Colorado Trout Unlimited and Boulder Flycasters
South Boulder Creek Stream Management Plan
Phase I Final Report
May 31, 2020

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1.) Executive Summary

Colorado Trout Unlimited (CTU) and Boulder Flycasters (BFC), a Trout Unlimited local chapter, along with our partners, completed Phase I of a Stream Management Plan (SMP) for lower South Boulder Creek (SBC). The project location was the (approximately) 9 mile reach of SBC beginning at the FRICo (Community Ditch) check structure at the mouth of Eldorado Canyon (LAT: 39.932 / LONG: -105.281), to the confluence with Boulder Creek (LAT: 40.033 / LONG: -105.217). **Please refer to Key Deliverables – A. in the Appendix for the project Reach Map.** The overall project scope included Stakeholder Outreach, Data Collection / Assessment, River Health Assessment Methodology Selection, and Existing Physical Infrastructure Assessment. The project commenced in March 2019, and all field work tasks were completed in November 2019. Consolidation and final analysis of findings, and report writing, were completed from November 2019 to April, 2020. This final report completes the agreed-to scope of work.

The project was funded by cash grants, direct cash match contributions, and in-kind services contributions from the following organizations:

- Colorado Water Conservation Board (CWCB) – Colorado Watershed Restoration Program – Stream Management Plan grant
- Metro Basin Round Table – Water Supply Reserve Fund – cash match
- South Platte Basin Round Table – Water Supply Reserve Fund – cash match
- Trout Unlimited (CTU and BFC) – cash and in-kind services match
- City of Boulder – Water Utilities Division (Boulder Water) – in-kind services match
- City of Boulder – Open Space & Mountain Parks (OSMP) – in-kind services match
- City of Lafayette – Public Works (Lafayette Water) – in-kind services match
- Denver Water – in-kind services match
- Colorado School of Mines – Senior Engineering Design Project Team – in-kind services match

The prime consultant, sub-contractors and advisers to the project were:

- Biohabitats, LLC – prime consultant / contractor
- Wright Water Engineers – sub contractor
- GEI – sub contractor
- Colorado Water Conservation Board – advisor
- Colorado Parks and Wildlife – advisor
- District 6 Water Commissioner – advisor
- Lefthand Watershed Center – advisor

In 2017 BFC identified this reach of SBC as an important improvement opportunity within the overall Boulder Creek watershed (our “home waters”). As we researched how to approach improvement for this reach, and discussed opportunities with key stakeholders, we found there was growing interest for action. Local municipalities were interested in overall watershed improvement, due to a combination of post-2013 flood impacts, public recreation / open space along the reach, and long term plans for watershed resiliency. A second important factor was the growing likelihood that Denver Water would gain permitting to expand Gross Reservoir. Based on an existing intergovernmental agreement (IGA) between Denver Water, Boulder and Lafayette, the expansion would create a 5,000 AF Environmental Pool. Water stored in the Environmental Pool would be from water rights owned by Boulder and Lafayette. It would be used to help maintain minimum sustainable in-stream flows throughout the year. This is especially important in the drier, “non-irrigation,” winter months (approximately October to March).

Beginning in December of 2017, BFC worked with Boulder and Lafayette to explore opportunities for collaboration and resource leverage to maximize any improvements to the reach. In the summer of 2018, Denver Water joined these discussions. In parallel BFC researched opportunities for watershed improvement

project funding. CTU (grantee) and BFC (program manager) subsequently applied for and were awarded an SMP Phase I grant in March 2019.

This reach of SBC is a highly segmented and diverted waterway. For its relative length, it is heavily used by a wide range of stakeholders. There are consumptive and non-consumptive users across multiple categories (municipal, agricultural, industrial / commercial, private landowners). This reach passes through or along approximately 5 miles of City of Boulder Open Space and is a heavily used recreation area (hiking, running, biking, bird watching, fishing). City of Boulder Open Space lands are also leased to farms / ranches. The reach is segmented by eighteen (18) creek-spanning structures, of which there are fourteen (14) ditch head-gates with diversion structures. There are an additional two (2) side-channel diversions to head gates, and one (1) in-stream diversion pipe. It is home to native / non-native fish and habitat, including eight (8) species of plants and animals classified as sensitive or threatened. During the non-irrigation winter months the reach suffers from no-to-extremely-low flows (1 CFS or less).

The background information above informed our decision to engage the SMP process. With an existing key stakeholder group in place and supporting the project, we moved forward with the key tasks. A summary of findings and recommendations is as follows:

- A steering committee was organized to include Boulder, Lafayette, Denver Water, BFC and our consultants. Through on-going meetings, the priorities of our municipal partners were discussed, existing relationships with other stakeholders (primarily ditch companies) were identified, and the "what" and "how" to message this project to the broader stakeholder groups were defined. This resulted in going slower than our original assumptions regarding stakeholder outreach to ensure we first had meaningful and actionable messages. An overall Communications Plan was developed to guide these efforts. Some key industrial / commercial stakeholders were approached as part of the Communications Plan roll out. The bulk of the Communications Plan will be executed in Phase II.
- We found that a significant body of scientific and engineering studies (mostly from our municipal partners), as well as indicative data (largely from State and municipal sources) existed. However, data were highly fragmented across many organizations / entities and pertained to different points in time. As we collected and reviewed information, we tested the reports and data for relevance against post-2013 flood conditions. This effort resulted in the creation of a central data base for use in this and future phases, as well as the identification of data gaps to be filled in Phase II.
- We collaborated with other SMP experts and projects to identify and select a River Health Assessment (RHA) methodology. We selected COSHAF / FACStream as the base methodology and then modified / fleshed out the framework with categories / components specific to SBC circumstances. We then compared existing data against the assessment categories and identified data gaps to be filled in Phase II. We also recommend further refinement of the RHA methodology in Phase II.
- R2-cross section analysis was applied to four (4) selected sub-reaches, roughly aligned with past sub-reach analyses, to provide a preliminary analysis of current flow needs. This preliminary data was then compared to existing flow regime data, and previously recommended sustaining and improvement flow levels. The preliminary results did not deviate substantially from existing flow level recommendations, but there are gaps in the flow history, much of which is from the lack of gauges post-2013 flood (gauges blown out and not yet replaced). Additional flow data gathering and sub-reach analysis is recommended in Phase II. We propose to complete point flow analysis for the project reach, develop the "highest practical" flow scenario and assess flow parameters as part of the RHA.
- A significant part of the field work in Phase I was to identify, survey and assess the physical infrastructure on this reach.
    - We enlisted a student engineering team from Colorado School of Mines through their Senior Engineering Design Project program. These students were all seniors nearing graduation. They were supervised by a project advisor, a PE member of the faculty, and our registered engineer consultants.

- These resources, combined with BFC volunteers and our consultants, created an inventory of the structures including GPS location, ownership, water rights data, photos, and other indicative data.
- The infrastructure analysis identified 21 structures in the reach. The infrastructure inventory includes eighteen (18) channel-spanning structures, two (2) side channel / return channels to a ditch head gate, and one (1) in-stream diversion pipe. Fourteen (14) of the channel spanning structures are ditch head gates and accompanying diversion structures.
- We established assessment criteria based on four opportunity improvement categories: 1) ability to pass and administer low flows, 2) potential for channel connectivity to enhance aquatic organism passage, 3) habitat improvement proximate to the structure, and 4) water use / operational efficiency potential. Four priority levels were created based on scoring each structure against the above criteria, with low flow passage / administration being heavily weighted. This resulted in recommendations for improvement (if any) for each structure. This then guided our recommendations for Phase II preliminary engineering design on the highest priority structures.
- In summary, we identified seven (7) structures as the highest priorities for modification. With low flow capabilities and aquatic organism passage as our top two criteria, the proposed modifications would not only allow for administration and passage of low flows, but also reconnect ~ 7 miles of this reach.

The above findings and recommendations are described in more detail in the next section of this report. **Please refer to Key Deliverables – B. in the Appendix for a Summary of Findings and Recommendations.**

Phase I results provide the basis for the Phase II scope of work and the completion of the SMP. Phase II will focus on executing the Communications Plan, closing the data gaps, performing the RHA, completing flow regime analysis, and performing the preliminary engineering design work on the seven (7) high priority structures. The engineering design work will require the participation of the ditch owners, and that participation is not guaranteed. However, gaining their cooperation is the first step in the Communications Plan execution. Many of the identified structures are either majority-owned / operated by our municipal partners, and / or our municipal partners hold significant shares in these ditch companies, which should increase our chances of successfully engaging these stakeholders.

(Continued on next page)

2.) Findings and Recommendations

This section will provide more detail regarding Phase I findings and associate recommendations. We will present these results using the key deliverables as the main organizing construct, and reference other scope of work deliverables in summary.

Task 1.0 – Stakeholder Engagement and Communications

Communications Plan (see Appendix: Key Deliverables – C.)

Most of this task work in the SMP Phase I was focused on identifying stakeholder groups, developing an inventory of existing data / information sources, selecting assessment methodologies, cataloging physical infrastructure within the reach, and performing preliminary assessments of physical structures and flow requirements. As such, much of the Phase I communication efforts focused on our direct project partners. There were few actionable recommendations to communicate to infrastructure / land owners resulting from the SMP Phase I work. The Steering Committee discussed the makeup of each stakeholder group, municipal partner experiences in working with these stakeholders, and how and when to best approach these stakeholders. Originally, we planned to begin outreach to the major ditch company stakeholders in Phase I. However, until the scope of Phase II was defined, funding secured, and actionable recommendations made ready to communicate, the Steering Committee believed that direct outreach would be premature. This was further reinforced by our municipal partners' experience. As a result, the project team decided to delay most of this outreach until Phase II. In Phase II we would be much better positioned to solicit specific input and bring relevant, concrete, actionable recommendations forward. However, during the SMP Phase I we did develop preliminary recommendations / priorities for physical infrastructure modifications and data monitoring that we believed would allow limited outreach. We began to communicate in 2019 with two key stakeholders on a very preliminary basis – Xcel Energy regarding Leggett / Jones-Donnelly and East Boulder Ditch, and Eldorado Artesian Water regarding access to their property near the FRICo check structure..

Overall, and as a result of the SMP Phase I, we recommend dividing the next steps between the remaining SMP tasks (in a separate SMP Phase II grant application) and the engineering / design and structural tasks (in a separate Watershed Restoration (WSR) Phase I grant application). Execution of the Communications Plan beyond the SMP Phase I will support both projects.

We recommend executing the Communications Plan across targeted groups, in order of degree of impact and direct participation in final solutions, as follows:

1. Steering Committee (Direct Project Partners): City of Boulder – Water Utilities Division, City of Boulder – Open Space & Mountain Parks, City of Lafayette – Public Works, and Denver Water (began March 2019 – on-going Phases I & II)
2. Core (Directly Affected) Stakeholders: High Priority Infrastructure Owners (Ditch Companies and Commercial Entities), High Priority Water Rights Owners (Other Private, Industrial, Commercial and Municipal Entities), and Immediately Proximate Landowners (Industrial); (limited 2019 communications in Phase I, with the majority of outreach in Phase II)
3. Secondary (Indirectly Affected) Stakeholders: Other Infrastructure Owners (Ditch Companies and Commercial Entities), Other Water Rights Owners (Other Private, Industrial, Commercial and Municipal Entities), and Other Proximate Private Landowners (2020 – Phase II)
4. Other Related Stakeholders: Conservation / Advocacy / Recreational Groups with a Boulder Watershed Mission, Other Adjacent Private Landowners (limited engagement in Phase I; expanding into Phase II)
5. General Public as Stakeholder (2020 – Phase II)
6. Advisors Stakeholder Group: Colorado Water Conservation Board, Colorado Parks & Wildlife, District Water Commissioner, and other select stakeholders

- Communication on-going with CWCB, CPW, and the District Water Commissioner (began in March 2019 and on-going)
- Update the Basin Roundtables (Q4 2019 and Q1 2020, and then on-going)
- Communication with the District Water Commissioner (began in March 2019 and on-going)

The Communications Plan is intended to be a "living" document. It will guide the work of BFC / CTU and their consultant team, continue to use guidance from our Steering Committee, and evolve over time based upon recommended future projects and feedback from the stakeholders.

Other Scope of Work Deliverables for Task 1.0

- Stakeholders list and commitments / level of involvement – embedded within the Communications Plan
- Meeting notes and project memorandum – Steering Committee presentations, notes, and meeting summaries (see Appendix: Additional Project Management Documentation i.)
- Interview / discussion notes, and inventory of needs, objectives, etc. - Steering Committee recommended delaying this level of outreach until Phase II beyond what resulted from Steering Committee interaction
- Communication Protocols – embedded within the Communications Plan
- PR Plan – embedded within the Communication Plan

Task 2.0 – Governance and Third Party Relationships

This task involves the efforts to establish the steering committee and other communications protocols. In hindsight, this task should have been combined with Task 1.0. As such, the background narrative in Task 1.0 (above) is sufficient to cover this task as well. The specific tasks in 2.0 included:

- Establish steering committee
- Establish relationship structures with other related groups
- Set up communication and collaboration technology as needed

In Phase I we established lines of communication with multiple groups / stakeholders as described in Task 1.0 above. Of special mention are other watershed and SMP education organizations. We received invaluable input and guidance from the Lefthand Watershed Center regarding our River Health Assessment methodology selection. In this same regard, the SMP Resource team (the "Colorado SMP Library"), led by River Network, provided overall assistance and guidance. Additionally, we reached out to various local watershed advocacy groups to discuss opportunities for collaboration and / or learning from their projects; including, Fourmile Watershed Coalition, Boulder Waterkeeper, Keep It Clean Partnership, and Boulder Creek Watershed Initiative. As appropriate we attended formal meetings, had less formal in-person discussions, read reports, and exchanged information via email. Lastly, we extended a relationship with Colorado School of Mines (CSM), started by CTU in 2018. The relationship involves using senior student engineers (near graduation) as project resources, on an in-kind basis. The CSM structure for this was the engineering student Capstone Senior Design Project program held every semester. The CSM students provided valuable field work and data collection in regard to infrastructure assessment.

Other Scope of Work Deliverables for Task 2.0

- Steering Committee Membership List – embedded in Communications Plan
- 2019 Schedule – steering committee reports
- Identified people for each relationship and frequency / type of contact – see narrative above
- Identified tool(s) – google, slack, drop box etc. - the level of communications with third party organizations in Phase I was generally handled using email, in-person meetings and exchanges of

reports / documents via email. Our prime contractor, Biohabitats, established a SharePoint collaboration space for all project team members using their Microsoft 365 technology platform. In addition, BFC established a Google-based email, document storage and calendar to facilitate BFC sharing of information within our organization.

Task 3.0 – River Health Assessment (RHA) Methodology

River Health Assessment Methodology Selection (see Appendix: Key Deliverables – D.)

After consultation with advisors and reviewing other SMPs' selected methodology, we chose to use Colorado's COSHAF / FACStream framework, with modifications for "human values" assessment, as the basis for this project's RHA methodology. We then customized the categories / components:

- Hydrology
  - Flow Regime
  - Sediment
- Water Quality
  - Chemistry (including metals and organics)
  - Temperature
- Biology
  - Riparian Condition (critical habitat)
  - Organics
  - Stability
  - Biota (native, non-native, invasive, sensitive / threatened)
- Morphology
  - Floodplain / Wetted Perimeter
  - Buffer Capacity
  - Connectivity (terrestrial and aquatic)
  - Structure
- Values
  - Recreation
  - Resilience (based on flow regime scenarios)

The process by which the methodology was fleshed out included:

- Leaning heavily on the results of other completed SMPs to create a starting point for discussing an overall RHA methodology; including categories; components; measurement types; data sources; notes, level of uncertainty, data and information gaps, for each component; and baseline measurement criteria to be applied to each component.
- A facilitated (by BFC), half-day, working session with representatives from Biohabitats project team, Boulder Flycasters, and City of Boulder Water Utility and Open Space & Mountain Parks personnel to discuss, edit and create an SBC specific methodology
- Mapping existing data collected (Data Inventory) to the categories of the RHA to confirm our ability to create a baseline, and to also identify data gaps.
- Adding to the COSHAF / FACStream categories (hydrological, biological and geo-morphological) to represent unique circumstances in the SBC reach under study (values assessment, such as recreation).
- We also consulted EPA Rapid Assessment and CDPHE 303 (d) listings of impaired waters and data categories.
- Then participants reviewed the draft result to incorporate edits and updates.

The major, overarching limitations identified were gaps in existing data (lack of historical data) and standard measurement criteria (objective measures). In some cases, given the dearth of existing scientific standards and

/ or inability fill a data gap for some of the categories / components, the working group recommended eliminating the least critical in order to have a practical assessment process. The biggest of these gaps in the historical data are: dry up locations, flow gauge data at needed level of detail (particularly on the downstream part of the reach), limited location water / biomass testing, and lack of sub-reach differentiation of water chemistry measurement. Because there are gaps in the availability of objective measures, there will be a reliance on professional judgment applied to some critical assessment areas. Areas deemed low priority and lacking historical data / objective measures were identified as potential components for elimination. Given the assumed level of analysis provided by the CDPHE during the Tri-annual Water Quality Review, the 303 (d) listing of water quality impairments will be used as an overall indication of water quality impacts on the entire stream segment. Other specific concerns resulting from other water quality data sources will be considered on an exceptions basis.

In Phase II we recommend one more process cycle to finalize the RHA before proceeding. This area is rapidly evolving, with new frameworks, criteria refinement, and data sources coming available.

Initial Low-Flow Analysis (see Appendix: Key Deliverables E.)

Minimum flows necessary to support fish / aquatic biota populations have been evaluated several times over the last 40 years. We looked at the following assessments:

- CDOW's work that led to in-stream flow recommendations (1980)
- Hydrosphere's 1994 re-analysis of the CDOW data along with newer information from a 1992 study
- CPW's re-analysis of historical CDOW R2Cross data (2019)
- Our analysis using recently surveyed cross sections (2019)

Considering the potential variability possible with R2Cross, particularly regarding the selection of a representative critical riffle, which sets the channel geometry and bank-full top width (the big drivers of the model), the estimated flows from the different studies are similar. See Appendix E for more detail. We then compared these to the minimum target flows agreed upon by Denver Water, City of Boulder, and City of Lafayette that would result from an Environmental Pool, if the proposed Gross Reservoir expansion project is approved. Based on this initial, high level assessment, the Environmental Pool minimum flows appear reasonable for preserving current conditions while also being feasible to implement. In addition, we recommend that additional opportunities for higher flows be pursued to help create a more resilient system.

While the current approach is to make use of a newly expanded Environmental Pool in an expanded Gross Reservoir to provide storage, if the reservoir expansion does not go forward or is significantly delayed, flow goals might still be met through other arrangements that, and while not preferred, would still be worth pursuing.

In Phase II we recommend confirming in-stream flow targets at different levels of beneficial outcomes; i.e. base line (status quo), with the Environmental Pool, and at highest practical levels. The RHA evaluation of sub-reaches will be used to establish potential benefits of structural, stream and riparian area modifications. In parallel, we recommend that monitoring already in place and proposed for the near future move ahead independent of the SMP project to build the data base as quickly as possible. This includes collecting flow data at key locations through existing and new measurement devices.

Existing Data Inventory (see Appendix: Key Deliverables F.)

The project team, with significant help from municipal partners' professional staff, identified and evaluated existing information pertinent to South Boulder Creek, and, in particular, the reach under study. We found that a significant body of scientific and engineering studies, as well as indicative data (largely from State and

municipal sources) existed. However, it was highly fragmented across many organizations / entities and varied in terms of time frame, level of detail, assessment criteria used, and grading scales applied. We also tested the reports and data for relevance against post-2013 flood conditions. This resulted in the creation of a central data base for use in this and future phases, as well as the identification of data gaps to be filled in Phase II.

The Inventory of existing Data / information includes, but not limited to:

- Biological and chemical testing
- Flow records from stream gauges
- In-stream flow rights / water rights
- Ditch companies / operators
- Habitat / biological studies
- Bio-mass counts
- Flood plain analysis

The project team also compared the existing data inventory against the RHA and flow needs. In general, the major findings are: 1) the lack of key historical data – dry up locations, flow gauge data at needed level of detail (particularly for the downstream part of the reach), limited location water quality testing; and 2) the lack of objective measures for some RHA categories / components will likely result in reliance upon professional judgment in the Phase II field assessment.

Overall, the project team has a better understanding how this data will be used for ongoing improvement and monitoring, and as the foundation of the River Health Assessment Methodology. In Phase II, we recommend closing data / criteria gaps required for RHA. We also recommend the project team perform a self-defined "reference reach" (basis for the "highest practical" scenario) exercise based on professional judgment to help fill in gaps for which quantitative data is unlikely to be found or developed within a the Phase II project time frame (2020 – 2021). And as stated above in regard to flow, in parallel, we recommend that the monitoring already in place and proposed move ahead independent of the SMP project so as to build the data base as quickly as possible. This includes collecting data at key locations through existing and new measurement devices: air and water temperature data, dissolved O2, chemical, and biomass data.

Task 4.0: Existing Physical Infrastructure Assessment (see Appendix: Key Deliverables G.)

A significant part of the field work in Phase I was to identify, survey and assess the physical infrastructure on this reach. The initial survey of infrastructure was performed by BFC chapter volunteers. These volunteers walked the reach, took notes and photos for each structure, and prepared a preliminary inventory and associated reach map. The project team reviewed these findings with our municipal partners and made corrections as needed. The project team also walked the City of Boulder Open Space with municipal partners to discuss Boulder Open Space & Mountain Parks' long term plans for each structure on their property.

The project team looked into university programs that might be appropriate to help with the Phase I structures work, particularly confirming and adding to the preliminary inventory. We were invited to present to, and then later engage with, the Colorado School of Mines' engineering Capstone Senior Design Projects program. The team consisted of 6 senior engineering students nearing graduation, and covering the disciplines of mechanical, civil and environmental engineering. We agreed on a scope of work and time frame for their participation. They were supervised by their faculty advisor, a registered PE member of the engineering faculty, and our registered engineering consultants from Wright Water Engineers and geo-morphologistsfrom GEI. These resources, combined with BFC volunteers and our functional consultants, created a more complete inventory of the structures including GPS location, ownership, water rights data, photos, and other indicative data.

The infrastructure inventory includes twenty-one (21) structures; eighteen (18) of which are creek spanning. Fourteen (14) of the eighteen (18) are ditch head gates and accompanying diversion structures, three (3) are small concrete drop structures, and one (1) is a pipeline. There are two (2) with side-channel / return-channels serving ditch head-gates with no in-stream structures. There is one (1) pipe in the channel diverting water to a pond on private property.

Our consultants developed an infrastructure assessment score card (Key Deliverables E) that incorporated the priorities for structure modification from the 2010 IGA to allow for low flow passage and administrations, improvement opportunities important to BFC / TU, and factors from the consultant's experience. This produced a priority ranking by structure for the team to consider. Based on this information and further discussions with our Steering Committee, we simplified this to four primary criteria as follows below (in order of importance):

1. Ability to pass and administer low flows,
2. Potential for channel connectivity to enhance aquatic organism passage,
3. Habitat improvement proximate to the structure, and
4. Water use / operational efficiency potential.

We then scored each structure against the above criteria, with low flow passage / administration being heavily weighted. Recommendations for improvement (if any) for each structure were then described based on the evaluation process. The outcome guided our recommendations for Phase II preliminary engineering design on the highest priority structures.

After grouping the structures based on the above assessment criteria, we then looked across Priority groups to identify the structures for emphasis in Phase II. We identified seven (7) structures from the Priority 1 (5 structures) and Priority 2 (2 structures) groups as the highest priorities for modification (*see below). With low flow capabilities and aquatic organism passage as our top two criteria, the proposed modifications would not only allow for administration and passage of low flows, but also reconnect ~ 7 miles of this reach.

Priority 1 Structures – inhibiting low flow passage / administration, as well as opportunities for channel connectivity / passage, habitat improvement and operational efficiency improvements

1. FRICo ("Community Ditch")* Check Structure (Mouth of Eldorado Canyon) -High Complexity. The FRICo structure is a relatively large and complex structure. It is the first structure downstream of Gross Reservoir with senior enough water rights to "sweep" the creek of all water during low flow periods. As such the ability to measure and administer the Environmental Pool flows is of critical importance. The district water commissioner reports that, at its present configuration, it would not be possible to administer the Environmental Pool low flows through this structure. The downstream segment of the creek is approximately 1 mile of cold-water fishery habitat supporting good populations of brown, brook, and rainbow trout. Very low populations of native species of fish are also present. The diversion structure is approximately 9-feet high, representing a significant barrier to fish passage. Providing fish passage is likely to be very expensive and of limited benefit, since the upstream segment is only about 200 meters long before another man-made diversion provides the next barrier to connectivity. As a result the FRICo structure is a very high priority for low flow management, with some potential opportunities to improve operational efficiency. Stream connectivity and habitat improvement opportunities are judged to be relatively low.
2. Goodhue Ditch* (along Prado Road neighborhood) – Low Complexity. The Goodhue Ditch diversion structure is a simpler structure than the FRICo diversion, with a water surface height of approximately 5-feet. The structure is not currently set up to measure and control low flows, but repairs and modifications to existing equipment may be sufficient to do this. The upstream segment is approximately 2500 meters, while the downstream segment is approximately 215 meters. Both segments are fair to good cold water fisheries with populations of brown, brook, and rainbow trout.

Native species are present in low populations. Fish passage using a grouted boulder ramp was previously designed to a 90% stage, but was not constructed. It appears that this configuration, or an alternate approach using more natural channel modifications may be able to provide fish passage at a moderate cost. The benefits of providing passage for native and non-native species is considered relatively high, given the length and quality of the upstream habitat. This structure is considered high priority for both low flow management and fish passage. Significant opportunities for habitat and operational efficiency improvements have also been identified.

3. New Dry Creek Carrier Ditch* (Downstream of South Boulder Road) – High Complexity. The New Dry Creek Carrier Ditch Diversion has two flow paths. It has a large swing gate leading to the Ditch, and a shallow, wide main channel overflow weir with a sand gate that is rusted and structurally undercut. This location is difficult for the district water commissioner to administer given current water rights requirements. The existing facilities will not be able to measure and administer the Environmental Pool low flows without significant modification. The upstream segment is 3600 meters of good cold water fishery habitat. Good populations of brown, brook, and rainbow trout are found, along with low populations of native species. Downstream is a 238 meter transitional habitat that contains native and non-native species. This structure is a significant barrier to cold water fish stranded in downstream segments that get very warm during the summer. It also is a barrier to native species from migrating to portions of the creek that contained a more diverse mix of species prior to the 2013 flood. Despite the high level of complexity of modifications required, this structure is considered high priority for both low flow water management and fish passage. There are also significant opportunities for improving habitat and operational efficiencies.
4. East Boulder Ditch* (Upstream of Baseline Road) - Conceptual Design Existing – Moderate to High Complexity. The East Boulder Ditch diversion manages relatively senior water rights that currently allow the entire creek flow to be swept under some low flow conditions. While the existing sand gate may be sufficient to measure and administer low flows, there are serious operational efficiency issues that also need to be addressed for this to work. This structure is one of the most significant barriers to the passage of trout trapped in the lower part of the stream when summer temperatures warm the water beyond what the trout can tolerate. It also is a barrier to native species free movement through this transition zone, preventing re-population to pre-2013 flood levels. Boulder OSMP has identified this as a priority location for fish passage improvement. A project is currently underway to design a natural channel approach to this fish passage. The needs for low flow management and operational improvements should also be considered either within this project or in a future project initiated in response to implementation of the Environmental Pool.
5. Leggett Inlet / Jones-Donnelly Diversion* (Downstream of Arapahoe Road) – Moderate Complexity. The Leggett Inlet is a large and complex structure that diverts water to Xcel cooling ponds. This structure currently is used to sweep all available flow under certain low flow conditions. There is currently no provision for management of low flows passing to SBC. This makes low flow measurement and management a high priority to ensure that Environmental Pool flows can be passed through to SBC, facilitating the water exchange agreements to make the in-stream flows possible. The upstream creek segment is fair for native and non-native species. Trout are found in this segment during high flows, but when flows drop off the upstream fish passage barriers trap trout in warm water that trout do not tolerate well. The downstream segment terminates at the KOA Lake inlet, which is a drop structure that forms a barrier to fish passage from the Lake. Given the invasive species present in the KOA Lake, fish passage through the lake inlet is not proposed, and the segment downstream from Leggett is relatively low priority for establishing fish populations. In addition, the Xcel cooling ponds are known to contain invasive species of fish and other aquatic life, so connectivity through those gates is not desired. Based on this, the Leggett Inlet Diversion is considered a very high priority for low flow management, and a very low priority for fish passage. Opportunities for operational improvements are limited to correcting structural degradation of the concrete. Habitat improvement opportunities are considered relatively low.

Priority 2 Structures – representing best opportunities for channel connectivity / passage, as well as habitat improvement and operational efficiency improvements

6. Marshallville Ditch* (at the State Hwy 93 overpass). The Marshallville Ditch is a side-channel diversion to the ditch head gate, with a return side-channel to the main channel when the gate is closed. However there is a weir / drop structure in the main channel where the side-channel exits the main channel. This creates a stream spanning barrier to fish passage in the main channel year round, and through the side channel at low flow. The side channel passage is further complicated by debris build up in and around the channel. Providing fish passage appears to be relatively easy, with the potential for a grouted rock ramp leading up to the crest of the weir. The Marshallville Ditch water rights are relatively minor, and will likely not be taking water during low flow periods when the Environmental Pool flows are in the creek. The aquatic and terrestrial habitats in this area are poor. Riparian areas are mostly privately owned. Ditch modification and habitat improvement may be more difficult due to land issues rather than stream conditions.
7. Howard Ditch* (downstream of South Boulder Road). The Howard Ditch head gate is off to the side of the main flow. However the main channel passes over a channel wide weir with two concrete steps downstream. Providing fish passage appears to be relatively low complexity, with the potential for a grouted rock ramp leading up to the crest of the weir.
8. KOA Lake Outlet (upstream of Valmont Road overpass). The KOA Outlet is a small structure that controls the level of the KOA Lake. No fish passage is envisioned. While the current outlet can manage flow flows adequately, operational improvements are recommended to reduce icing problems at the control structure and improve the ability to more precisely control lake levels and pass low flows.
9. Butte Mill Ditch (immediately upstream from confluence with Boulder Creek). The Butte Mill ditch is used to pass water from Boulder Creek (main stem) upstream of the confluence with SBC, to the Butte Mill ditch. In doing so it creates a complex structure to allow SBC water to pass through to Boulder Creek, and diverted Boulder Creek water to the ditch. Riparian areas are on public and private land. Water management efficiency is low. This structure effectively blocks the migration of fish between Boulder Creek, SBC and KOA lake.

Priority 3 Structures – representing opportunities for habitat improvement and operational efficiency improvements improvement:

10. Davidson Ditch (downstream of Eldorado Springs)
11. Bear Creek Ditch (diversion / return side canal along Prado Road Neighborhood)
12. New Dry Creek #2 (upstream of State Hwy 93)
13. Shearer Ditch (upstream of US 36 / modified for fish passage in the past)
14. South Boulder Canon (upstream of US 36 / modified for fish passage in the past)
15. McGinn Ditch (downstream of US 36 / modified for fish passage in the past)

Priority 4 Structures – representing minimum habitat improvement and / or operating efficiency improvement opportunities

16. Hunter-Hinde Property Diversion Pipe (in-stream pipe diverting water to private pond – just upstream of Baseline Road)
17. KOA Lake Inlet (upstream of Valmont Road)
18. Small concrete drop structure #1 (between Leggett / Jones-Donnelly and KOA Lake inlet)
19. Small concrete drop structure #2 (between Leggett / Jones-Donnelly and KOA Lake inlet)
20. Small concrete drop structure #3 (between Leggett / Jones-Donnelly and KOA Lake inlet)
21. Pipeline (between Leggett / Jones-Donnelly and KOA Lake inlet)

Based on recommendations from CWCB, the originally proposed SMP Phase II project will spin-out the infrastructure preliminary engineering tasks into a separate, but integrated project ("WSR Phase I"). SMP Phase I results provide the basis for the WSR Phase I. WSR Phase I will focus on performing the preliminary

engineering design work on the seven (7) high priority structures. In parallel, SMP Phase II will focus on executing the Communications Plan, closing the data gaps, performing the RHA, and completing flow regime analysis. These SMP Phase II tasks will directly inform WSR Phase I design decisions. The WSR Phase I work will begin later than the SMP Phase II work to allow for the data to be available and not delay engineering design work.

The engineering design work will require the participation of the ditch owners, and that participation is not yet guaranteed. However, gaining their cooperation is the first step in the Communications Plan execution. Many of the identified structures are either majority-owned / operated by our municipal partners, and / or our municipal partners hold significant shares in these ditch companies. This should increase our chances of successfully engaging these stakeholders.

Task 5.0 – Program Management and Administration

Phase I program management and project administration followed along typical project management tasks:

- We established a Program Management Office led by the sponsors' representative, a BFC board member and volunteer with extensive program and project management experiences
- After an RFP competitive process, we contracted with a consortium led by Biohabitats Environmental Consultants, and included Wright Water Engineers and GEI Fish Biologists
- Colorado Trout Unlimited (CTU), the CWCB grantee, managed the payment of invoices and collection of cash funds from our funding sources. The program management office provided monthly updates on costs expended and hours worked, matched to invoices. And also tracked work / schedule to date, and estimates to complete, versus budgets
- CTU provided financial reporting to funding sources. While BFC provided interim and final reports
- All major deliverables were reviewed and authorized by a BFC project oversight committee consisting of board members and project volunteers

As of this writing the project is complete, under budget and applying for grant funds for SMP Phase II and WSR Phase I

Scope of Work Deliverables for Task 5.0 (see Appendix: Supporting Documentation)

- Grant specific reports
- RFP process
- Biohabitats contract
- Budget reporting
- In-Kind services time sheets and reports

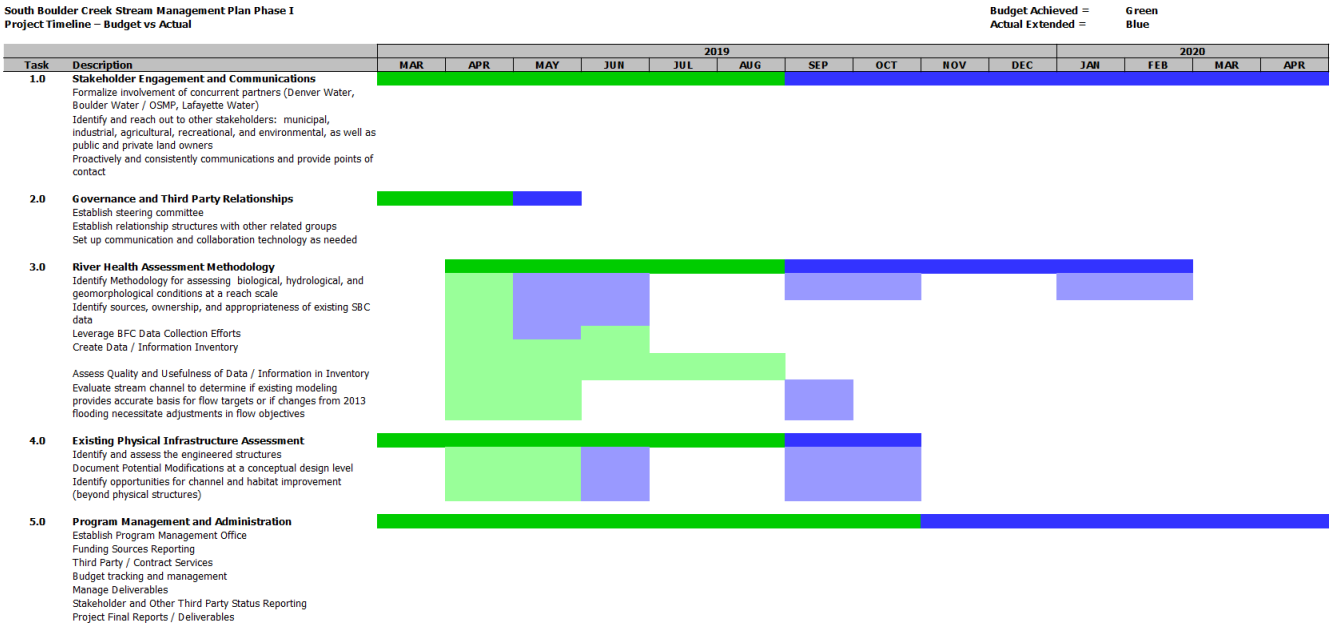
This Final Report, required by CWCB, will be used to complete the reporting requirements to each funding source:

- South Platte Basin Round Table
- Metro Basin Round Table
- Colorado Trout Unlimited
- City of Boulder
- City of Lafayette
- Denver Water

The final report will also be transmitted to CPW, the District Water Commissioner and the Colorado SMP Library.

3. Task Completion / Time Line (see Appendix: Supporting Documentation)

As of this writing, the project is complete, under budget and applying / contracting for grant funds for SMP Phase II and WSR Phase I. The project commenced in March 2019, and all field work tasks were completed in November 2019. Consolidation and final analysis of findings, and report writing, were completed from November 2019 to April, 2020. This final report completes the agreed-to scope of work.



Material exceptions to the planned and actual tasks completed are as follows:

- **Task 1.0 – Stakeholder Engagement and Communications**
  - The project team decided to delay this outreach beyond the Steering Committee stakeholders until Phase II (see comments page 5). However, key stakeholders from the Steering committee were actively engaged in providing feedback, priorities, concerns and future plans. This included the City of Boulder Water Utility, City of Boulder Open Space & Mountain Parks, City of Lafayette, and Denver Water
  - In April and May preliminary discussions were held with Eldorado Springs Artesian Water regarding access to their property for assessing the FRICo structure and for establishing flow, temperature and dissolved O2 monitoring. These discussions are on-going.
  - In April and May, preliminary discussions regarding Leggett / Jones Donnelly potential modification were held with Xcel Energy. And in September and October, preliminary discussions were held with Xcel Energy regarding East Boulder Ditch proposed modifications. These discussions are on-going.

- **Task 2.0 – Governance and Third Party Relationships**
  - In hindsight this task should have been combined with Task 1.0. As such the exception narrative in Task 1.0 (above) applies to this task as well
  - There were no material exceptions from the original statement of work

- **Task 3.0 – River Health Assessment (RHA) Methodology**
  - The project team did not make substantial progress in determining how best to normalize the wide array of data available and collected. We did create a meta-data key word list and housed all data

in a common shared repository. We will move to incorporating the data in a searchable database in Phase II

- **Task 4.0: Existing Physical Infrastructure Assessment (see appendix)**
  - There were no material exceptions from the original statement of work

- **Task 5.0 – Program Management and Administration**
  - There were no material exceptions from the original statement of work

(Continued on next page)

4. Budget-to-Actual Project Financial Results (see Appendix: Supporting Documentation)

The project was completed on time and under budget. Below is a summary of the financial results.

South Boulder Creek Stream Management Plan Phase I Budget to Actual Financial Summary Under / Over	as of:	05/31/20	
PROJECT ESTIMATE (FUNDED) **CASH:**		**ACTUAL**	**TOTAL VARIANCE**
Sub Contractor (Biohabitats)	**$85,000**	$83,195	-$1,805
BFC Admin / Out of Pocket Expenses (5%)	**$5,000**	$2,351	-$2,649
Contingency (10%)	**$10,000**	$0	-$10,000
TOTAL CASH	**$100,000**	**$85,546**	**-$14,454**
IN-KIND:			
CTU / BFC	**$11,000**	$14,494	$3,494
Municipalities	**$7,000**	$19,925	$12,925
CSM Student Team	**$20,000**	$20,487	$487
TOTAL IN-KIND	**$38,000**	**$54,906**	**$16,906**
PROJECT TOTAL	**$138,000**	**$140,452**	**$2,452**

Each funding source was supporting the project in total, and not by specific task. Therefore, the expected, final funding by source for the project is as follows:

South Boulder Creek Stream Management Plan Phase I Budget to Actual Financial Summary Funding Source Reconciliation	Final as of:	05/31/20		under / over
FUNDING SOURCES	**ORIGINAL BUDGET**	**FUNDED**	**ACTUAL**	**VARIANCE to BUDGET**
CASH:				
CWCB	$55,500	$55,500	$47,478	-$8,022
MBRT	$13,500	$13,500	$11,549	-$1,951
SPBRT	$13,500	$13,500	$11,549	-$1,951
CTU / BFC	$17,500	$17,500	$14,971	-$2,529
TOTAL CASH	**$100,000**	**$100,000**	**$85,546**	-$14,454
IN-KIND:				
CTU/ BFC	$9,700	$11,000	$14,494	$4,794
Municipalities	$1,300	$7,000	$19,925	$18,625
CSM Student Team	$0	$20,000	$20,487	$20,487
TOTAL IN-KIND	**$11,000**	**$38,000**	**$54,906**	**$43,906**
TOTAL PROJECT	**$111,000**	**$138,000**	**$140,452**	**$29,452**

CTU, as the grantee, completed the invoicing and accounting as required by our contract with the State of Colorado.

(end of report)

APPENDIX

Key Deliverables

A. Reach Map
B. Summary of Findings and Recommendations
C. Communications Plan (and Supporting Graphic Representation)
D. River Health Assessment Methodology Selection
E. Preliminary Flow Analysis and Cross Section Survey Locations Map
F. Data Inventory
G. Infrastructure Assessment Summary, Evaluation and Detail Assessment / Inventory

Supporting Documentation

a. Volunteer / In-Kind Hours Summary
b. Steering Committee Presentations