Fraser Canyon near Tabernash.
Water Supply Use – Iron (dissolved) – M&E List
Water Supply Use – Arsenic (total) – 303(d)
 - COUCUC10c_B - Fraser River from Fraser Canyon near Tabernash to the Town of Granby.
Water Supply Use – Arsenic (total) – 303(d)
Water Supply Use – Iron (dissolved) – 303(d)
 - COUCUC10c_C - From the Town of Granby to confluence with the Colorado River.
Water Supply Use – Arsenic (total) – 303(d)
Water Supply Use – Iron (dissolved) – 303(d)

Evaluation of Monitoring vs. Impairments

The impairments listed in these segments were evaluated against the 2017 Monitoring Summary (Appendix B). This evaluation showed that there is sufficient monitoring being conducted by various entities throughout the CEA. There was only one area where a site was added due to a 303d listing paired with a lack of data: a macroinvertebrate site on the Fraser River above Jim Creek. Details on this new site are included in the 2018 Macroinvertebrate Monitoring Plan.

2018 CPW Fish Monitoring Plan

In cooperation with LBD monitoring efforts, CPW plans to survey fish populations at the following established locations in 2018. All fish survey activities are dependent upon flow and temperature conditions as well as crew availability.

Fraser River

Idlewild Campground – site was surveyed in 2014 and 2016. 2018 survey will continue biannual survey pattern. Week of September 3

Safeway – site is surveyed annually and is the longest contiguous data set on the Fraser. Week of September 3

Grand County Water and Sanitation property – see Fraser Flats monitoring plan. Week of October 1

Colorado River

Town of Granby property – Formerly referred to as Shorefox reach. Two electrofishing reaches. Sites have been surveyed once previously, in 2016. Planned for biannual surveys. Week of October 1.

Parshall-Sunset – raft electrofishing reach. Surveyed annually. Week of September 24.

2018 Riparian Areas and Wetlands Monitoring Plans

This section documents known riparian vegetation monitoring or other revegetation efforts within the CEA.

Revegetation on Ranch Creek

On May 19, June 2, and 3, 2018, the Colorado River Headwaters Chapter of Trout Unlimited, an LBD partner, led the re-vegetation of a portion of Ranch Creek on Devil's Thumb Ranch property by donating volunteer time and resources to prepare the planting design and coordinate three volunteer work days. In total, 2,700 willow stakes were harvested and replanted along the banks of this targeted portion of Ranch Creek to improve riverbank stability, reduce solar influence on the water's surface and provide cover for trout. Over the three workdays, volunteers from communities in Grand County and on the Front Range came out to participate, which is a testament of the mutual passion and care expressed for the health of the Fraser River and the work that LBD is undertaking.

Northern Water's Municipal Subdistrict Riparian Vegetation Monitoring

Condition 30 of the WGFP 1041 Permit requires the Subdistrict to prepare a monitoring plan to establish baseline conditions of riparian and wetland vegetation along the Colorado River from Windy Gap Reservoir downstream to the lower terminus of the Kemp-Breeze Wildlife Area, and on Willow Creek below Willow Creek Reservoir (Grand County, 2012).

The primary objectives of the Riparian Vegetation Monitoring Plan are to:

- Obtain baseline data that describes the existing conditions of riparian vegetation and communities within the study area.
- Confirm that WGFP is not adversely affecting riparian and wetland vegetation within the study area post project implementation.

The monitoring will be conducted by ERO, Consultants in Natural Resources and the Environment, utilizing methods to provide information on the conditions of riparian vegetation complexes present along the Colorado River and Willow Creek within the study area for both baseline conditions and conditions following project implementation.

The study area includes 5 reaches:

Reach 1 – Extends downstream from the Windy Gap Reservoir to Drowsey Water Creek. The rough length of this reach is 2.73-river miles.

Reach 2 – Extends downstream from Reach 1, Drowsey Water Creek, to Sheriff Creek. The rough length of this reach is 2.42-river miles.

Reach 3 – Extends downstream from Reach 2, Sheriff Creek, to an unnamed drainage along Parshall Divide Road. The rough length of this reach is 2.90-river miles.

Reach 4 – Extends downstream from the unnamed drainage to Kemp-Breeze Wildlife Area. The rough length of this reach is 5.35-river miles.

Reach 5 – Extends from the downstream end of the Willow Creek Reservoir to the confluence with the Colorado River. The rough length of this reach is 3.20-river miles.

Baseline monitoring will be completed during the growing season both in 2018 and one year prior to project implementation. Both baseline monitoring events would occur between June through August. Monitoring will also occur following project implementation at years 2, 5, and 10. Additional monitoring may be necessary; if the results of the monitoring at years 2 or 5 indicate that adverse effects to riparian vegetation are occurring, the additional monitoring would be determined in discussions with Grand County.

The data generated as part of this monitoring plan can also be used to develop more specific management objectives to determine if conditions are being maintained, improved, or are declining. Based on the baseline and future monitoring data, management actions can be designed to meet management objectives.

2018 ILVK Monitoring Program

This section documents monitoring and restoration efforts on the Colorado River which are managed by the Irrigators in Lands in the Vicinity of Kremmling (ILVK) and supported by a grant to the Colorado River Headwaters Project from the National Resource Conservation Service (NRCS). The following is from the May 11, 2018 ILVK proposed monitoring plan.

ILVK Proposed Monitoring Plan

The goal of the monitoring plan is two-fold. The first goal is to monitor constructed improvements at each of the discreet project sites, including the monitoring of constructed bank and channel features as well as plant establishment. The second goal is to monitor the effects of the project components on the aquatic species and their habitat. These two plans are outlined below.

Monitoring of Constructed Improvements

The monitoring of constructed improvements shall begin following construction of the improvements and extend for several years depending on site conditions and length of time required for stabilization. Any projects requiring a USACE permit shall be monitored in accordance with the permit requirements outside of or in addition to the monitoring outlined below.

Each site will include a temporary control point, set for construction and used to survey as-builts. Following construction as-built surveys will be performed to confirm the project was constructed in accordance with the plans. The as-built survey will include channel cross sections and a profile of the channel thalweg through the constructed reach. Sites with riffle structures installed to control headwater at pump intakes will be surveyed at a pre-identified location such as at the crest elevation, as well as a water surface elevation.

The post-construction monitoring shall be conducted for one year after the completion of construction and as-built surveys generally following the list below. Note that not all items will be applicable at every site and that vegetation should be monitored more frequently during the first year.

1. Visually inspect the channel and all installed structures. Check in-stream structures from the bank or a dry location and document using digital photos.
2. Check all banks, rock, wood, and structures for accelerated weathering, displacement, or significant changes since the original construction.
3. Check for scour or excessive erosion of stream banks, bed and crossings.
4. Inspect vegetation and plantings frequently. During the first part of the growing season, check the vegetation every week or two.
5. Monitor vegetation and plantings for damage caused by animals, insects, and disease.
6. Check for vigorous growth of desirable vegetation.

7. Inspect channel upper banks for settlement or large cracks in the soil.
8. Inspect temporary fences installed to control grazing access while plants become established.
9. Inspect for trash and debris accumulation.

Following the first year, monitor as needed until vegetation is established and the site appears stable. Ocular surveys should be conducted in early spring before runoff and late summer or early fall when river flows are low, but before vegetation becomes dormant for the fall/winter following the list below.

1. Visually inspect the channel and all installed structures. Check in-stream structures from the bank or a dry location and document using digital photos.
2. Check all banks, rock, wood, and structures for accelerated weathering, displacement, or significant changes since the original construction.
3. Check for scour or excessive erosion of stream banks, bed and crossings.
4. Inspect vegetation and plantings.
5. Inspect for trash and debris accumulation.

Should the monitoring indicate remedial action is warranted, implementation should be conducted as soon as possible. This might include adjustments to rock and wood in the bank and channel to restore original grade, and/or re-stabilize; replacement of vegetation; installation of additional fencing to protect plants; reseeding, watering, weeding by hand, replanting, mulching, and removal of invasive plants when necessary; and the removal of debris and trash that could cause damage to installed structures and bank treatments, or if debris poses a safety/flooding hazard. Document inspections and remedial actions.

Monitoring Aquatic Species and Habitat

While there are many potential indicators of aquatic health, this monitoring plan focuses on four key parameters: river water levels at pump intakes, surface water temperature, fish population and macroinvertebrate. The following is a general overview of the monitoring efforts proposed to evaluate the effects of the project components on the aquatic species and their habitat. Note that detailed testing, protocol and evaluation will be developed in conjunction with the ILVK partners including Colorado Parks and Wildlife (CPW) and the Learning-By-Doing (LBD) committee. This proposal is pending an agreement on protocol among the partners, potentially leveraging monitoring that may be, or is being done by the ILVK partners, in combination with new monitoring that may require an outside funding source, yet to be determined.

River Temperature and Water Levels

Data from two sites currently being monitored by others will be utilized to monitor temperatures in the ILVK reach. The first site, located on the upstream end of the ILVK reach at County Road 39, is monitored by GCWIN. The second site is located at the U.S. Highway 9 Bridge and is monitored by the Bureau of Land Management (BLM). BLM has agreed to share

their temperature data with the ILVK. These two sites will provide important temperature baseline and post-construction information.

ILVK is also proposing to monitor surface water levels at pump intakes wherever riffle grade controls are installed. Currently there are two riffle structures in place on the Riverside Ranch property where monitoring is proposed pending final bank stabilization above and below the two riffles. It is anticipated that under the ILVK RCPP EQIP, additional riffle grade control structures will be installed, and all will include water level monitoring. ILVK proposes to engage the property owners with the monitoring effort using a technology that is appropriate and manageable by the producers. This could range from automated data, or a manually read staff gage, and is dependent on funding and input from the producers.

Fish Population Surveys

CPW has already provided baseline fish surveys in a three-mile reach generally located between the Ennis and Orr no. 2 Pumps. CPW has committed to continue to conduct fish surveys for the next five years. For purposes of the ILVK project, this fish sampling is strategically located within the central portions of the project and will provide important and informative data on fish population and impacts from the ILVK projects.

Macroinvertebrates

Macroinvertebrate monitoring is proposed in three locations:

1. County Road 39 Bridge,
2. Downstream of the confluence with Troublesome, and
3. The Thompson Riffle.

Macroinvertebrate monitoring has been conducted at County Road 39 on the upstream end of the ILVK project reach through the Learning By Doing efforts for seven years. Learning By Doing proposes to continue macroinvertebrate sampling at County Road 39 in 2018. This will inform on conditions upstream of County Road 39 and provide valuable overall trends as it is the longest running monitoring site within the ILVK project reach. Because the continuation of monitoring at this location would provide valuable feedback on the effects of the proposed projects, continued monitoring is critical.

The Thompson family recently constructed two grade control riffles on their property. ILVK recommends macroinvertebrate monitoring in this location as it is key to informing on the effects of construction riffles. ILVK is committed to working with its partners to identifying resources for implementation of monitoring at these riffles. In addition, a third site is proposed, located downstream of the confluence of Troublesome Creek. Troublesome Creek is a major contributor of fine sediments and it will be important to understand the impacts of Troublesome Creek on the downstream reach of the Colorado River. A 100 count Pebble Count, including embeddedness, is also recommended at each of the macroinvertebrate sites, conducted at riffles used by or in the vicinity of the macroinvertebrate sampling sites. To achieve these monitoring goals, continued

coordination will be required between LBD, CPW and the ILVK to partner and/or seek additional funding.

2018 Connectivity Channel Monitoring

Northern Water's Municipal Subdistrict is planning to construct a bypass channel to provide habitat connectivity between segments of the Colorado River downstream from Windy Gap Reservoir and segments of the Colorado and Fraser Rivers upstream as a habitat enhancement. To meet requirements of the Windy Gap Firing Project 1041 permit (Grand County, 2012), Northern Water is funding a study by the CPW Research Branch to monitor fish movement and determine the effects of the connectivity channel on fish communities.

Fish and fish movements around Windy Gap will be monitored with a combination of electrofishing and electronic tagging. With construction anticipated to begin in 2021, CPW would begin work in 2019, so baseline data can be obtained for two years before construction of the connectivity channel and four additional years during and after construction. CPW will deliver annual updates to the LBD Management Committee beginning after the first year of the study, tentatively 2020.

References

- Colorado Department of Public Health and Environment. (2010). *Aquatic life use attainment: Methodology to determine use attainment for rivers and streams. Policy Statement 2010-1.*
- Colorado Department of Public Health and Environment, Water Quality Control Commission. Reg #93. (2018). *Colorado's Section 303(D) List of Impaired Waters and Monitoring and Evaluation List.* Retrieved from https://www.colorado.gov/pacific/sites/default/files/93_2018%2803%29.pdf
- Colorado Department of Public Health and Environment, Water Quality Control Division. (March 2017). *Section 303(d) Listing Methodology 2018 Listing Cycle.*
- Colorado Department of Public Health and Environment, Water Quality Control Division, Moffat. (2016, June). Rationale for Conditional 401 Certification of the Moffat Collection System Project. Denver, CO. Retrieved from <https://www.colorado.gov/pacific/sites/default/files/Moffat%20Collection%20System%20Final%20401%20Certification.pdf>
- Colorado Department of Public Health and Environment, Water Quality Control Division, WGFP. (2016, March). Rationale for Conditional 401 Certification of the Windy Gap Firming Project. Denver, Colorado, USA. Retrieved from https://www.colorado.gov/pacific/sites/default/files/WQ_WindyGapFirmingProject_ConditionalCertification.pdf
- Grand County. (2012, December 4). Resolution No. 2012PA-12-1, 1041 Permit.
- Intergovernmental Agreements for the Learning by Doing Cooperative Effort. (2012). *Section II.B.5 - Monitoring Plan.*
- Learning By Doing Monitoring Committee. (2017). *Learning By Doing Aquatic Resource Monitoring Planning Process.*
- Merritt, R. W. (2008). *An Introduction to the Aquatic Insects of North America* (Fourth ed.). Dubuque, Iowa: Kendall/Hunt.
- Tetra Tech and HabiTech. (2018). *2017 Monitoring Report, Grand County, Colorado.*
- Ward, J. V. (2002). *An Illustrated Guide to the Mountain Stream Insects of Colorado* (Second ed.). Boulder, Colorado: University Press of Colorado.

Appendix A – 2017 Monitoring Sites with River Mile and Entity Station Name

River Mile ID	Entity Station ID	Description	Monitoring Type	Entity
AC-0.6	AC-GRU	Arapaho Creek upstream Lake Granby	Flow	Northern
AC-0.6	AC-GRU	Arapaho Creek upstream Lake Granby	Temperature	Northern
AC-0.6	AC-GRU	Arapaho Creek at Monarch Lake outlet, upstream of Lake Granby	Water Quality	Northern
BC-0	09034900	Bobtail Creek upstream diversion dam downstream of gauging station	Flow	Denver Water
BC-0	WS-WF-008	Bobtail Creek upstream diversion dam downstream of gauging station	Water Quality	Denver Water
CBN-0.1	CAB-Nchan	Cabin Creek North Channel on Devils Thumb Ranch property	Temperature	Denver Water
CBS-0.1	CAB-Schan	Cabin Creek South Channel on Devils Thumb Ranch property	Temperature	Denver Water
CB-2.7	09032100	Cabin Creek Near Fraser, CO	Flow	Denver Water
CB-2.7	CAB-blwDWB	Cabin Creek downstream Denver Water diversion	Temperature	Denver Water
CH-0.5	CH-WCU	Church Creek upstream of Willow Creek at Flume	Water Quality	Northern
CR-2.3	COR-Hwy9	Colorado River upstream Hwy 9 Bridge at Kremmling	Temperature	BLM
CR-2.3	WS-CO-004	Colorado River at Kremmling (@ bridge on Colo 9)	Water Quality	Denver Water
CR-9.1	COR-KBDitch	Colorado River downstream of KB Ditch	Macroinvertebrate	LBD
CR-9.1	COR-KBDitch	Colorado River downstream of KB Ditch	Temperature	GCWIN
CR-9.1	CR-KBD	Colorado River downstream of KB Ditch	Flow	Northern
CR-9.1	CR-KBD	Colorado River downstream of KB Ditch	Sediment	LBD
CR-12.6	COR-ConRitschard	Colorado River at ConRitschard	Temperature	GCWIN
CR-12.6	CR-CON	Colorado River at ConRitschard	Macroinvertebrate	CPW
CR-13.7	Parshall-Sunset		Fish	CPW
CR-14.9	COR-KidPond	Colorado River upstream Kid Fishing Pond	Temperature	GCWIN
CR-14.9	CR-PAR	Colorado River downstream of Parshall near Kid Fishing Pond	Flow	Northern
CR-14.9	CR-WFD	Colorado River downstream of Williams Fork at Kid's Pond	Macroinvertebrate	CPW
CR-14.9	CR5	Colorado River downstream of Parshall and the confluence with Williams Fork	Sediment	LBD
CR-16.7	COR-CR3	Colorado River at County Rd 3	Temperature	GCWIN
CR-16.7	CR-WFU	Colorado River upstream of Williams Fork	Macroinvertebrate	Northern
CR-16.7	CR-WFU	Colorado River upstream of Williams Fork	Macroinvertebrate	CPW
CR-16.7	WS-CO-003	Colorado River north of Parshall at Bar Lazy J Ranch bridge	Water Quality	Denver Water
CR-16.7	CR-WFU	Colorado River upstream of Williams Fork	Sediment	LBD
CR-18.4	COR-LoneBuck	Colorado River at Lone Buck	Temperature	GCWIN
CR-19.8	COR-blwByers	Colorado River downstream Byers Canyon	Temperature	GCWIN
CR-21.9	CR4	Colorado River downstream of Hot Sulphur Springs.	Sediment	LBD
CR-22.1	COR-abvHSR	Colorado River upstream Hot Sulfur Resort	Temperature	GCWIN
CR-22.9	CR-HSU	Colorado River at Pioneer Park upstream of Hot Sulfur Springs	Macroinvertebrate	Northern
CR-22.9	CR-HSU	Colorado River at Pioneer Park upstream of Hot Sulfur Springs	Macroinvertebrate	CPW
CR-22.9	CR-HSU	Colorado River at Pioneer Park upstream of Hot Sulfur Springs	Sediment	LBD
CR-23.5	CR-HSU	Colorado River upstream of Hot Sulfur Springs	Flow	Northern
CR-24.9	Chimney Rock Ranch		Fish	CPW
CR-24.9	COR-SHRF	Colorado River at Sheriff Ranch	Temperature	GCWIN
CR-28.7	09034250	Colorado River downstream of Windy Gap Reservoir	Flow	Northern
CR-28.7	COR-blwWG	Colorado R downstream Windy Gap at Hitching Post	Temperature	GCWIN
CR-28.7	CR-WGD	Colorado River downstream of Windy Gap Reservoir	Macroinvertebrate	Northern
CR-28.7	CR-WGD	Colorado River downstream of Windy Gap Reservoir	Temperature	Northern
CR-28.7	CR-WGD	Colorado River downstream of Windy Gap Reservoir	Water Quality	Northern
CR-28.7	CR-WGD	Colorado River downstream of Windy Gap Reservoir	Macroinvertebrate	CPW
CR-28.7	CR-WGD	Colorado River downstream of Windy Gap Reservoir	Sediment	LBD
CR-29.8	CR-WGC	Colorado River at confluence of Windy Gap spillway and bypass	Temperature	Northern
CR-30	CR-WGB	Colorado River at Windy Gap Bypass	Flow	Northern
CR-30	CR-WGB	Colorado River at Windy Gap Bypass	Temperature	Northern
CR-30.8	CR-FRD	Colorado River downstream of Fraser, upstream of Windy Gap	Macroinvertebrate	CPW
CR-31	CR-WGU	Colorado River upstream of Windy Gap and Fraser River confluence	Macroinvertebrate	Northern
CR-31	CR-WGU	Colorado River upstream of Windy Gap and Fraser River confluence	Temperature	Northern
CR-31	CR-WGU	Colorado River upstream of Windy Gap and Fraser River confluence	Water Quality	Northern
CR-31	CR-WGU	Colorado River upstream of Windy Gap and Fraser River confluence	Macroinvertebrate	CPW
CR-31	CR-WGU	Colorado River upstream of Windy Gap and Fraser River confluence	Sediment	LBD
CR-31.3	CR-GPD	Colorado River downstream of Gravel Pit	Water Quality	Northern
CR-32.1	CR-GPU	Colorado River upstream of Gravel Pit	Water Quality	Northern
CR-34.6	CR-WCD	Colorado River downstream of Willow Creek	Water Quality	Northern
CR-35.2	CR-WCU	Colorado River upstream of Willow Creek	Water Quality	Northern
CR-35.6	09019500	Colorado River downstream of Lake Granby at flow gage	Flow	USGS
CR-35.6	CR-YGAGE	Colorado River downstream of Lake Granby at flow gage	Temperature	Northern
CR-38.3	CR-GRD	Colorado River downstream of Lake Granby	Temperature	Northern
CR-38.3	CR-GRD	Colorado River downstream of Lake Granby	Water Quality	Northern

River Mile ID	Entity Station ID	Description	Monitoring Type	Entity
CR-43.5	CR-GRU	Colorado River upstream of Lake Granby	Temperature	Northern
CR-44.6	09015000	Colorado River downstream of Shadow Mountain Reservoir	Flow	USGS
CR-44.6	CR-SMD	Colorado River downstream of Shadow Mountain Reservoir	Temperature	Northern
CR-44.6	CR-SMD	Colorado River downstream of Shadow Mountain Reservoir	Water Quality	Northern
CC-1.5	395927105505700	Crooked Creek Abv Pole Creek at Tabernash	Water Quality	EGWQB
EI-0.1	EI-GLU	East Inlet upstream of Grand Lake	Flow	Northern
EI-0.1	EI-GLU	East Inlet upstream of Grand Lake	Temperature	Northern
EI-0.1	EI-GLU	East Inlet upstream of Grand Lake	Water Quality	Northern
EC-5.5	09025300	Elk Creek at Upper Station near Fraser, CO	Flow	Denver Water
EC-5.5	Elk-blwDWB	Elk Creek downstream of Denver Water diversion	Temperature	Denver Water
FR-0.1	FR-WGU	Fraser River upstream of confluence with Colorado River	Flow	Northern
FR-0.1	FR-WGU	Fraser River upstream of Windy Gap	Macroinvertebrate	CPW
FR-0.1	FR-WGU	Fraser River upstream of confluence with Colorado River	Temperature	Northern
FR-0.1	FR-WGU	Fraser River upstream of confluence with Colorado River	Water Quality	Northern
FR-1.6	FR-blwGSD	Fraser River downstream Granby Sanitation	Temperature	GCWIN
FR-1.9	FR-abvGSD	Fraser River upstream Granby Sanitation District	Temperature	GCWIN
FR-1.9	FR-abvGSD	Fraser River upstream Granby Sanitation District	Macroinvertebrate	LBD
FR-1.9	FR-abvGSD	Fraser River upstream Granby Sanitation District	Sediment	LBD
FR-3.5	400453105554200	Fraser River downstream Highway 40 in Granby	Water Quality	EGWQB
FR-3.5	FR-Hwy40Gr	Fraser River downstream Highway 40 in Granby	Temperature	GCWIN
FR-3.5	Kaibab Park	Fraser River downstream Highway 40 in Granby	Fish	CPW
FR-5.5	F9	Fraser River at Granby Ranch downstream of golf course maintenance building	Sediment	LBD
FR-12.4	09033300	Fraser River downstream Crooked Creek at Tabernash Co	Flow	EGWQB/CRWCD
FR-12.4	09033300	Fraser River downstream Crooked Creek at Tabernash Co	Water Quality	EGWQB/CRWCD
FR-12.4	FR-abvFrCan	Fraser River upstream Fraser Canyon downstream Tabernash	Temperature	GCWIN
FR-12.4	FR-abvFrCan	Fraser River upstream Fraser Canyon downstream Tabernash	Macroinvertebrate	LBD
FR-12.4	FR-blwCrCr	Fraser River downstream Crooked Creek	Sediment	LBD
FR-14	09027100	Fraser River at Tabernash Co.	Flow	EGWQB
FR-14	09027100	Fraser River at Tabernash Co.	Temperature	EGWQB/TU
FR-14	09027100	Fraser River at Tabernash Co.	Water Quality	EGWQB
FR-14	FR-CR83	Fraser River at Tabernash downstream bridge on CR83	Macroinvertebrate	LBD
FR-14	FR-CR83	Fraser River at Tabernash downstream bridge on CR83	Sediment	LBD
FR-14.4	FR-SpProjD	Fraser River LBD Restoration Project, downstream end	Temperature	GCWIN
FR-14.4	Winter Park W & S		Fish	CPW
FR-15	FR-SpProjU	Fraser River LBD Restoration Project, upstream end	Sediment	LBD
FR-15	FR-SpProjU	Fraser River LBD Restoration Project, upstream end	Temperature	GCWIN
FR-15	FR-SpProjU	Fraser River LBD Restoration Project, upstream end	Macroinvertebrate	LBD
FR-16.6	FR-blwFSD	Fraser River downstream Fraser Sanitation	Temperature	GCWIN
FR-16.9	FR-abvFSD	Fraser River upstream Fraser Sanitation	Temperature	GCWIN
FR-17.7	FR-blwCR8HD	Fraser River downstream County Rd 8 at Hammond Ditch	Temperature	GCWIN
FR-18.1	FR-CR804	Fraser River downstream County Rd 804	Temperature	GCWIN
FR-18.1	Safeway		Fish	CPW
FR-20	FR-Rendezvous	Fraser River at Rendezvous Bridge	Temperature	GCWIN
FR-20	FR-Rendezvous	Fraser River at Rendezvous Bridge	Macroinvertebrate	LBD
FR-20	FR-Rendezvous	Fraser River at Rendezvous Bridge	Sediment	LBD
FR-20.6	09025010	Fraser River downstream Vasquez Creek at Winter Park Co.	Water Quality	EGWQB
FR-21	Confluence Park		Fish	CPW
FR-22.5	09024000	Fraser River at Winter Park Co	Flow	Denver Water
FR-22.5	FR-blwWP	Fraser River downstream Winter Park Resort at Idlewild Campground	Temperature	GCWIN
FR-22.5	Idlewild Campground		Fish	CPW
FR-23.2	FR-blwWPSD	Fraser River downstream Winter Park Sanitation	Temperature	GCWIN
FR-23.4	FR-abvWPSD	Fraser River upstream Winter Park Sanitation District	Macroinvertebrate	LBD
FR-23.4	FR-abvWPSD	Fraser River upstream Winter Park Sanitation District	Temperature	GCWIN
FR-23.4	FR-abvWPSD	Fraser River upstream Winter Park Sanitation District	Sediment	LBD
FR-23.4	09023750	Fraser River downstream Buck Creek at Winter Park Co.	Water Quality	EGWQB
FR-24	09023560	Fraser River upstream Moffat Tunnel near Winter Park, Co	Water Quality	EGWQB
FR-24	WS-FR-010	Fraser/Jim Canal at Gaging Station	Water Quality	Denver Water
FR-27.2	09022000	Fraser River at Upper Station, near Winter Park, Co.	Flow	EGWQB
FR-27.2	09022000	Fraser River at Upper Station, near Winter Park, Co.	Water Quality	EGWQB
FR-27.2	FR-Upper	Fraser River upstream Mary Jane entrance to Winter Park	Temperature	GCWIN
GRP-0	GR-PUMP	Granby Pump Canal at foot bridge on south side of Shadow Mountain	Water Quality	Northern
GRP-0	GR-PUMP	Granby Pump Canal at foot bridge on south side of Shadow Mountain	Temperature	Northern

River Mile ID	Entity Station ID	Description	Monitoring Type	Entity
GR-DAM	GR-DAM	Granby Reservoir at Dam	Water Quality	Northern
GR-EAS	GR-EAS	Granby Reservoir on East Side	Water Quality	Northern
GR-WES	GR-WES	Granby Reservoir on West Side	Water Quality	Northern
GL-ATW	GL-ATW	Grand Lake West Portal	Water Quality	Northern
GL-MID	GL-MID	Grand Lake Mid-Section	Water Quality	Northern
SM-CHL	09014050	Grand Lake Outlet downstream Chipmunk Ln at Grand Lk, Co	Flow	GC
SM-CHL	09014050	Grand Lake Outlet downstream Chipmunk Ln at Grand Lk, Co	Temperature	GC
SM-CHL	09014050	Grand Lake Outlet downstream Chipmunk Ln at Grand Lk, Co	Water Quality	GC
SM-CHL	SM-CHL	Shadow Mountain Reservoir Channel in Grand Lake at mouth of Channel	Water Quality	Northern
HC-0.5	HRD-atCR843	Herd Creek on County Road 843	Temperature	Denver Water
LCB-2.2	LCAB-blwDWB	Little Cabin Creek downstream Denver Water diversion	Temperature	Denver Water
LVC-0.2	LVC- abvWP	Little Vasquez upstream Winter Park on Arapaho Road	Temperature	Denver Water
MQC-0	WS-WF-006	McQueary Creek upstream diversion dam 1 3/4 miles north of dorm	Water Quality	Denver Water
MC-0.5	MEA-atCR84	Meadow Creek on County Road 84/USFS 129	Temperature	Denver Water
NF-0.1	CR-SMU	North Fork of Colorado River upstream of Shadow Mountain Reservoir	Flow	Northern
NF-0.1	CR-SMU	North Fork of Colorado River upstream of Shadow Mountain Reservoir	Temperature	Northern
NF-0.1	CR-SMU	North Fork of Colorado River upstream of Shadow Mountain Reservoir	Water Quality	Northern
NI-0.1	NI-GLU	North Inlet upstream Grand Lake	Flow	Northern
NI-0.1	NI-GLU	North Inlet upstream Grand Lake	Temperature	Northern
NI-0.1	NI-GLU	North Inlet upstream of Grand Lake	Water Quality	Northern
RCC-0	WS-FR-011	Ranch Canal at Gaging Station	Water Quality	Denver Water
RC-1.1	09033100	Ranch Creek downstream Meadow Creek near Tabernash Co	Flow	EGWQB/CRWCD
RC-1.1	09033100	Ranch Creek downstream Meadow Creek near Tabernash Co	Temperature	GC/DW
RC-1.1	09033100	Ranch Creek downstream Meadow Creek near Tabernash Co	Water Quality	EGWQB/CRWCD
RC-1.1	RC-blwMC	Ranch Creek downstream Meadow Creek	Temperature	GCWIN
RC-1.1	RC-blwMC	Ranch Creek downstream Meadow Creek	Macroinvertebrate	LBD
RC-1.1	F-RC2	Ranch Creek downstream of County Road 84	Sediment	LBD
RC-4.7	RC-blwCR8315	Ranch Creek downstream County Rd 8315	Temperature	GCWIN
RC-9	09032000	Ranch Creek Near Fraser, Co.	Flow	EGWQB
RC-9	09032000	Ranch Creek Near Fraser, Co.	Water Quality	EGWQB
RDC-0	REE-Upper	Reeder Creek, upper	Temperature	BLM
RDC-0.7	REE-Lower	Reeder Crk upstream footbridge, downstream irrigation ditch	Temperature	BLM
RF-0	RF-GRU	Roaring Fork upstream Lake Granby	Temperature	Northern
RF-0	RF-GRU	Roaring Fork inlet upstream of Lake Granby	Water Quality	Northern
SM-DAM	SM-DAM	Shadow Mountain Reservoir Dam	Water Quality	Northern
SM-MID	SM-MID	Shadow Mountain Reservoir Mid-Section	Water Quality	Northern
USF-0	WS-WF-007	Upper South Fork of the Williams Fork (3.5 miles upstream trail head)	Water Quality	Denver Water
SWF-0	09035900	South fork at South Fork Campground	Flow	Denver Water
SWF-0	WS-WF-003	South fork at South Fork Campground at gaging station	Water Quality	Denver Water
STC-0	ST-LC	St. Louis Creek upstream confluence with Fraser R	Temperature	GCWIN
STC-5.4	09026500	Saint Louis Creek Near Fraser, CO	Flow	Denver Water
SC-0	WS-WF-005	Steelman Creek at bridge upstream diversion dam (south of dorm)	Water Quality	Denver Water
ST-0	ST-GRU	Stillwater Creek upstream Lake Granby	Temperature	Northern
ST-0	ST-GRU	Stillwater Creek upstream of Lake Granby	Water Quality	Northern
TR-0	TRB-WCU	Tributary to Willow Creek upstream of C Lazy U Ranch (Trail Creek)	Water Quality	Northern
VCC-0	WS-FR-009	Vasquez Canal at Vasquez #1 Gaging Station	Water Quality	Denver Water
VT-0	WS-WF-019	Vasquez Tunnel outlet	Water Quality	Denver Water
VC-0	09025000	Vasquez Creek at Winter Park, CO	Flow	Denver Water
VC-0	VC-WP	Vasquez Creek at the town of Winter Park	Temperature	GCWIN
VC-4.3	WS-FR-001	Vasquez Creek upstream Vasquez Tunnel	Water Quality	Denver Water
VC-8	WS-FR-002	Vasquez Creel at diversion structure	Water Quality	Denver Water
WF-2	09038500	Williams Fork downstream Williams Fork Reservoir, CO	Flow	Denver Water
WF-2	WS-WF-009	Williams Fork downstream Williams Fork Reservoir	Water Quality	Denver Water
WF-5.5	09037500	Williams Fork near Parshall, CO	Flow	Denver Water
WF-5.5	WS-WF-001	Williams Fork River upstream of Williams Fork Reservoir	Water Quality	Denver Water
WF-13.1	KR-LS-11081	Williams Fork	Habitat	BLM
WF-13.1	KR-LS-11081	Williams Fork	Water Quality	BLM
WF-13.1	KR-LS-11081	Williams Fork	Macroinvertebrate	BLM
WF-19	09036000	Williams Fork near Leal, CO	Flow	Denver Water
WF-19	WS-WF-002	Williams Fork downstream Kinney Creek confluence at Leal gauge	Water Quality	Denver Water
WF-19.6	09035700	Williams Fork upstream Darling Creek near Leal, CO	Flow	Denver Water
WF-22.6	WS-WF-004	Williams Fork upstream bridge at Sugarloaf Campground	Water Quality	Denver Water

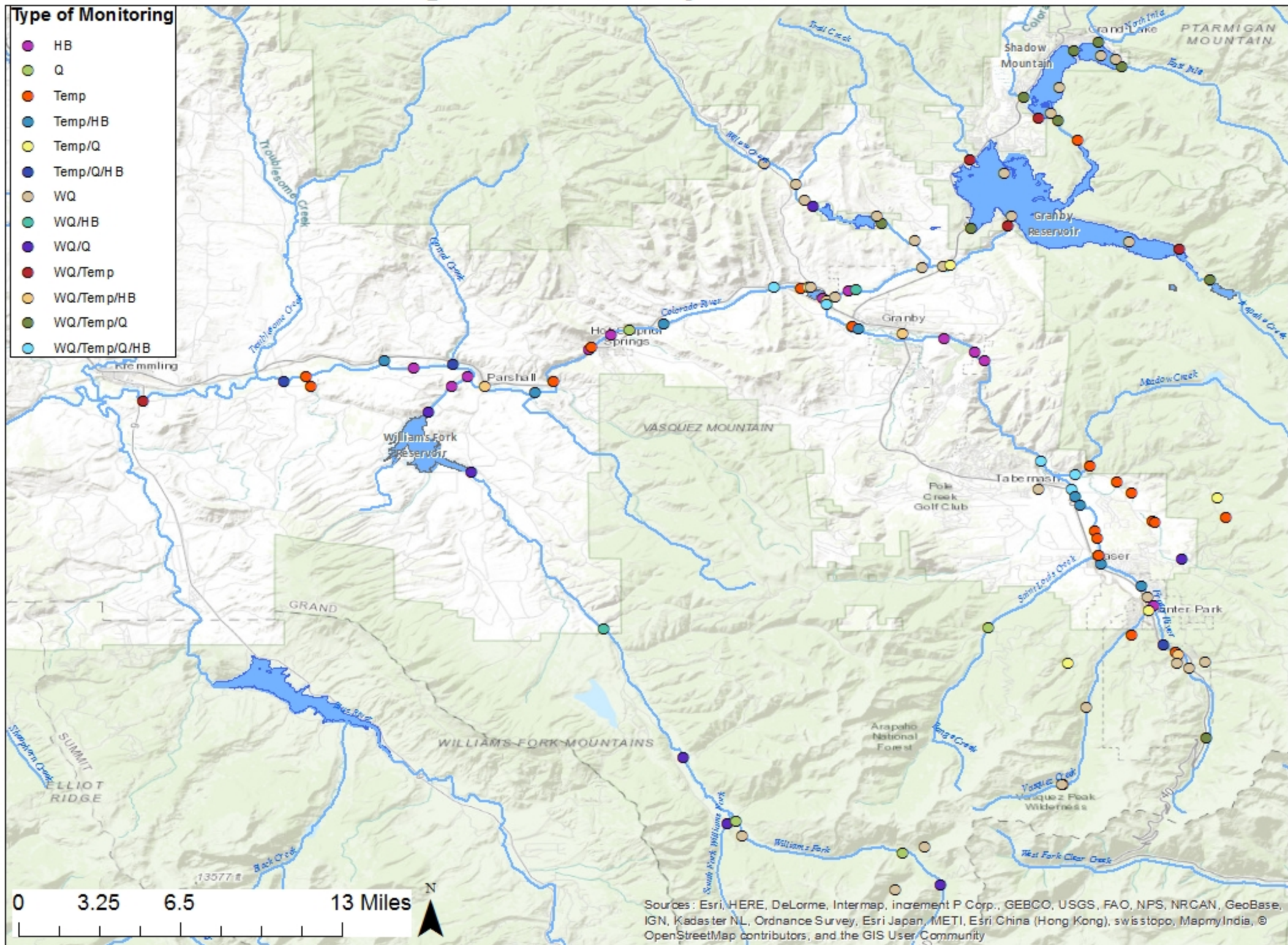
River Mile ID	Entity Station ID	Description	Monitoring Type	Entity
WF-28.2	09035500	Williams Fork downstream Steelman Creek, CO.	Flow	Denver Water
CLU-0	CLU1-WCU	Surface drainage channel on C Lazy U pasture that drains to Willow Creek	Water Quality	Northern
WC-3.8	WC-WCRD	Willow Creek downstream of Willow Creek Reservoir	Temperature	Northern
WC-3.8	WC-WCRD	Willow Creek downstream of Willow Creek Reservoir	Water Quality	Northern
WC-3.8	WILWCRCO	Willow Creek downstream of Willow Creek Reservoir	Flow	Northern
WC-6.3	WC-WCRU	Willow Creek at gage upstream C-Lazy-U Ranch	Flow	Northern
WC-6.3	WC-WCRU	Willow Creek at gage upstream C-Lazy-U Ranch	Water Quality	Northern
WC-9.6	WC-IRU	Willow Creek upstream of C-Lazy U Irrigated Areas	Water Quality	Northern
WC-P-0	WC-PUMP	Willow Creek Pump Canal Inflow to Lake Granby	Temperature	Northern
WCP-0	WC-PUMP	Willow Creek Pump Canal Inflow to Lake Granby	Water Quality	Northern
WCP-0	WILCANCO	Willow Creek Pump Canal Inflow to Lake Granby	Flow	Northern
WC-DAM	WC-DAM	Willow Creek Reservoir at Dam	Water Quality	Northern
WGP-0	WG-PUMP	Windy Gap Pump Inflow to Lake Granby	Flow	Northern
WGP-0	WG-PUMP	Windy Gap Pump Inflow to Lake Granby	Temperature	Northern
WGP-0	WG-Pump	Windy Gap discharge chute to Lake Granby	Water Quality	Northern
WG-DAM	WG-DAM	Windy Gap Reservoir at Dam	Water Quality	Northern

Appendix B – 2017 Monitoring Summary

Monitoring Sites in Cooperative Effort Area

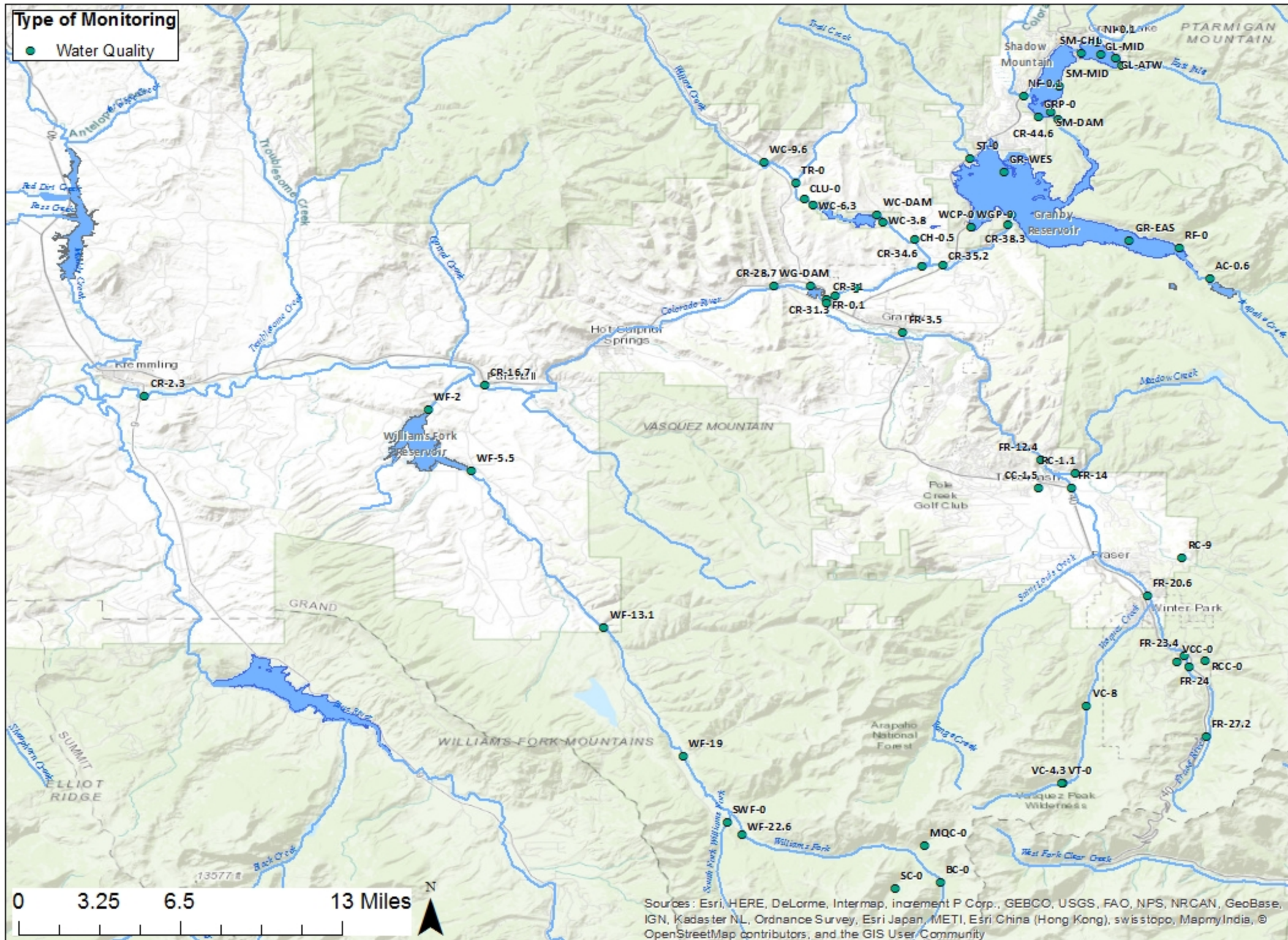
Type of Monitoring

- HB
- Q
- Temp
- Temp/HB
- Temp/Q
- Temp/Q/HB
- WQ
- WQ/HB
- WQ/Q
- WQ/Temp
- WQ/Temp/HB
- WQ/Temp/Q
- WQ/Temp/Q/HB

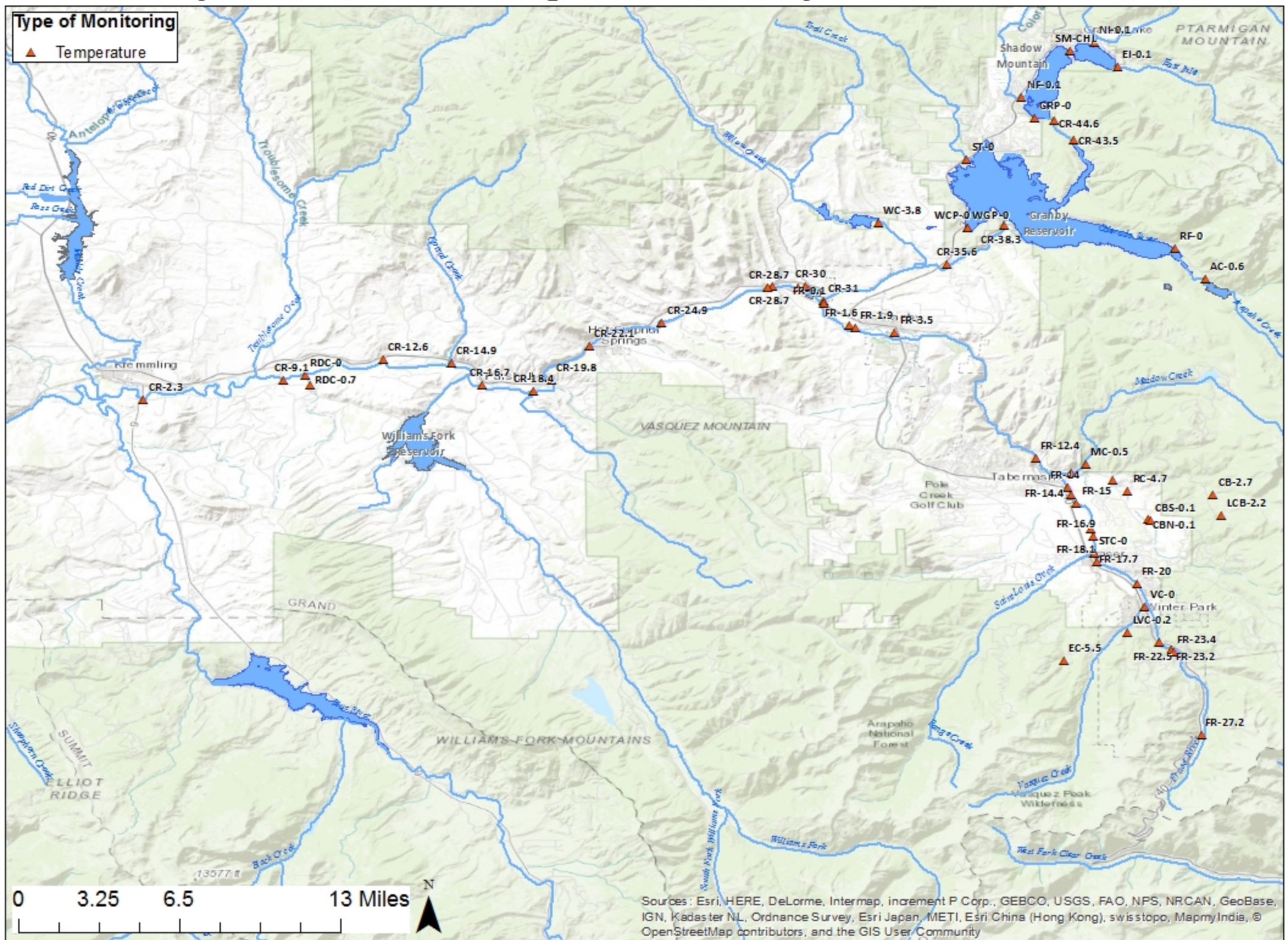


Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

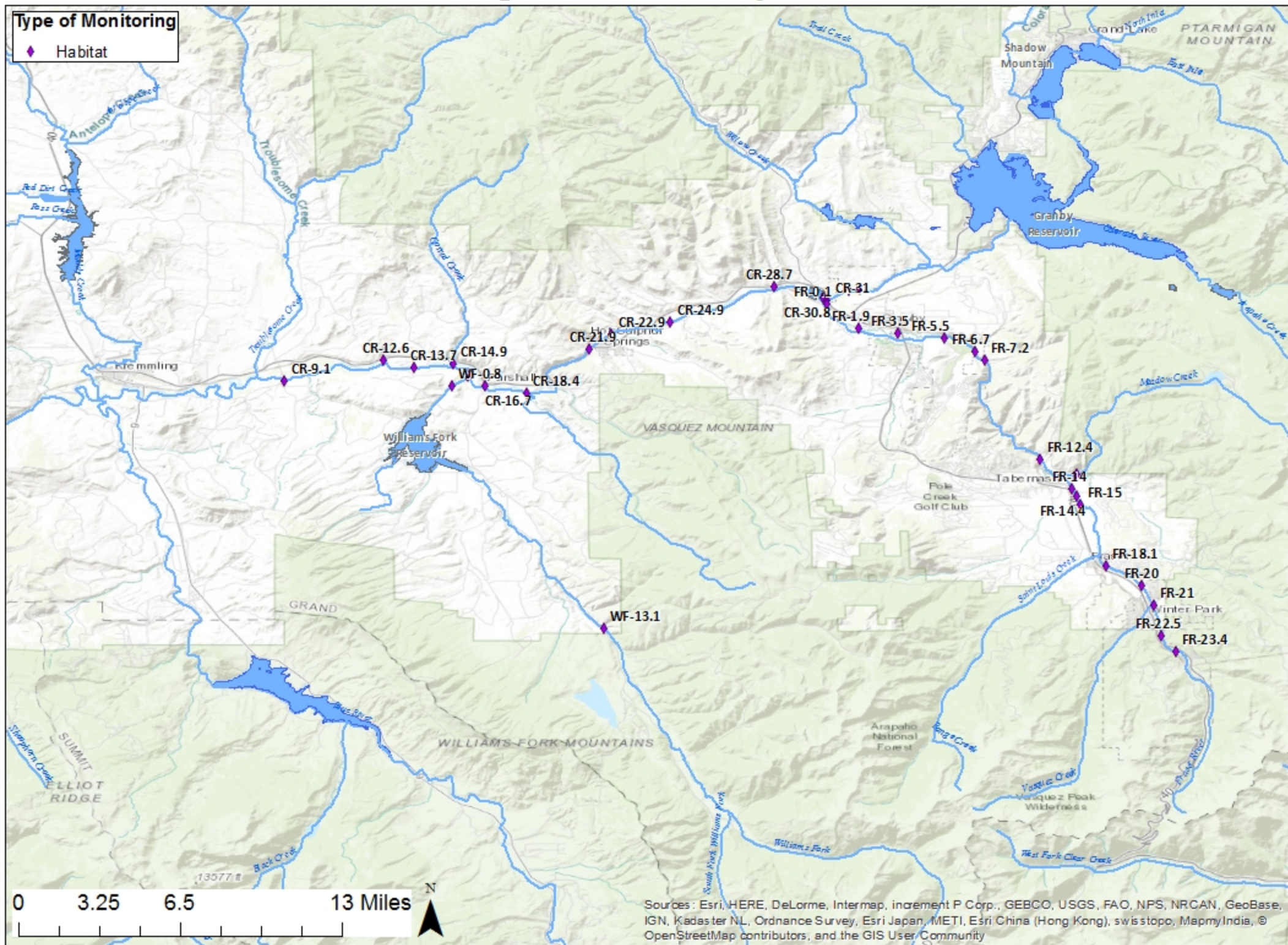
Water Quality Monitoring Sites in Cooperative Effort Area



Temperature Monitoring Sites in Cooperative Effort Area

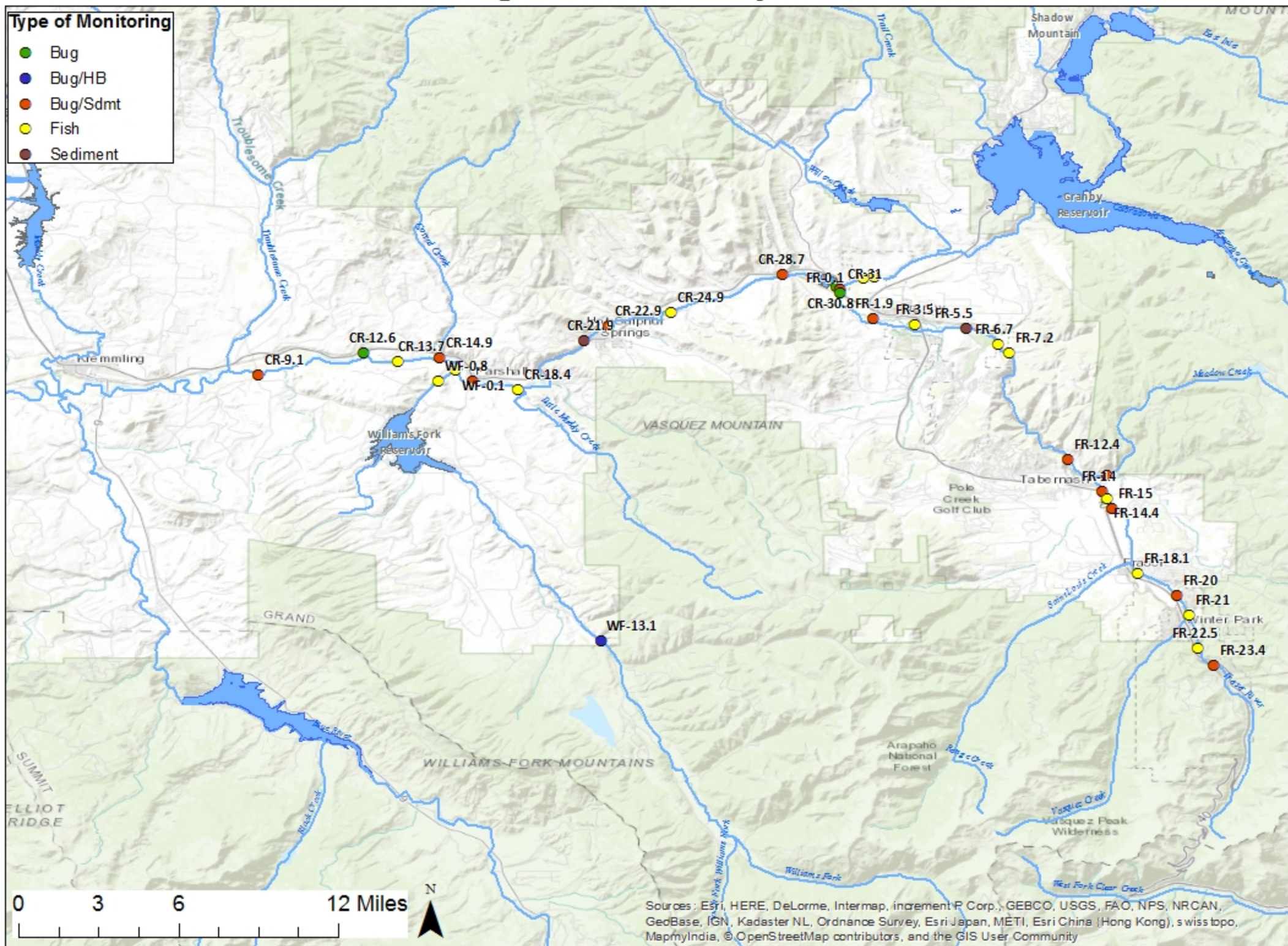


Habitat Monitoring Sites in Cooperative Effort Area



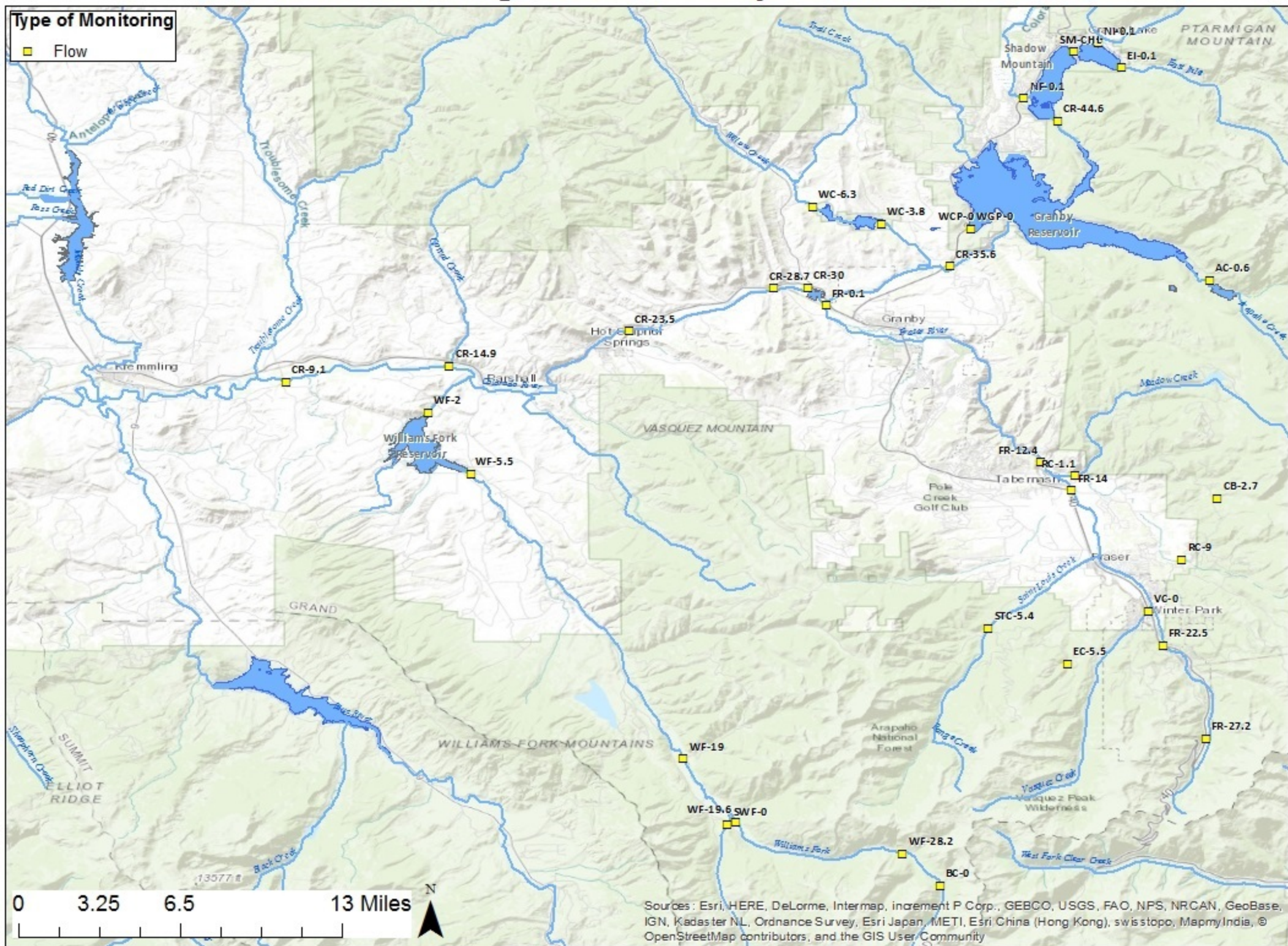
Habitat Monitoring Sites in Cooperative Effort Area

- Type of Monitoring**
- Bug
 - Bug/HB
 - Bug/Sdmt
 - Fish
 - Sediment



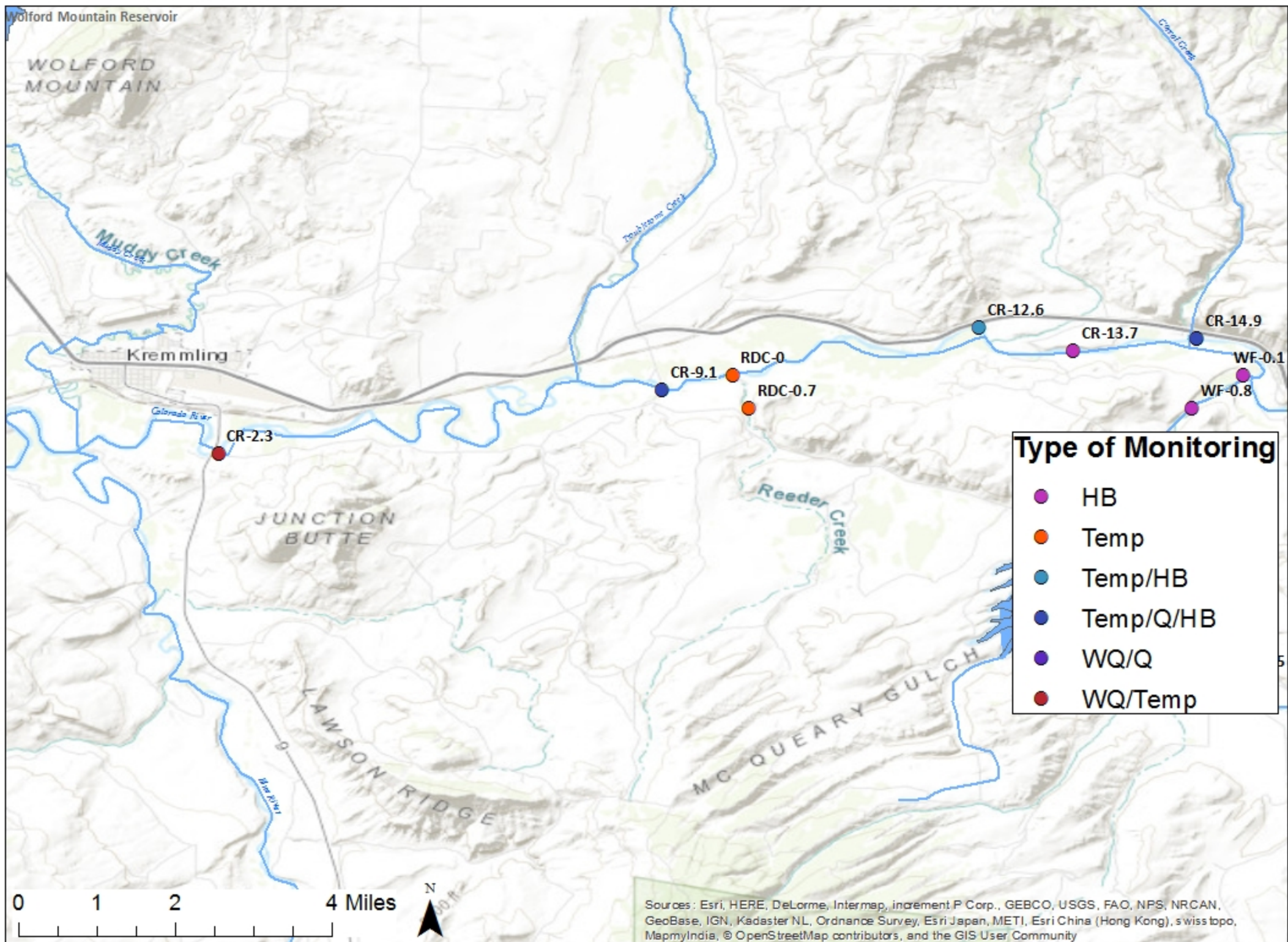
Flow Monitoring Sites in Cooperative Effort Area

Type of Monitoring
■ Flow



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Blue River to Williams Fork



Colorado River - Blue River to Williams Fork

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
CR-2.3	COR-Hwy9	2.3	Colorado River above Hwy 9 Bridge at Kremmling	BLM	Temperature	Colorado River
CR-2.3	WS-CO-004	2.3	Colorado River at Kremmling (@ bridge on Colo 9)	Denver Water	Water Quality	Colorado River
CR-9.1	COR-KBDitch	9.1	Colorado River downstream of KB Ditch	GCWIN	Temperature	Colorado River
CR-9.1	COR-KBDitch	9.1	Colorado River downstream of KB Ditch	LBD	Macroinvertebrate	Colorado River
CR-9.1	CR-KBD	9.1	Colorado River downstream of KB Ditch	LBD	Sediment	Colorado River
CR-9.1	CR-KBD	9.1	Colorado River downstream of KB Ditch	Northern	Flow	Colorado River
CR-12.6	COR-ConRitschard	12.6	Colorado River at ConRitschard	GCWIN	Temperature	Colorado River
CR-12.6	CR-CON	12.6	Colorado River at ConRitschard	CPW	Macroinvertebrate	Colorado River
CR-13.7		13.7	Parshall-Sunset	CPW	Fish	Colorado River
CR-14.9	COR-KidPond	14.9	Colorado River downstream of Parshall near Kid Fishing Pond	GCWIN	Temperature	Colorado River
CR-14.9	CR-WFD	14.9	Colorado River downstream of Parshall near Kid Fishing Pond	CPW	Macroinvertebrate	Colorado River
CR-14.9	CR5	14.9	Colorado River downstream of Parshall near Kid Fishing Pond	LBD	Sediment	Colorado River
CR-14.9	CR-PAR	14.9	Colorado River downstream of Parshall near Kid Fishing Pond	Northern	Flow	Colorado River
RDC-0	REE-Upper	0	Reeder Creek, upper	BLM	Temperature	Reeder Creek
RDC-0.7	REE-Lower	0.7	Reeder Crk above footbridge, blw irrigation ditch	BLM	Temperature	Reeder Creek

Colorado River - Blue River to Williams Fork

General Field Parameters	DW1	AQ1	AQ2	SMP1	SMP2
Temperature	X				
Dissolved Oxygen	X				
Specific Conductance	X				
pH	X				
Turbidity	X				
Flow	X				

Major Ions (plus carbon and misc)

Calcium					
Magnesium					
Potassium					
Sodium					
Chloride					
Sulfate					
Total Organic Carbon					
Total Alkalinity	X				
Total Suspended Solids	X				
Total Dissolved Solids					
Ecoli					

Metals

ICPMS Total/Dis Suite*	X				
Iron, total					
Aluminum, total					
Arsenic, total					
Chromium, total					
Manganese, total					
Aluminum, dis					
Copper, dis					
Iron, dis					
Manganese, dis					
Arsenic, dis					
Boron, dis					
Cadmium, dis					
Chromium, dis					
Lead, dis					
Nickel, dis					
Selenium, dis					
Silver, dis					
Uranium, dis					
Zinc, dis					

Nutrients

TKN					
NH3 as N					
NO3					
NO3+NO2					
Ortho P					
P Total	X				
chlorophyll a					

Aquatic Habitat

Macroinvertebrates		X			
Fish			X		
Riffle Stability Index				X	
Pebble Count				X	X
Embeddedness					X

*ICPMS Total/Dis Suite - Be, B, Na, Mg, Al, Si, K, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Mo, Ag, Cd, Sb, Ba, Hg, Tl, Pb, U

DW - Denver Water

AQ- Aquatic Life (bugs/fish)

SMP - Stream Management Plan

Colorado River - Blue River to Williams Fork

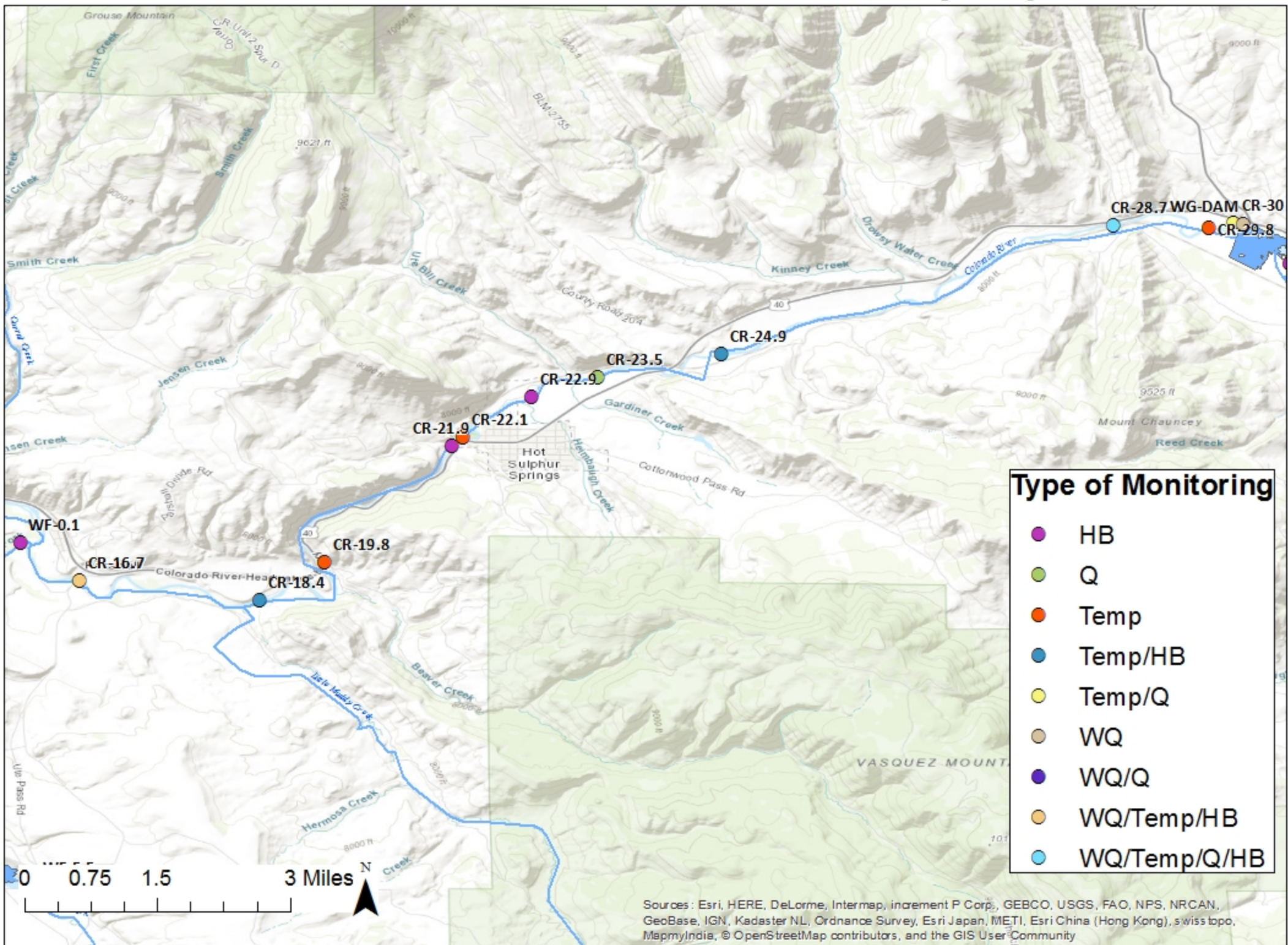
Station	Jan			Feb				Mar				Apr					May					Jun				Jul					Aug				Sep				Oct					Nov				Dec					
	Jan 01	Jan 08	Jan 15	Jan 22	Jan 29	Feb 05	Feb 12	Feb 19	Feb 26	Mar 05	Mar 12	Mar 19	Mar 26	Apr 02	Apr 09	Apr 16	Apr 23	Apr 30	May 07	May 14	May 21	May 28	Jun 04	Jun 11	Jun 18	Jun 25	Jul 02	Jul 09	Jul 16	Jul 23	Jul 30	Aug 06	Aug 13	Aug 20	Aug 27	Sep 03	Sep 10	Sep 17	Sep 24	Oct 01	Oct 08	Oct 15	Oct 22	Oct 29	Nov 05	Nov 12	Nov 19	Nov 26	Dec 03	Dec 10	Dec 17	Dec 24	Dec 31
CR-2.3	DW1													DW1																																							
CR-9.1																																																					
CR-12.6																																																					
CR-13.7																																																					
CR-14.9																																																					
RDC-0																																																					
RDC-0.7																																																					

River Name	Site Abbreviation
Colorado River	CR
Reeder Creek	RDC

Approximate months when temperature data are collected

Sites where there are flow gages

Colorado River Williams Fork to Windy Gap



Colorado River -Williams Fork to Windy Gap

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
CR-16.7	COR-CR3	16.7	Colorado River upstream of Williams Fork	GCWIN	Temperature	Colorado River
CR-16.7	CR-WFU	16.7	Colorado River upstream of Williams Fork	Northern	Macroinvertebrate	Colorado River
CR-16.7	CR-WFU	16.7	Colorado River upstream of Williams Fork	CPW	Macroinvertebrate	Colorado River
CR-16.7	CR-WFU	16.7	Colorado River upstream of Williams Fork	LBD	Sediment	Colorado River
CR-16.7	WS-CO-003	16.7	Colorado River north of Parshall at Bar Lazy J Ranch bridge	Denver Water	Water Quality	Colorado River
CR-18.4	COR-LoneBuck	18.4	Colorado River at Lone Buck	GCWIN	Temperature	Colorado River
CR-18.4		18.4	Gilbert-Lone Buck	CPW	Fish	Colorado River
CR-19.8	COR-blwByers	19.8	Colorado River below Byers Canyon	GCWIN	Temperature	Colorado River
CR-21.9	CR4	21.9	Colorado River downstream of Hot Sulphur Springs.	LBD	Sediment	Colorado River
CR-22.1	COR-abvHSR	22.1	Colorado River above Hot Sulfur Resort	GCWIN	Temperature	Colorado River
CR-22.9	CR-HSU	22.9	Colorado River at Pioneer Park upstream of Hot Sulfur Springs	Northern	Macroinvertebrate	Colorado River
CR-22.9	CR-HSU	22.9	Colorado River at Pioneer Park upstream of Hot Sulfur Springs	CPW	Macroinvertebrate	Colorado River
CR-22.9	CR-HSU	22.9	Colorado River at Pioneer Park upstream of Hot Sulfur Springs	LBD	Sediment	Colorado River
CR-23.5	CR-HSU	23.6	Colorado River upstream of Hot Sulfur Springs	Northern	Flow	Colorado River
CR-24.9		24.9	Chimney Rock Ranch	CPW	Fish	Colorado River
CR-24.9	COR-SHRF	24.9	Colorado R at Sheriff Ranch	GCWIN	Temperature	Colorado River
CR-28.7	CR-WGD	28.7	Colorado River downstream of Windy Gap Reservoir	Northern	Water Quality	Colorado River
CR-28.7	CR-WGD	28.7	Colorado River downstream of Windy Gap Reservoir	Northern	Temperature	Colorado River
CR-28.7	CR-WGD	28.7	Colorado River downstream of Windy Gap Reservoir	Northern	Macroinvertebrate	Colorado River
CR-28.7	CR-WGD	28.7	Colorado River downstream of Windy Gap Reservoir	CPW	Macroinvertebrate	Colorado River
CR-28.7	CR-WGD	28.7	Colorado River downstream of Windy Gap Reservoir	LBD	Sediment	Colorado River
CR-28.7	09034250	28.7	Colorado River downstream of Windy Gap Reservoir	NW/USGS	Flow	Colorado River
CR-29.8	CR-WGC	29.8	Colorado River at confluence of Windy Gap spillway and bypass	Northern	Temperature	Colorado River
CR-30	CR-WGB	30	Colorado River at Windy Gap Bypass	Northern	Flow	Colorado River
CR-30	CR-WGB	30	Colorado River at Windy Gap Bypass	Northern	Temperature	Colorado River
WG-DAM	WG-DAM		Windy Gap Reservoir at Dam	Northern	Water Quality	Windy Gap Reservoir

Not Monitored in 2017

Colorado River -Williams Fork to Windy Gap

General Field Parameters	Rivers and Streams						Windy Gap Reservoir		
	NW1	NW2	DW1	AQ1	AQ2	SMP1	SMP2	NW8	NW9
Temperature	X	X	X					X	X
Dissolved Oxygen	X	X	X					X	X
Specific Conductance	X	X	X					X	X
pH	X	X	X					X	X
Turbidity	X	X	X					X	X
Flow	X	X	X						

Major Ions (plus carbon and misc)

Calcium	X							X	
Magnesium	X							X	
Potassium	X							X	
Sodium	X							X	
Chloride	X							X	
Sulfate	X							X	
Total Organic Carbon	X	X						X	X
Total Alkalinity	X		X					X	
Total Suspended Solids	X	X	X					X	X
Total Dissolved Solids									

Metals

ICPMS Total/Dis Suite*	X		X					X	
Iron, total	X								
Aluminum, total									
Arsenic, total	X							X	
Chromium, total	X							X	
Manganese, total									
Aluminum, Dis									
Copper, dis	X							X	X
Iron, dis	X							X	X
Manganese, dis	X							X	X
Arsenic, dis	X							X	
Boron, dis	X							X	
Cadmium, dis	X							X	
Chromium, dis	X							X	
Lead, dis	X							X	
Nickel, dis	X							X	
Selenium, dis	X							X	
Silver, dis	X							X	
Uranium, dis	X							X	
Zinc, dis	X							X	

Nutrients

TKN	X	X						X	X
NH3 as N	X	X						X	X
NO3+NO2	X	X						X	X
Ortho P	X	X						X	X
P Total	X	X	X					X	X
chlorophyll a								X	X

Aquatic Habitat

Macroinvertebrates				X					
Fish					X				
Riffle Stability Index						X			
Pebble Count						X	X		
Embeddedness							X		

*ICPMS Total/Dis Suite - Be, B, Na, Mg, Al, Si, K, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Mo, Ag, Cd, Sb, Ba, Hg, Tl, Pb, U

NW - Northern Water

DW - Denver Water

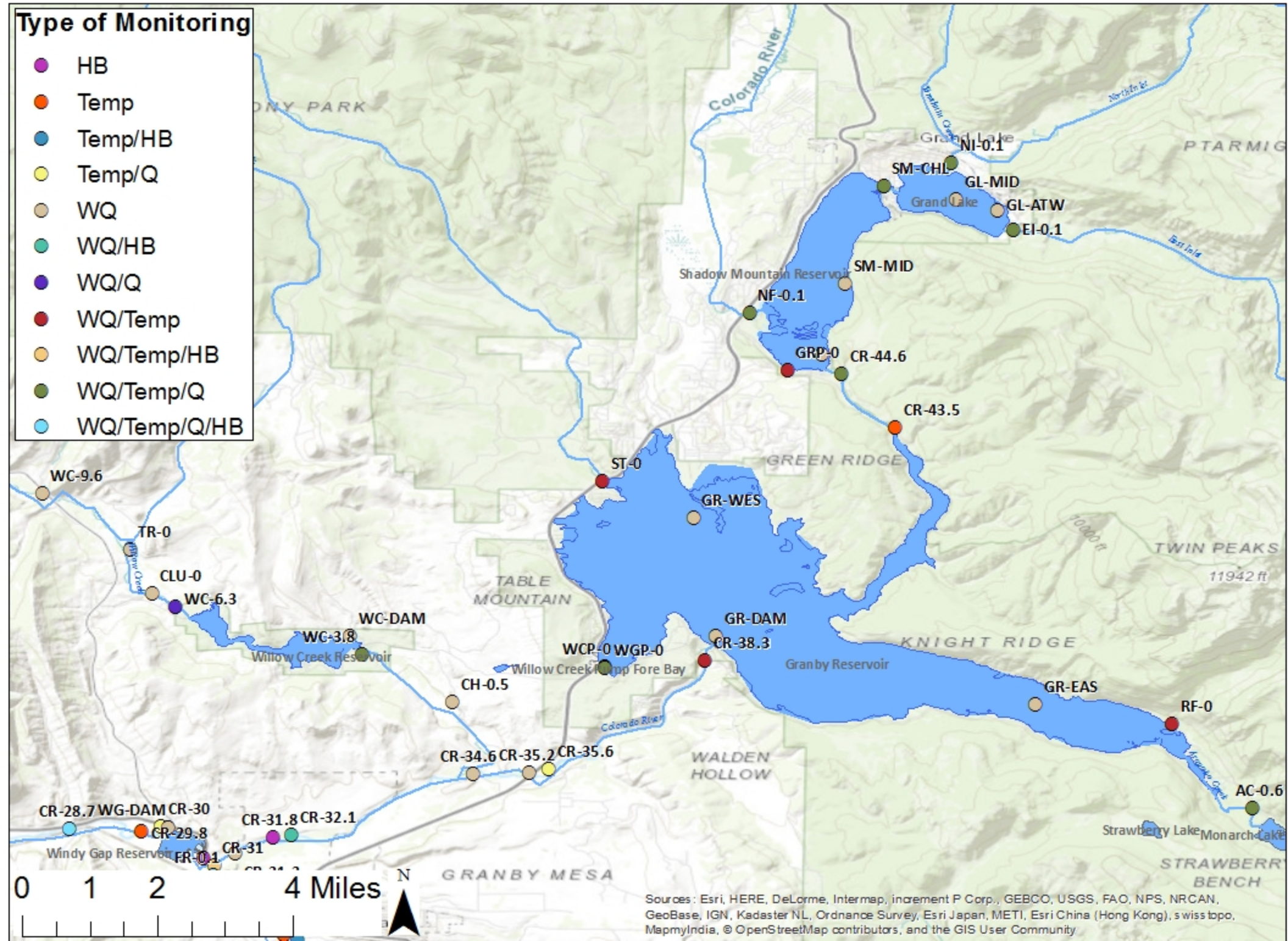
AQ - Aquatic Life (bugs/fish)

SMP - Stream Management Plan

Colorado River Windy Gap to Headwaters

Type of Monitoring

- HB
- Temp
- Temp/HB
- Temp/Q
- WQ
- WQ/HB
- WQ/Q
- WQ/Temp
- WQ/Temp/HB
- WQ/Temp/Q
- WQ/Temp/Q/HB



Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swiss topo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Colorado River - Upstream of Windy Gap to Headwaters

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
AC-0.6	AC-GRU	0.6	Arapaho Creek upstream of Lake Granby	Northern	Water Quality	Arapaho Creek
AC-0.6	AC-GRU	0.6	Arapaho Creek upstream of Lake Granby	Northern	Temperature	Arapaho Creek
AC-0.6	AC-GRU	0.6	Arapaho Creek upstream of Lake Granby	Northern	Flow	Arapaho Creek
CH-0.5	CH-WCU	0.5	Church Creek upstream of Willow Creek at Flume	Northern	Water Quality	Church Creek
CLU-0	CLU1-WCU	0	Surface drainage channel on C Lazy U pasture that drains to Willow Creek	Northern	Water Quality	Willow Creek
CR-30.8	CR-FRD	30.8	Colorado River downstream of Fraser, upstream of Windy Gap	CPW	Macroinvertebrate	Colorado River
CR-31	CR-WGU	31	Colorado River upstream of Windy Gap and Fraser River confluence	Northern	Temperature	Colorado River
CR-31	CR-WGU	31	Colorado River upstream of Windy Gap and Fraser River confluence	Northern	Water Quality	Colorado River
CR-31	CR-WGU	31	Colorado River upstream of Windy Gap and Fraser River confluence	Northern	Macroinvertebrate	Colorado River
CR-31	CR-WGU	31	Colorado River upstream of Windy Gap and Fraser River confluence	CPW	Macroinvertebrate	Colorado River
CR-31	CR-WGU	31	Colorado River upstream of Windy Gap and Fraser River confluence	LBD	Sediment	Colorado River
CR-31.3	CR-GPD	31.3	Colorado River downstream of Gravel Pit	Northern	Water Quality	Colorado River
CR-31.8		31.8	Shorefox Lower	CPW	Fish	Colorado River
CR-32.1	CR-GPU	32.1	Colorado River upstream of Gravel Pit	Northern	Water Quality	Colorado River
CR-32.1		32.1	Shorefox Upper	CPW	Fish	Colorado River
CR-34.6	CR-WCD	34.6	Colorado River downstream of Willow Creek	Northern	Water Quality	Colorado River
CR-35.2	CR-WCU	35.2	Colorado River upstream of Willow Creek	Northern	Water Quality	Colorado River
CR-35.6	CR-YGAGE	35.6	Colorado River downstream of Lake Granby at flow gage	Northern	Temperature	Colorado River
CR-35.6	09019500	35.6	Colorado River downstream of Lake Granby	USGS	Flow	Colorado River
CR-38.3	CR-GRD	38.3	Colorado River downstream of Lake Granby	Northern	Water Quality	Colorado River
CR-38.3	CR-GRD	38.3	Colorado River downstream of Lake Granby	Northern	Temperature	Colorado River
CR-43.5	CR-GRU	43.5	Colorado River upstream of Lake Granby	Northern	Temperature	Colorado River
CR-44.6	CR-SMD	44.6	Colorado River downstream of Shadow Mountain Reservoir	Northern	Water Quality	Colorado River
CR-44.6	CR-SMD	44.6	Colorado River downstream of Shadow Mountain Reservoir	Northern	Temperature	Colorado River
CR-44.6	09015000	44.6	Colorado River downstream of Shadow Mountain Reservoir	USGS	Flow	Colorado River
EI-0.1	EI-GLU	0.1	East Inlet upstream of Grand Lake	Northern	Water Quality	East Inlet
EI-0.1	EI-GLU	0.1	East Inlet upstream of Grand Lake	Northern	Temperature	East Inlet
EI-0.1	EI-GLU	0.1	East Inlet upstream of Grand Lake	Northern	Flow	East Inlet
GL-ATW	GL-ATW		Grand Lake West Portal	Northern	Water Quality	Grand Lake
GL-MID	GL-MID		Grand Lake Mid-Section	Northern	Water Quality	Grand Lake
GL-WES	GL-WES		Grand Lake west end of lake, south of Shadow Mountain Channel	Northern	Water Quality	Grand Lake
GR-DAM	GR-DAM		Granby Reservoir Dam	Northern	Water Quality	Lake Granby
GR-EAS	GR-EAS		Granby Reservoir East Side	Northern	Water Quality	Lake Granby
GR-WES	GR-WES		Granby Reservoir West Side	Northern	Water Quality	Lake Granby
GRP-0	GR-PUMP	0	Granby Pump Canal above Shadow Mountain Reservoir	Northern	Water Quality	Granby Pump Canal
GRP-0	GR-PUMP	0	Granby Pump Canal above Shadow Mountain Reservoir	Northern	Temperature	Granby Pump Canal

Colorado River - Upstream of Windy Gap to Headwaters

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
NF-0.1	CR-SMU	0.1	North Fork of Colorado River upstream of Shadow Mountain Reservoir	Northern	Water Quality	North Fork of Colorado
NF-0.1	CR-SMU	0.1	North Fork of Colorado River upstream of Shadow Mountain Reservoir	Northern	Temperature	North Fork of Colorado
NF-0.1	CR-SMU	0.1	North Fork of Colorado River upstream of Shadow Mountain Reservoir	Northern	Flow	North Fork of Colorado
NI-0.1	NI-GLU	0.1	North Inlet upstream of Grand Lake	Northern	Water Quality	North Inlet
NI-0.1	NI-GLU	0.1	North Inlet above Grand Lake	Northern	Temperature	North Inlet
NI-0.1	NI-GLU	0.1	North Inlet upstream of Grand Lake	Northern	Flow	North Inlet
RF-0	RF-GRU	0	Roaring Fork inlet upstream of Lake Granby	Northern	Water Quality	Roaring Fork
RF-0	RF-GRU	0	Roaring Fork above Lake Granby	Northern	Temperature	Roaring Fork
SM-CHL	SM-CHL		Shadow Mountain Reservoir Channel in Grand Lake at mouth of Channel	Northern	Water Quality	Grand Lake
SM-CHL	09014050		Grand Lake Outlet Blw Chipmunk Ln At Grand Lk, Co	GC/USGS	Temperature	Grand Lake
SM-CHL	09014050		Grand Lake Outlet Blw Chipmunk Ln At Grand Lk, Co	GC/USGS	Water Quality	Grand Lake
SM-CHL	09014050		Grand Lake Outlet Blw Chipmunk Ln At Grand Lk, Co	GC/USGS	Flow	Grand Lake
SM-DAM	SM-DAM		Shadow Mountain Reservoir Dam	Northern	Water Quality	Shadow Mountain
SM-MID	SM-MID		Shadow Mountain Reservoir Mid-Section	Northern	Water Quality	Shadow Mountain
SM-NOR	SM-NOR		Shadow Mountain Reservoir North	Northern	Water Quality	Shadow Mountain
SM-NW1	SM-NW1		Shadow Mountain Reservoir northwest of the center of the Reservoir	Northern	Water Quality	Shadow Mountain
ST-0	ST-GRU	0	Stillwater Creek upstream of Lake Granby	Northern	Water Quality	Stillwater Creek
ST-0	ST-GRU	0	Stillwater Creek above Lake Granby	Northern	Temperature	Stillwater Creek
TR-0	TRB-WCU	0	Tributary to Willow Creek upstream of C Lazy U Ranch (Trail Creek)	Northern	Water Quality	Trail Creek
WC-3.8	WC-WCRD	3.8	Willow Creek directly downstream of Willow Creek Reservoir Dam	Northern	Water Quality	Willow Creek
WC-3.8	WC-WCRD	3.8	Willow Creek downstream of Willow Creek Reservoir	Northern	Temperature	Willow Creek
WC-3.8	WC-WCRD	3.8	Willow Creek downstream of Willow Creek Reservoir	Northern	Flow	Willow Creek
WC-6.3	WC-WCRU	6.3	Willow Creek at USGS Gage above C-Lazy-U Ranch	Northern	Water Quality	Willow Creek
WC-6.3	WC-WCRU	6.3	Willow Creek at USGS Gage above C-Lazy-U Ranch	Northern	Flow	Willow Creek
WC-9.6	WC-IRU	9.6	Willow Creek upstream of C-Lazy U Irrigated Areas	Northern	Water Quality	Willow Creek
WC-DAM	WC-DAM		Willow Creek Reservoir at Dam	Northern	Water Quality	Willow Creek Reservoir
WCP-0	WC-Pump	0	Willow Creek discharge chute to Lake Granby	Northern	Water Quality	Willow Creek Pump Canal
WCP-0	WC-PUMP	0	Willow Creek Pump Canal Inflow to Lake Granby	Northern	Temperature	Willow Creek Pump Canal
WGP-0	WG-Pump	0	Windy Gap discharge chute to Lake Granby	Northern	Water Quality	Windy Gap Pump Canal
WGP-0	WG-PUMP	0	Windy Gap Pump Inflow to Lake Granby	Northern	Temperature	Windy Gap Pump Canal

Not Monitored in 2017

Colorado River - Upstream of Windy Gap to Headwaters

General Field Parameters	Rivers and Streams							Lakes and Reservoirs				
	NW1	NW2	NW3	NW4	NW5	AQ1	AQ2	SMP2	NW6	NW7	NW8	NW9
Temperature	X	X	X	X	X				X	X	X	X
Dissolved Oxygen	X	X	X	X	X				X	X	X	X
Specific Conductance	X	X	X	X	X				X	X	X	X
pH	X	X	X	X	X				X	X	X	X
Turbidity	X	X	X	X	X				X	X	X	X
Flow	X	X	X	X	X							
secchi depth									X	X	X	X

Major Ions (plus carbon and misc)

Calcium	X								X		X	
Magnesium	X								X		X	
Potassium	X								X		X	
Sodium	X								X		X	
Chloride	X								X		X	
Sulfate	X								X		X	
Total Organic Carbon	X	X							X	X	X	X
Total Alkalinity	X								X		X	
Total Suspended Solids	X	X	X						X	X	X	X
Total Dissolved Solids												

Metals

Iron, total	X								X		X	
Arsenic, total	X								X		X	
Chromium, total	X								X		X	
Copper, dis	X								X	X	X	X
Iron, dis	X								X	X	X	X
Manganese, dis	X				X				X	X	X	X
Arsenic, dis	X								X		X	
Boron, dis	X								X		X	
Cadmium, dis	X								X		X	
Chromium, dis	X								X		X	
Lead, dis	X								X		X	
Nickel, dis	X								X		X	
Selenium, dis	X								X		X	
Silver, dis	X								X		X	
Uranium, dis	X								X		X	
Zinc, dis	X								X		X	

Nutrients

TKN	X	X	X	X	X				X	X	X	X
NH3 as N	X	X	X	X	X				X	X	X	X
NO3+NO2	X	X	X	X	X				X	X	X	X
Ortho P	X	X	X	X	X				X	X	X	X
P Total	X	X	X	X	X				X	X	X	X
chlorophyll a									X	X	X	X

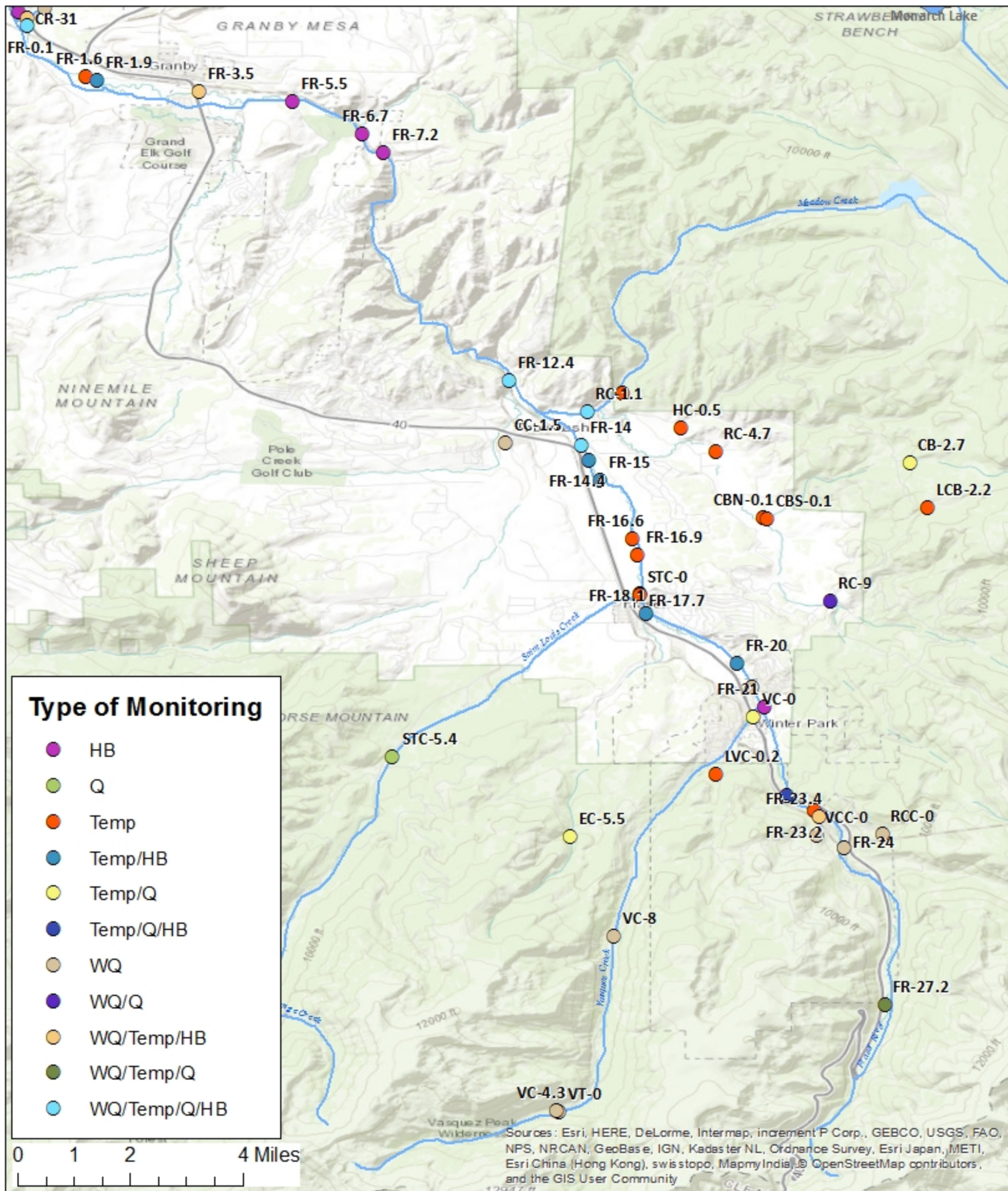
Aquatic Habitat

Phytoplankton									X	X		
Zooplankton									X	X		
Macroinvertebrates						X						
Fish							X					
Pebble Count								X				
Embeddedness								X				

NW - Northern Water

AQ- Aquatic Life (bugs/fish)

Fraser River and Tributaries



Fraser River - Colorado River to Winter Park

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
CBN-0.1	CAB-Nchan	0.1	Cabin Creek North Channel on DTR property	Denver Water	Temperature	Cabin Creek
CBS-0.1	CAB-Schan	0.1	Cabin Creek South Channel on DTR property	Denver Water	Temperature	Cabin Creek
CB-2.7	09032100	2.7	CABIN CREEK NEAR FRASER, CO.	DW/USGS	Flow	Cabin Creek
CB-2.7	CAB-blwDWB	2.7	Cabin Creek below Denver Water diversion	Denver Water	Temperature	Cabin Creek
CC-1.5	395927105505700	1.5	Crooked Cr Abv Pole Creek At Tabernash	EGWQB	Water Quality	Crooked Creek
EC-5.5	09025300	5.5	Elk Creek near Fraser	DW/USGS	Flow	Elk Creek
EC-5.5	Elk-blwDWB	5.5	Elk Creek below Denver Water diversion	Denver Water	Temperature	Elk Creek
FR-0.1	FR-WGU	0.1	Fraser River upstream of confluence with Colorado River	Northern	Water Quality	Fraser River
FR-0.1	FR-WGU	0.1	Fraser River upstream of confluence with Colorado River	Northern	Temperature	Fraser River
FR-0.1	FR-WGU	0.1	Fraser River upstream of confluence with Colorado River	CPW	Macroinvertebrate	Fraser River
FR-0.1	FR-WGU	0.1	Fraser River upstream of confluence with Colorado River	Northern	Flow	Fraser River
FR-1.6	FR-blwGSD	1.6	Fraser River downstream of Granby Sanitation District	GCWIN	Temperature	Fraser River
FR-1.9	FR-abvGSD	1.9	Fraser River upstream of Granby Sanitation District	GCWIN	Temperature	Fraser River
FR-1.9	FR-abvGSD	1.9	Fraser River upstream of Granby Sanitation District	LBD	Macroinvertebrate	Fraser River
FR-1.9	FR-abvGSD	1.9	Fraser River upstream of Granby Sanitation District	LBD	Sediment	Fraser River
FR-3.5	400453105554200	3.5	Fraser River At Hwy. 40 At Granby, Co	EGWQB	Water Quality	Fraser River
FR-3.5	FR-Hwy40Gr	3.5	Fraser R blw Highway 40 in Granby	GCWIN	Temperature	Fraser River
FR-3.5		3.5	Kaibab Park	CPW	Fish	Fraser River
FR-5.5	F9	5.5	Fraser River at Granby Ranch downstream of golf course	LBD	Sediment	Fraser River
FR-6.7		6.7	Granby Ranch	CPW	Fish	Fraser River
FR-7.2		7.2	Behler Creek	CPW	Fish	Fraser River
FR-12.4	09033300	12.4	Fraser River downstream of Crooked Creek and Tabernash	EGWQB/CRWCD	Water Quality	Fraser River
FR-12.4	FR-abvFrCan	12.4	Fraser River downstream of Crooked Creek and Tabernash	GCWIN	Temperature	Fraser River
FR-12.4	FR-abvFrCan	12.4	Fraser River downstream of Crooked Creek and Tabernash	LBD	Macroinvertebrate	Fraser River
FR-12.4	FR-blwCrCr	12.4	Fraser River downstream of Crooked Creek and Tabernash	LBD	Sediment	Fraser River
FR-12.4	09033300	12.4	Fraser River downstream of Crooked Creek and Tabernash	EGWQB/CRWCD	Flow	Fraser River
FR-14	09027100	14	Fraser River upstream of Tabernash	EGWQB	Water Quality	Fraser River
FR-14	09027100	14	Fraser River upstream of Tabernash	EGWQB/TU	Temperature	Fraser River
FR-14	FR-CR83	14	Fraser River upstream of Tabernash	LBD	Macroinvertebrate	Fraser River
FR-14	FR-CR83	14	Fraser River upstream of Tabernash	LBD	Sediment	Fraser River
FR-14	09027100	14	Fraser River upstream of Tabernash	EGWQB/USGS	Flow	Fraser River
FR-14.4	FR-SpProjD	14.4	Fraser River LBD Restoration Project, Downstream end	GCWIN	Temperature	Fraser River
FR-14.4		14.4	Winter Park W & S	CPW	Fish	Fraser River

Fraser River - Colorado River to Winter Park

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
FR-15	FR-SpProjU	15	Fraser River LBD Restoration Project, Upstream end	GCWIN	Temperature	Fraser River
FR-15	FR-SpProjU	15	Fraser River LBD Restoration Project, Upstream end	LBD	Macroinvertebrate	Fraser River
FR-15	FR-SpProjU	15	Fraser River LBD Restoration Project, Upstream end	LBD	Sediment	Fraser River
FR-16.6	FR-blwFSD	16.6	Fraser River below Fraser Sanitation	GCWIN	Temperature	Fraser River
FR-16.9	FR-abvFSD	16.9	Fraser River above Fraser Sanitation	GCWIN	Temperature	Fraser River
FR-17.7	FR-blwCR8HD	17.7	Fraser River below County Rd 8 at Hammond Ditch	GCWIN	Temperature	Fraser River
FR-18.1	FR-CR804	18.1	Fraser River below County Rd 804	GCWIN	Temperature	Fraser River
FR-18.1		18.1	Safeway	CPW	Fish	Fraser River
FR-20	FR-Rendezvous	20	Fraser River at Rendezvous bridge	GCWIN	Temperature	Fraser River
FR-20	FR-Rendezvous	20	Fraser River at Rendezvous bridge	LBD	Macroinvertebrate	Fraser River
FR-20	FR-Rendezvous	20	Fraser River at Rendezvous bridge	LBD	Sediment	Fraser River
FR-20.6	09025010	20.6	Fraser River Blw Vasquez Creek At Winter Park Co.	EGWQB	Water Quality	Fraser River
FR-21		21	Confluence Park	CPW	Fish	Fraser River
FR-22.5	FR-blwWP	22.5	Fraser River below Winter Park Resort at Idlewild Campground	GCWIN	Temperature	Fraser River
FR-22.5		22.5	Idlewild Campground	CPW	Fish	Fraser River
FR-22.5	09024000	22.5	Fraser River at Winter Park	DW/USGS	Flow	Fraser River
FR-23.2	FR-blwWPSD	23.2	Fraser River below Winter Park Sanitation	GCWIN	Temperature	Fraser River
FR-23.4	09023750	23.4	Fraser River Blw Buck Creek At Winter Park Co.	EGWQB	Water Quality	Fraser River
FR-23.4	FR-abvWPSD	23.4	Fraser River above Winter Park Sanitation	GCWIN	Temperature	Fraser River
FR-23.4	FR-abvWPSD	23.4	Fraser River above Winter Park Sanitation	LBD	Macroinvertebrate	Fraser River
FR-23.4	FR-abvWPSD	23.4	Fraser River above Winter Park Sanitation District	LBD	Sediment	Fraser River
FR-24	09023560	24	Fraser River Above Moffat Tunnel Nr Winter Park, Co	EGWQB	Water Quality	Fraser River
FR-24	WS-FR-010	24	Fraser/Jim Canal at Gaging Station	Denver Water	Water Quality	Fraser River
FR-27.2	09022000	27.2	Fraser River At Upper Sta, Near Winter Park, Co.	EGWQB	Water Quality	Fraser River
FR-27.2	FR-Upper	27.2	Fraser R above Mary Jane entrance to Winter Park	GCWIN	Temperature	Fraser River
FR-27.2	09022000	27.2	Fraser River At Upper Sta, Near Winter Park, Co.	EGWQB/USGS	Flow	Fraser River
HC-0.5	HRD-atCR843	0.5	Herd Creek on County Road 843	Denver Water	Temperature	Herd Creek
LCB-2.2	LCAB-blwDWB	2.2	Little Cabin Creek below Denver Water diversion	Denver Water	Temperature	Little Cabin Creek
LVC-0.2	LVC- abvWP	0.2	Little Vasquez above Winter Park on Arapaho Road	Denver Water	Temperature	Little Vasquez Creek
MC-0.5	MEA-atCR84	0.5	Meadow Creek on County Road 84/USFS 129	Denver Water	Temperature	Meadow Creek
RC-1.1	09033100	1.1	Ranch Creek Blw Meadow Cr Nr Tabernash Co	EGWQB/CRWCD	Water Quality	Ranch Creek
RC-1.1	09033100	1.1	Ranch Creek Blw Meadow Cr Nr Tabernash Co	GC/DW	Temperature	Ranch Creek
RC-1.1	RC-blwMC	1.1	Ranch Creek below Meadow Creek	GCWIN	Temperature	Ranch Creek

Fraser River - Colorado River to Winter Park

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
RC-1.1	RC-blwMC	1.1	Ranch Creek below Meadow Creek	LBD	Macroinvertebrate	Ranch Creek
RC-1.1	F-RC2	1.1	Ranch Creek downstream of County Road 84	LBD	Sediment	Ranch Creek
RC-1.1	09033100	1.1	Ranch Creek Blw Meadow Cr Nr Tabernash Co	EGWQB/CRWCD	Flow	Ranch Creek
RC-4.7	RC-blwCR8315	4.7	Ranch Creek below County Rd 8315	GCWIN	Temperature	Ranch Creek
RC-9	09032000	9	Ranch Creek Near Fraser, Co.	EGWQB	Water Quality	Ranch Creek
RC-9	09032000	9	Ranch Creek Near Fraser, Co.	EGWQB/USGS	Flow	Ranch Creek
RCC-0	WS-FR-011	0	Ranch Canal at Gaging Station	Denver Water	Water Quality	Ranch Canal
STC-0	ST-LC	0	St. Louis Creek above confluence with Fraser River	GCWIN	Temperature	St Louis Creek
STC-5.4	09026500	5.4	St. Louis Creek near Fraser	DW/USGS	Flow	St Louis Creek
VC-0	VC-WP	0	Vasquez Creek at the town of Winter Park	GCWIN	Temperature	Vasquez Creek
VC-0	09025000	0	Vasquez Creek at the town of Winter Park	DW/USGS	Flow	Vasquez Creek
VC-4.3	WS-FR-001	4.3	Vasquez Ck. above Vasquez Tunnel	Denver Water	Water Quality	Vasquez Creek
VC-8	WS-FR-002	8	Vasquez Ck. at diversion structure	Denver Water	Water Quality	Vasquez Creek
VCC-0	WS-FR-009	0	Vasquez Canal at Vasquez #1 Gaging Station	Denver Water	Water Quality	Vasquez Canal
VT-0	WS-WF-019	0	Vasquez Tunnel outlet	Denver Water	Water Quality	Vasquez Canal

Not Monitored in 2017

Fraser River - Colorado River to Winter Park

General Field Parameters	NW1	NW2	DW1	EG1	EG2	EG3	EG4	EG5	EG6	AQ1	AQ2	SMP1	SMP2
Temperature	X	X	X	X	X	X	X	X	X				
Dissolved Oxygen	X	X	X	X	X	X	X	X	X				
Specific Conductance	X	X	X	X	X	X	X	X	X				
pH	X	X	X	X	X	X	X	X	X				
Turbidity	X	X	X	X	X	X	X	X	X				
Flow	X	X	X	X	X	X	X	X	X				

Major Ions (plus carbon and misc)

Calcium	X					X	X	X	X				
Magnesium	X					X	X	X	X				
Potassium	X												
Sodium	X												
Chloride	X			X	X	X	X	X	X				
Sulfate	X												
Total Organic Carbon	X	X											
Total Alkalinity	X		X										
Total Suspended Solids	X	X	X					X	X				
Total Dissolved Solids								X	X				
Cyanide								X	X				
Ecoli													

Metals

ICPMS Total/Dis Suite*			X										
Iron, total	X							X	X				
Aluminum, total													
Arsenic, total	X							X	X				
Boron, total								X	X				
Chromium, total	X							X	X				
Manganese, total													
Aluminum, dis													
Copper, dis	X					X	X	X	X				
Iron, dis	X					X	X	X	X				
Manganese, dis	X							X	X				
Arsenic, dis	X												
Boron, dis	X												
Cadmium, dis	X							X	X				
Chromium, dis	X												
Lead, dis	X					X	X	X	X				
Nickel, dis	X							X	X				
Selenium, dis	X							X	X				
Silver, dis	X							X	X				
Uranium, dis	X							X	X				
Zinc, dis	X					X	X	X	X				
Mercury, dis					X		X	X	X				

Nutrients

TKN	X	X		X	X	X	X	X					
NH3 as N	X	X		X	X	X	X	X					
NO3													
NO3+NO2	X	X		X	X	X	X	X					
Ortho P	X	X		X	X	X	X	X					
P Total	X	X	X	X	X	X	X	X					

Aquatic Habitat

Macroinvertebrates										X			
Fish											X		
Riffle Stability Index												X	
Pebble Count												X	X
Embeddedness													X

*ICPMS Total/Dis Suite - Be, B, Na, Mg, Al, Si, K, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Mo, Ag, Cd, Sb, Ba, Hg, Tl, Pb, U

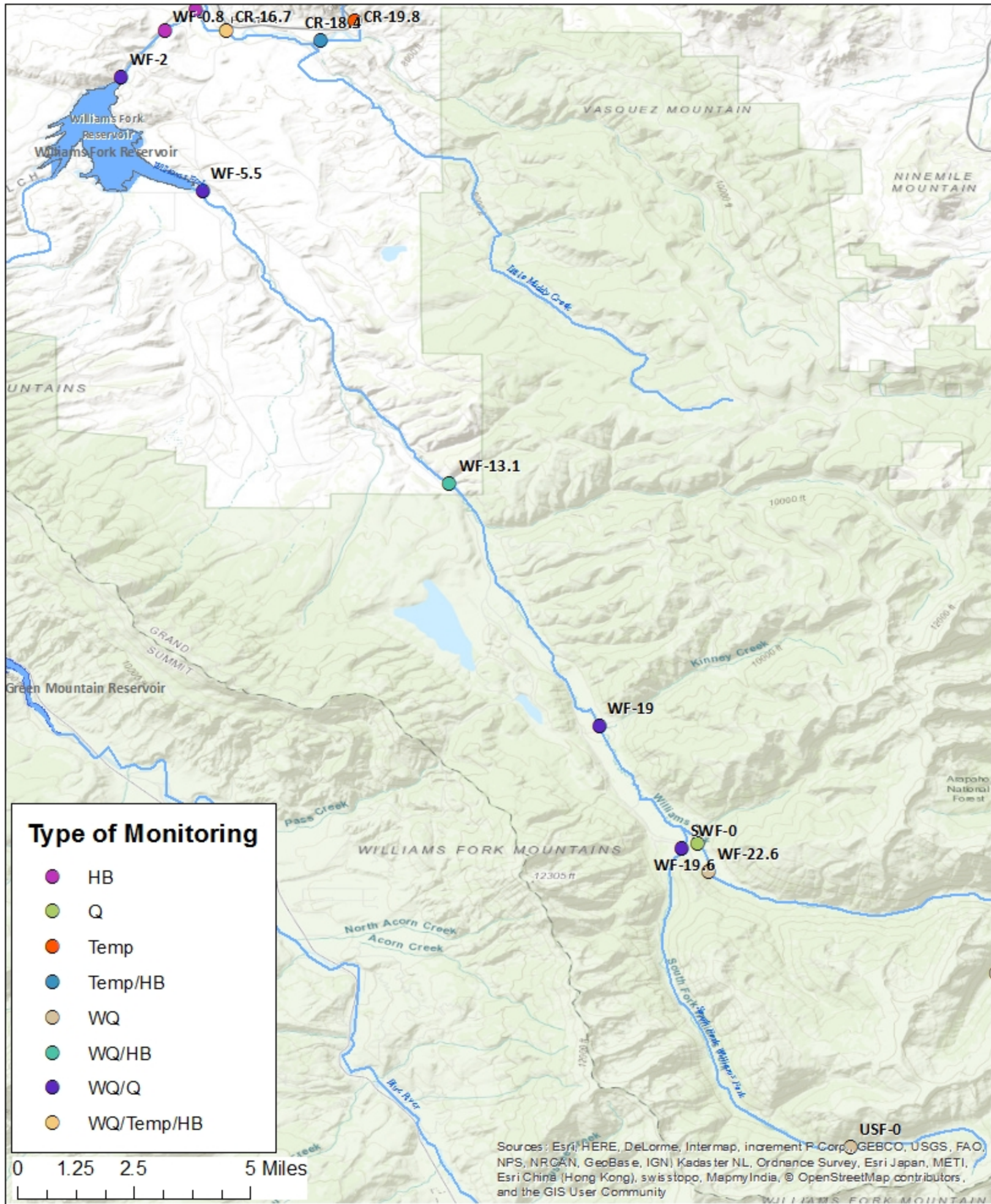
DW - Denver Water

AQ- Aquatic Life (bugs/fish)

EG - East Grand Water Quality Board

SMP - Stream Management Plan

Williams Fork



Williams Fork

River Mile ID	Entity Station ID	River Mile	Description	Entity	Type	Location
BC-0	WS-WF-008	0	Bobtail Creek above diversion dam downstream of gauging station (south of dorm)	Denver Water	Water Quality	Bobtail Creek
BC-0	09034900	0	Bobtail Creek above diversion dam	Denver Water	Flow	Bobtail Creek
MQC-0	WS-WF-006	0	McQueary Creek above diversion dam 1 3/4 miles north of dorm	Denver Water	Water Quality	McQueary Creek
SC-0	WS-WF-005	0	Steelman Creek at bridge above diversion dam (south of dorm)	Denver Water	Water Quality	Steelman Creek
SWF-0	WS-WF-003	0	South fork at South Fork Campground at gauging station	Denver Water	Water Quality	South Fork WF
SWF-0	09035900	0	South fork at South Fork Campground	DW/USGS	Flow	South Fork WF
USF-0	WS-WF-007	0	Upper South Fork of the Williams Fork (3.5 miles above trail head)	Denver Water	Water Quality	Upper South Fork WF
WF-0.1		0.1	Fence Hole station	CPW	Fish	Williams Fork
WF-0.8		0.8	Diversion station	CPW	Fish	Williams Fork
WF-2	WS-WF-009	2	Williams Fork R. below Williams Fork Res.	Denver Water	Water Quality	Williams Fork
WF-2	09038500	2	Williams Fork R. below Williams Fork Res.	DW/USGS	Flow	Williams Fork
WF-5.5	WS-WF-001	5.5	Williams Fork River upstream of Williams Fork Reservoir	Denver Water	Water Quality	Williams Fork
WF-5.5	09037500	5.5	WILLIAMS FORK NEAR PARSHALL, CO	DW/USGS	Flow	Williams Fork
WF-13.1	KR-LS-11081	13.1	Williams Fork	BLM	Water Quality	Williams Fork
WF-13.1	KR-LS-11081	13.1	Williams Fork	BLM	Macroinvertebrate	Williams Fork
WF-13.1	KR-LS-11081	13.1	Williams Fork	BLM	Habitat	Williams Fork
WF-19	WS-WF-002	19	WilliamsForkRiver below Kinney Creek confluence at Leal gauge	Denver Water	Water Quality	Williams Fork
WF-19	09036000	19	WILLIAMS FORK NEAR LEAL, CO.	DW/USGS	Flow	Williams Fork
WF-19.6	09035700	19.6	WILLIAMS FORK ABOVE DARLING CREEK, NEAR LEAL, CO	DW/USGS	Flow	Williams Fork
WF-22.6	WS-WF-004	22.6	Williams Fork above bridge at Sugarloaf Campground	Denver Water	Water Quality	Williams Fork
WF-28.2	09035500	28.2	WILLIAMS FORK BELOW STEELMAN CREEK, CO.	DW/USGS	Flow	Williams Fork

Not Monitored in 2017

Williams Fork

<u>General Field Parameters</u>	DW1	BLM1	AQ1	AQ2
Temperature	X	X		
Dissolved Oxygen	X	X		
Specific Conductance	X	X		
pH	X	X		
Turbidity	X			
Flow	X			

Major Ions (plus carbon and misc)

Calcium				
Magnesium				
Potassium				
Sodium				
Chloride				
Sulfate				
Total Organic Carbon				
Total Alkalinity	X			
Total Suspended Solids	X			
Total Dissolved Solids				
Ecoli				

Metals

ICPMS Total/Dis Suite*	X			
------------------------	---	--	--	--

Nutrients

TKN		X		
NH3 as N		X		
NO3				
NO3+NO2		X		
Ortho P				
P Total	X	X		

Aquatic Habitat

Macroinvertebrates		X	X	
Fish				
Habitat (% fines,% pools, etc)		X		X

*ICPMS Total/Dis Suite - Be, B, Na, Mg, Al, Si, K, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Mo, Ag, Cd, Sb, Ba, Hg, Tl, Pb, U

DW - Denver Water

BLM -Bureau of Land Management

AQ- Aquatic Life (bugs/fish)

Williams Fork

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BC-0					DW1				DW1			
MQC-0					DW1				DW1			
SC-0					DW1				DW1			
SWF-0					DW1				DW1			
USF-0					DW1				DW1			
WF-0.1									AQ2			
WF-0.8									AQ2			
WF-2	DW1		DW1	DW1	DW1	DW1	DW1		DW1		DW1	
WF-5.5	DW1		DW1	DW1	DW1	DW1	DW1		DW1		DW1	
WF-13.1				BLM1								
WF-19					DW1				DW1			
WF-19.6												
WF-22.6					DW1				DW1			
WF-28.2												

River Name	Abbreviation
Bobtail Creek	BC
McQuery Creek	MQC
South Fork	SF
Steelman Creek	SC
Williams Fork	WF

Sites where there are flow gages