

Beaver Considerations for Burke Creek Rabe Meadow Riparian Restoration Project

By: Patrick Johson and Meghan Kelly, Nevada Tahoe Conservation District

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Introduction

The beaver population in the project area for the Burke Creek Rabe Meadow Riparian Restoration Project (BCRMRRP) is having significant effects on the hydraulics and ecosystems of Burke Creek and Rabe Meadow. The onset of the current beaver activity in the project area is relatively recent with the current initial beaver colonization likely having occurred around 2018. The extent of beaver activity has increased significantly since the start of planning for the BCRMRRP, and it has become clear that the project design must examine how beaver activity during, and post-construction will affect project outcomes. King County, Washington has published a comprehensive planning manual for restorations involving beavers which NTCD has used in project planning.

Beavers provide many benefits to ecosystems they inhabit. The following are some of their noted benefits (King County, 2022, 28):

- Reduced channel incision and increased stream complexity.
- Help reconnect stream channels to floodplains and increase aggradation.
- Provide habitat for fish, birds and amphibian species.
- Increase groundwater recharge raising the water table.
- Moderate downstream water temperatures due to increased groundwater exchange.
- Reduce peak discharge and increase downstream baseflow during low-flow periods.
- Introduce dead wood into aquatic systems.
- Create snags that provide cavities for cavity-nesting birds and bats, as well as habitat for insects that birds and fish feed upon.
- Reduce erosion and flash flooding during rainstorms by attenuation peaks of small- to moderate-sized storms.
- Increase downstream water-quality.
- Provide climate change resilience and resistance to wildfires.
- Increased carbon sequestration compared to pre-colonized channels.

Beavers also, however, can cause detrimental effects when their flooding occurs in the wrong place and affects infrastructure. This is currently occurring in select areas of the project area, where flooding from beavers affects the Lam Watah Trail, the Stateline to Stateline bike path, and Kahle Drive. As well, nuisance beaver activity in the future could potentially affect parts of Nevada Beach Campground and the Douglas County Lake Tahoe Sewer Authority pump station by the campground.

Because of their significant ecological benefits, maintaining a healthy and active beaver population in Burke Creek and Rabe Meadow post-project should be one of the project's primary goals. However, nuisance flooding could potentially threaten this goal if ongoing adverse flooding leads future land managers to remove beaver from Burke Creek and Rabe Meadow. As well, construction activities could disturb beaver populations by either causing them to leave the area or be predated upon due to a temporary loss in the ponded water that protects them from predators. Therefore, the BCRMRRP will

consider how its design and construction can reduce nuisance beaver flooding, protect beavers during construction and create and maintain habitat in suitable areas for beaver.

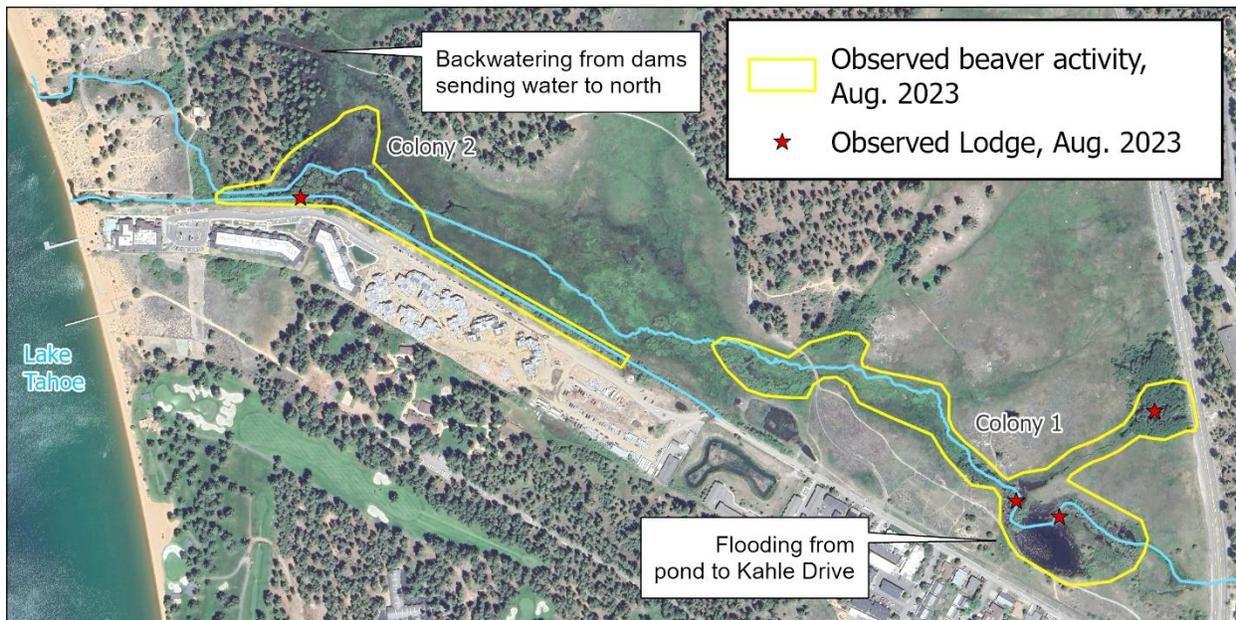
Beavers in the Lake Tahoe Basin and Burke Creek

Beavers were likely pervasive with high population numbers throughout North America prior to European contact, but populations were decimated by fur trappers during the 1700s and 1800s. Beaver were eradicated in Lake Tahoe by this trapping. In the early 1900s the importance of beaver to North American ecosystems began to be recognized by state and federal land managers, and the California Department of Fish and Game and the US Forest Service reintroduced a small number of beaver to the Truckee River watershed in the 1930s and 1940s. In the Tahoe Basin, this reintroduction occurred at Meiss Meadow where 4 beaver from the Rouge River National Forest in Oregon were introduced in 1938. Beaver populations in the Tahoe Basin today are likely primarily descended from these four and five others from which introduced beaver in the Truckee River Basin are descended from.

Today beaver can be noted in numerous creeks in Tahoe including Tallac Creek, Taylor Creek, the Upper Truckee River, Trout Creek, Meeks Creek, Slaughterhouse Creek, Incline Creek, Ward Creek, Blackwood Creek and, of course Burke Creek. The recent arrival and sustenance of beavers in Burke Creek is likely due to several factors. First, vegetation favored by beavers as food sources may have only recently reached a critical mass to sustain beavers. Willow and other riparian vegetation were likely cleared from Rabe Meadow when the area was used for grazing. Historic aerial imagery shows the meadow relatively devoid of vegetation until the early 2000s, and vegetation extent has continued to increase up to the present day, with ample food sources for beaver now existing. A second factor that may have helped the recent survival of beavers in the meadow may be changes in topography adjacent to the creek that have decreased nuisance flooding conflicts. The Tahoe Beach Club development raised the grade of the terrain and removed a large mobile home park that was previously adjacent to the creek. When this mobile home park existed, beaver activity would have quickly led to nuisance flooding that would have been met with applications for depredation permits. With this conflict area now gone, beavers are now able to inhabit this reach of the creek.

Beavers are territorial species that establish colonies with one breeding pair that give birth to litters that typically have 2 to 4 kits per year. Offspring tend to stay in the colony for two years before leaving to establish their own colonies. Based on observed patterns in Rabe Meadows it appears two colonies presently exist in the project area, one centered at Jennings Pond and one near where Burke Creek and the Kahle Ditch meet adjacent to the Tahoe Beach Club. A single colony will often have multiple lodges, with some being active and some inactive. Presently at least three lodges are noted in the Jennings colony and one at the newer colony by the Beach Club.

Previous studies have shown that colony density in beaver-occupied streams in California and Nevada are 1 colony per 1.2km and 0.9km of stream length respectively. The reach of Burke Creek between Highway 50 and Lake Tahoe is around 1.8km in length, which suggests that the area is likely at the number of colonies that we can expect to see in the area. Since the Jennings colony has now been around for several years, we might expect that population of beavers in the colony maybe near a plateau, while the population at the Beach Club colony may increase for another two years. The extent of both colonies may be expected to increase however, as beavers continue to expand their reach in search of food and materials to construct lodges.



Beaver colonies have varying longevity from a few years to many decades. The duration of a colony at a location is often driven by the amount of vegetation available for beavers to consume. If a beaver colony eats most of the food sources in its vicinity, the colony may shift location or be abandoned. Occupations of sites is often cyclical as beavers consume the vegetation then leave the site but return after several years when the vegetation recovers. In the intermediate years between occupation, ecological benefits from beavers often continue as there dams continue to exist with their associated effects. Beavers often then eventually return, repair and reoccupy these dams once vegetation has recovered. This could in fact be seen in Burke Creek, where the Beach Club colony reoccupied a dam the remnants of an old beaver dam.

Without human intervention, it is likely that the effects of beaver will continue to benefit the ecology of Burke Creek and Rabe Meadow for the foreseeable future. At present, ample vegetation exists for the current beaver population. In the event that the vegetation is eventually consumed to the point that beavers abandon the area, the extent of dams already constructed will continue to have ecological benefits in the watershed for some time. And because the project area is close to Lake Tahoe, and the many other beaver colonies in the Lake's streams, it is likely that the area will quickly be found and recolonized by beavers once vegetation recovers.

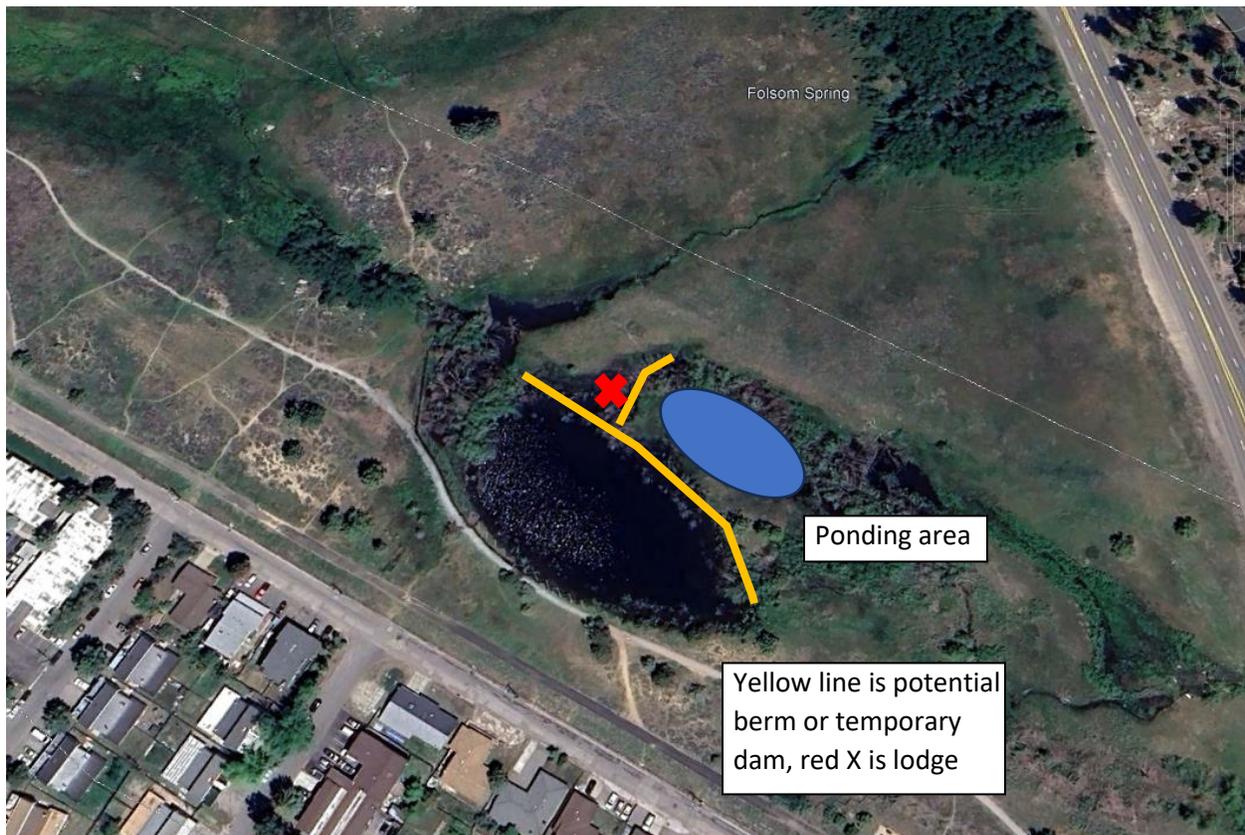
Construction scheduling

Based on previous discussions with LTBMU biologists, it has been determined that construction activities, including dewatering, will not commence until August 15th, so as not to disturb newborn kits. However, there is significant variation in timing of the birth and development of kits, and with multiple lodges existing in the Jennings Pond colony, it could be possible to try and identify which lodge the kits are born in to provide better spacing from construction activities. As well, if the kits were determined to be in the lodge at Folsom Spring, it would perhaps be possible to begin construction activities earlier than August 15th. Previous studies on beaver's have used listening devices placed on lodges to identify

the locations of kits, and discussions could perhaps be had with LTBMU biologists to determine if this is feasible to do at the lodges in the project area.

Water depth at lodge

Beavers generally create ponds with a minimum depth of three feet to cover their lodges' entrances for protection from predators. Therefore, at least three feet of water should be left at the lodge(s) to keep their entrances covered. Otherwise, there is a risk that predation could occur, especially on the kits. We have already designed the diversion at Jennings Pond to occur downstream of the main lodge to keep water flowing there. We could specify that the berm allow for 3' of ponding near the lodge – the temporary berm built of sandbags and plastic or a proprietary material would be in a Y configuration to pond an area upstream of the Burke outlet into Jennings Pond.



Beaver canals

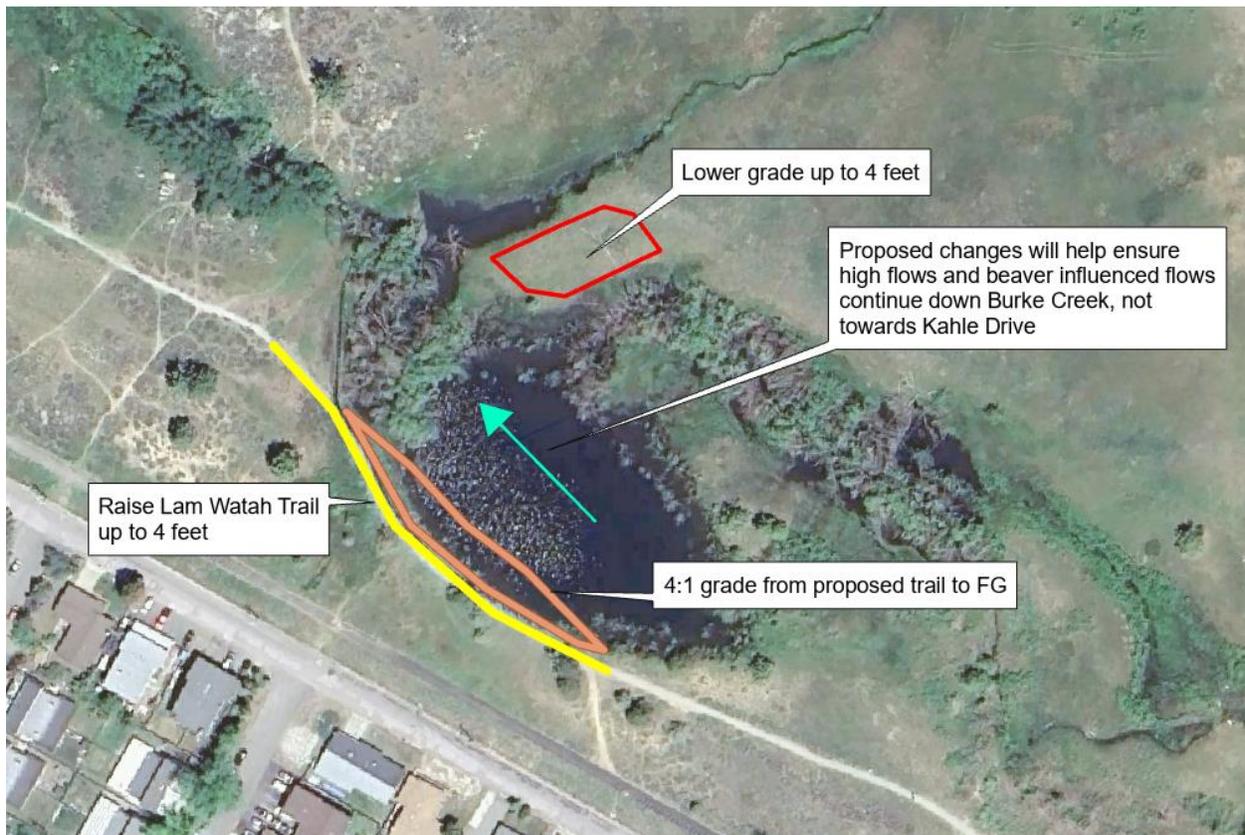
Beavers have been seen canaling to attempt to rewater ponds with dropping water elevations. This should be considered during work at Jennings and extra plastic and sand bags should be left on site.

Food cache/raft in ponds

In colder climates, beavers often store large amounts of wood at the bottom of ponds to provide a winter food source. We should observe their behavior this fall to see if this is happening at Jennings. If they are stashing food in the fall in the pond, we may be burying their winter food source. However, this might not be as important in the milder climate of Tahoe.

Ponding elevation and berm height

Because beavers need 3' of water depth for their lodges, we should expect future ponding in the restored Jennings area to be at least this high. Our current plans at Jennings show the finished grade of the filled in pond at ~6281. The Lam Watah trail elevation at the social trail south of the pond that connects to the State line to Stateline Bike Path is ~6284. As the trail travels toward Lake Tahoe, it descends to 6281 where the trail to the social crossing of Burke branches off. The height of the ground north of Jennings Pond at the plateau between Burke and the Folsom channel is ~6285. Therefore, it would make sense to lower the grade between Burke and Folsom and raise the grade of the Lam Watah trail to 6285 to allow future beaver ponding that will result in flooding back towards the Burke creek channel instead of Kahle Drive



Resilience to Construction

Dam notching and dam removal rarely causes beavers to leave an area. For the construction of a ditch near Jennings Pond in 2020, dams were destroyed and notched daily and the beaver population stayed in the area and grew. Beaver generally become efficient repairing and replacing dams as dams are destroyed. Beaver were also an issue during construction at Blackwood Creek burying and tampering with dewatering and diversion pipes. Pipe outlets should be covered in mesh or have an outlet structure that is large and difficult to tamper with overnight. Construction lighting could also be used to discourage beaver activity near dewatering devices.

Beaver Tunneling Prevention

Beavers often create tunnels to access food sources. This has occurred numerous times on the existing Lam Watah trail. When the grade of the Lam Watah trail is raised, we can dig a trench ~4' deep below the trail and put wire in it to prevent future beaver tunneling.

Groundwater Mitigation

While not necessarily related exclusively to beavers, current drainage issues on Kahle Drive are likely related to groundwater seepage from Jennings Pond and the existing reach of Burke Creek between Highway 50 and the pond. When the grade of the Lam Watah trail is raised and a trench is dug for tunneling prevention, this trench could also be backfilled with a low permeable fill as a structural deterrent to groundwater migration. The backfill for the 25' on the southern edge of the pond, where a slope from the raised Lam Watah Trail will be needed to the proposed restored wetland area, can also be a low permeable fill to move the wetted area north, further from Kahle Drive.

Sewer Station Protection

Techniques could be developed for deterring beaver populations to prevent beaver colonies from residing immediately downstream of the existing pump station at Nevada Beach. A formal management guide could accompany the flood mitigation plan for the pump station. We could also target willow removal in this area to limit the food source and use these willows for revegetation elsewhere in the project area. Since beaver are most active at night, artificial night lights at problem areas have been shown to deter beaver activity. These lights could be placed in and around culverts. Exclusionary fences could also be placed at culvert inlets and outlets. Finally, design of the new sewer plant access route can also be done in a way to minimize risks of beaver activity. Having the crossing upstream, rather than downstream of the station will make sure that in the event that beavers attempt to dam culverts, the backwatering will not affect the station.

Planting Strategy to Attract Beaver

Post-project planting can be used to attract beaver to sections of the project area where their presence is best suited to have positive ecological benefits and minimal impacts to infrastructure. Intensive willow staking could be conducted in these places. In doing this some of these areas may need to be temporarily fenced for 2-3 years to allow willow growth large enough to sustain new beaver activity. Short stakes (8-12" above ground) can also be utilized to prevent willow from prematurely uprooted by local beavers.

Population Sustainability

Research has shown that once an area has a sizable population of beavers, beavers will locate high-suitable accessible habitat quickly (3-5 years post restoration). If the focus is on both maintaining and creating suitable beaver habitat in the project area with a good food source, it is unlikely that the beaver population will disappear. Focusing on beaver related restoration near the main beaver colonies seems like a solid approach based on science and beaver population dynamics. The site is also ideally suited for

beaver related restoration as the gradient is less than 4 percent, the stream width is less than 75 feet, and a valley width of 70 feet is available at most of the reach.

Beaver Dam Analog Installation

Three beaver dam analog (BDA) structures were installed downstream of the aspen below Jennings Pond in 2022. After one winter, these structures appear to have promoted significant aggradation in the creek. On two of the structures, beavers have added vegetation and appear to have adopted them as dams. Based on these structures, it is clear the beaver dam analogs can be highly effective at providing a low-impact, low-cost approach to restoration in the project area. Additional BDAs could be installed in select areas, both to promote alternative beaver habitat during construction activities, but also to target restoration at headcuts and other eroded areas. These structures should be especially effective at addressing these areas due to the anticipated increased transport of sediment in the creek after the removal of Jennings Pond. These structures should be installed earlier in the season to provide additional habitat if they are forced out of Jennings Pond during construction.



Beaver activity on one of the large headcuts below Jennings Pond



BDAs on Burke Creek shortly after installation in 2022



August 2023: Beaver activity on one of the BDAs installed the previous summer (the middle BDA on the previous picture)

References

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