Poudre River Assessment Final Project
WR 204 Dr. Barbados
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Commented [Ey1]: As we finish our part, let's delete the instructions, and any other content that is not necessary, since the end game is a single pdf.

Part I: Qualitative Assessment

Table A: Qualitative Assessment Results

Indicators	Reaches ->	5 Rist	14 Timberline	17 Archery
Base flow	You	1	2	3
	SOPR	1	2	3
	Agree?	Yes	Yes	Yes
Flood plain extent	You	3	2	1
	SOPR	3	2	1
	Agree?	Yes	Yes	Yes
Riparian zone contributing area	You	1	2	3
	SOPR	1	2	3
	Agree?	Yes	No	No
Coarse scale channel structure	You	3	1	2
	SOPR	3	1	2
	Agree?	Yes	Yes	Yes

1. Base flow
    a. Which reach did you rank highest (rank=1), and why?
    Reach 5, Rist/Canyon Mouth; the median flow (cfs) was by far the highest with most flows sitting above 35 cfs constituting "good" base flow. Though diversions certainly exist, there are only three upstream of the Canyon Gage (Reach 5) compared to more than 15 downstream before coming to the Boxelder Gage (Reach 17).
    b. Which reach did you rank lowest (rank=3), and why?
    Reach 17, Archery/Boxelder; the median flow (cfs) was below 20 cfs for more time than the median flow of Reach 14 particularly from January through March. SOPR also notes that between Timberline (Reach 14) and I-25 (near Reach 17) "diminished peak flows and significantly impacted base flows" have reduced the channel width and more frequently disconnected it from the floodplain.

Commented [ZC2]: They are the highest/lowest because they are??? Reading a graph isn't rocket science.

Commented [Ey3R2]: Maybe just elaborate why a large floodplain is better than a thin one, and so forth....?

Commented [Ey4]: Maybe you could elaborate that its location upstream in a river that runs dry throughout the summer also contributes to more consistent base flows, and adversely for the lower score....?

2. Flood plain extent
    a. Which reach did you rank highest (rank=1), and why?
    Reach 17, Archery; the archery range site has development around it but no immediate encroaching construction. There seems to be a restriction on the northeast bank of the river where a lowland area has been turned into ponds with berms, but the south side looks very natural disrupted only minorly by a bike trail.
    b. Which reach did you rank lowest (rank=3), and why?
    Reach 5, Rist; this site is completely disconnected from its original floodplain by a berm and a road leading to a small parking area. Since the area is lacking virtually all connection to much of its original flood plain which is now Watson Lake on the other side of the berm road.
3. Riparian zone contributing area
    a. Which reach did you rank highest (rank=1), and why?
    Reach 5, Rist; the relatively unimpeded river lacks forest and woodland landcover found in the other reaches but remains primarily agricultural land uses with a section of semi-arid shrubland land cover to the north. Agricultural land also tends to have slightly lower impacts than fully developed land in an urban area.
    b. Which reach did you rank lowest (rank=3), and why?
    Reach 17, Archery; despite less proximity to urban development than Reach 14 (Timberline). There is less natural land cover (open water or forest and woodlands) around Reach 17 than there is creating a buffer around Reach 14. Additionally, Reach 17 sits within a quarter mile of the I-25 corridor, representing a major and high impact urbanized land use. There are also small pieces of land associated with developed human uses close to the north and west of the site.
4. Coarse scale channel structure
    a. Which reach did you rank highest (rank=1), and why?
    Reach 14, Timberline; other than minor erosion prevention measure on the levee/berm to the north to stabilize the lake the channel appears unmodified and sees little land use change around it as the road only contacts the floodplain briefly and the bike path is very low impact. Gravel bars and some variance within the floodplain indicate good river health.
    b. Which reach did you rank lowest (rank=3), and why?
    Reach 5, Rist; though there are diversion structures at both Reach 5 (Rist) and Reach 17 (Archery) which seem intended primarily for flow control within the channel. Reach 5 contains an additional diversion structure north of the test site diverting water into Watson Lake.

Commented [ZC5]: More work required (google earth, etc. to measure floodplain width to correspond to our scorings.

Commented [ZC6R5]: Likewise for 3) and 4).

Part II: Assessment Reflections

The Cache la Poudre River is one of Northern Colorado's largest rivers. It's well known in the region, being used for water by a variety of people in the area. According to the Poudre River Trail Corridor, the river is used for watering crops, and watering grass in parks, lawns, and golf courses. It also is used for industry and drinking and bathing water for the people who live nearby *(History of the Area - Poudre River Trail Corridor*, 2024). The National Wild and Scenic Rivers System additionally lists recreation as an Outstandingly Remarkable Value for the Poudre *(Cache la Poudre River, n.d.*).

The Rist reach seems moderately healthy, with good base flow due to being upstream and riparian zone contributing areas as a result, but poor flood plain extent and coarse scale channel structure. The Timberline reach is okay for everything likely due to urban encroachment, except coarse scale channel structure, which is good, thus making this reach also seem moderately healthy. The Archery reach does just a little worse, with poor base flow due to being downstream and poor riparian zone contributing areas as a result, okay coarse scale channel structure, and good flood plain extent. Each reach has strengths and weaknesses, and none of them score the same in any given category.

According to the Pacific Institute, stream reach assessments give us information on things such as mean annual pollutant load, evaluations of landscape features, point source locations and impacts, and mean annual concentration for pollutants in streams (*Stream Reach Assessment Tool – Pacific Institute*, 2020). These assessments allow us to see how effective current land management practices are.

I think that continuing to manage and regulate runoff, as well as creating and protecting better riparian zones could help to improve the health of the Poudre River. There's a lot of agriculture in this part of Colorado, and harmful chemicals could be seeping into the water from fertilizers and pesticides, for example (Marsh, 2020). Additionally, poorly maintained roads can contribute to runoff and sediment in rivers. For riparian zones, it's important to maintain them with native plants and work to ensure that they stay large enough so that they can have the biggest possible impact on the water's health *(Three Ways to Protect Your Rivers and Streams,* n.d.). Supporting natural riparian zones will also improve the health of other parts of the environment, by creating habitats and preventing erosion.

Part III: Thornton Pipeline

Commented [Ey7]: Let me know what you guys think after you are familiar with the scenario. If you have any questions, comments, differing opinions, please let me know.

Diversions dramatically affect flow regime, and base flows are commonly decreased by diversions during fall and winter or during drought. (City of Fort Collins, 2017, p. 27). Based on the evaluation of 2016 conditions from the State of the Poudre River report, on Table 4.1: Summary of river health indicator scores and letter grades organized by zones and reaches, it lists Reach 14 has a score of a 69, which is a "D" grade. Reach 17 has a score of 77, which is a "C" grade (City of Fort Collins, 2017, p. 41). By moving the diversion downstream, base flows in Reaches 14 and 17 could increase, particularly when it is most vulnerable.

When it comes to water quality, moving the diversion downstream might increase risks of pollutants entering the system, particularly from urban and agricultural runoff, which are common stressors. Reaches 14 and 17 have rather high scores for water quality currently, at 88 and 85 respectively, which could be altered by the greater chance of pollutants, but the higher base flows achieved may mitigate this (CITY OF FORT COLLINS, 2017, p48).

The Plains zone has some excellent patches of riparian habitat, such as the Riverbend Pond Natural Area and the ELC. Yet our reaches, 14 and 17, have lower scores, 73 and 71 respectively (City of Fort Collins, 2017, p. 55). Much of the habitat here is essentially "high and dry" and disconnected from the river; therefore, its ability to support river health is diminished because the primary driver of vegetation structure is connectivity with river flows (City of Fort Collins 2017, p. 56). By moving the diversion downstream, flows to this area would increase, which would also allow a more extensive vegetated riparian zone.

Channel modification is strongly present since the Poudre River is channelized through most of the zones. If the river does overcome its current channel and begins to meander or form branches, it is usually reconstructed into its artificial, single-channel form (City of Fort Collins, 2017, p. 62). For this reason, the location of the diversion will most likely be mitigated with either location. However, if it is moved downstream, the higher flows may increase pressure on downstream sections and could destabilize channels, worsening sediment transport and elevating erosion rates.

Maintaining the current location for the diversion of water for Thornton will continue to reduce flows and negatively affect both ecological conditions and recreational opportunities for Fort Collins. Thornton residents might gain urban water supply, but it will be at the expense of

opportunities to improve the health of the river. It will also affect the recreational opportunity upstream at the new Whitewater Park downtown (Booth, 2024a). Thornton is concerned that letting the water supply continue through urban Fort Collins and industrial areas would increase the chance of picking up pollutants and contamination, costing hundreds of millions of dollars in the form of a new treatment plant before Thornton residents could use it (Booth, 2024b). But many people and environmental groups feel that doesn't outweigh the benefits of allowing it to flow through its native area. Additionally, Fort Collins residents prioritize the Poudre River's health for drinking water and ecosystem services. Upstream diversions could degrade downstream water quality, reducing clean water access for Fort Collins while meeting Thornton's urban demands. Not to mention that using the Poudre River as its own natural transport is cheaper, faster, easier, and more ecologically healthy than draining the water out of the Poudre and putting it in a pipeline (Wockner, 2024).

While both options for locations of a diversion have pros and cons, it seems that one favors the opportunities for ecological restoration which I believe should be a priority. The Poudre River is already experiencing stress from lower base flows, which also affects riparian habitat along its corridor. Thornton is a partner in "Poudre Flows", which is a coalition of various stakeholders that are implementing a project that will protect and improve river flows on the Cache la Poudre River (What is the Thornton Water Project, 2024). I feel the easiest way for Thornton to improve river flows is to divert it as far down river as possible. While any diversion is not ecological ideal, the farther downstream it occurs, the less amount of area adversely affected. Modifications of existing projects can improve some negative effects without changing the existing benefits or creating additional problems (Stream Corridor Restoration, 1998, p. 493). Following this train of thought, Thornton will still get their water and ecological processes, that have suffered for so long from intermittent flows, will be improved.

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