

Irrigation Infrastructure

Common Issues

Irrigation systems are the backbone of agricultural operations in the Yampa Valley. There are also many municipal and industrial diversions within stream corridors.

Aging or inefficient infrastructure can create challenges for both landowners and river health. Annual push-up dams, undersized or deteriorating headgates, disconnection of water availability at the point of diversion, and leaky ditches often require frequent maintenance and can disrupt fish passage and sediment transport.

Inefficient diversions may contribute to water loss and reduced late-season water availability. At the same time, conflicts sometimes arise where large wood, sediment, or beaver activity impact irrigation structures.

Questions to Consider

- Is the diversion infrastructure delivering the needed amount of water to the ditch?
- Does the diversion maintain minimum flows in the channel?
- Does the diversion allow for fish passage?
- Does the diversion structure allow for passage of sediment, wood, and recreational boats?
- Is upstream bank hardening causing downcutting of the riverbed?
- Is the diversion structure considered a “push-up dam?”
- What is the level of maintenance required by the current setup?
- Is the streambed dropping and making it more difficult over time to get water to the headgate?

Principles of River Health

Keeping Water in the River is Important to Maintain River Health

Having a minimum “biologically critical” flow is important for aquatic wildlife and riparian forest health. There are methods to study and identify the minimum quantity of water that should be maintained in a stream to support the health of the river. A dry stream in an area where wildlife did not specifically adapt with that condition can be extremely harmful for a system and catastrophic for the wildlife along specific reaches. CPW or other organizations or experts can help to assess flow needs using models such as R2Cross, which is specifically developed for Colorado streams.

Fish and Other Aquatic Wildlife Depend on the Ability to Move Up and Down the River

It is important to remove and reduce the impact of barriers such as push-up dams, low-head dams, and culverts that disrupt river function and pose problems for fish and other aquatic species to move up and downriver. Species rely on movement within the river to find food, reproduce, and take cover from predators.

Frequent Disturbance Within the Stream Channel Can Add Up Over Time

The yearly installation and maintenance of push up dams can cause increased loss of localized streambed sediment. Each year, cobble and rock are pushed up at diversion points to get water to headgates during irrigation season, and then moved within the river channel during spring flows. This constant cycle of unnatural disturbance can lead to excessive erosion and a deepening channel bottom. As a result, establishing an effective push-up dam becomes more difficult each season, further exacerbating impacts to river health.

Late Season Return Flows Help the River

Floodplains and wetlands along the river corridor maintain late season flows by slowly releasing water held on the land. Irrigation infrastructure can sometimes serve the same purpose. Infiltration of water from unlined ditches and flood irrigation can recharge aquifers and raise groundwater tables. Water applied to the land returns to the river weeks or months later.

Streams Move Over Time

Healthy rivers require the movement of the channel within the floodplain to regenerate riparian forests and dissipate the energy of high flows. Therefore, the establishment of a fixed point of diversion for irrigation can conflict with natural river processes. Irrigators should consider ways to access water for irrigation that don't require limiting stream movement.

Recommended Practices or Actions

Irrigators and landowners can undertake a variety of actions to improve diversions while reducing impacts to stream channels and aquatic habitat. Several recommendations are discussed below, including replacing annual push-up dams with permanent structures, incorporating fish and aquatic passage, protecting headgates and pump intakes with debris racks, planning for beaver coexistence, installing headgate automation, and relocating points of diversion where channel conditions have changed.

Replace Annual Push-up Dams



A permanent rock rundown diversion structure doesn't require annual excavation work | Photo by Roddy Beall, Zenobia Consultants

Where possible, the annual practice of pushing up a cobble dam can be replaced with a permanent or semi-permanent structure. A permanent rock diversion reduces annual maintenance requirements and reduces the erosion and channel deepening caused by annual excavation. This also eliminates the presence of foreign materials such as tarps in the waterway. Natural materials or designs that mimic beaver dams can be effective and also support river processes.

Build in Fish Passage

Fish and aquatic passage is the ability of fish or other aquatic species to move through an aquatic system to all the habitats necessary to complete their life cycle. As discussed previously in the Fisheries section, it is possible to retrofit existing diversion structures to allow for aquatic passage. It is especially important to consider aquatic passage with all new structures.



A boulder diversion structure allows fish passage | Photo by Roddy Beall, Zenobia Consultants

Protect Headgates and Pump Intakes with Debris Rack



Adding a wood debris rack protects the headgate so more wood can remain in the river | Photo By RK Trading Company

Wood in the river can snag on diversions and headgates. This creates a nuisance for irrigators and leads to a general feeling that all woody material should be removed from the river and areas adjacent to the river. However, as discussed previously, wood is important for fish habitat and river health. Installation of debris racks at the point of diversion that protect headgates and pump intake shafts can reduce the conflict between irrigators and the presence of wood in the system. The dual objective is to allow the passage of water into the irrigation headgate or pump system while directing wood naturally downstream. Design and placement of debris racks should consider the size of wood in

the system, the angle of the rack, inclusion of a deflector plate in the direction of stream flow, and the location of placement to increase the likelihood that wood will deflect or pass by. While it still may be necessary to periodically remove snags, a debris rack can reduce maintenance needs and improve reliability of water reaching the ditch.

Plan for Beaver Coexistence

The most common complaints regarding “problem beavers” are about dam-building in irrigation ditches causing flooding or disruption of flow. Beaver coexistence is an ongoing process. As discussed in the Beaver Coexistence section, starter dams and flow devices can be built onto a headgate to prevent beavers from obstructing the intake. Infrastructure upgrades can help reduce conflict so that the benefits of beavers for river health can be maximized while irrigation infrastructure is protected.



A flow device on an irrigation headwall protects the ditch without the need to remove beavers | Photo courtesy of Skip Lisle, Beaver Deceivers International

Install Headgate Automation

Adding automated operation to headgates can reduce the need for robust and expensive in-channel diversion structures. Automated operation enables the headgate to open and close automatically based on flow measured in the flume. Without automation, delivery of water to a headgate requires a diversion structure to create the necessary water surface elevation at the point of diversion. Automated operation can reduce the need for physical modification within the channel, thereby reducing passage concerns for aquatic species and recreational users.



Installed automation control | Photo by Eric Peterson, Bureau of Reclamation

Move the Point of Diversion

Streams naturally move over time through erosion, sedimentation, and avulsion. As streams move, it may be necessary to consider moving the irrigation diversion or headgate location. Colorado water law allows for a change in location to the head of a ditch without the need to file for the modification in water court when (a) the channel has changed (cut out, lowered, turned aside, etc.) and (b) the relocation is necessary to maintain the inflow. This flexibility in water law is intended to recognize that river channels migrate over time. Moving a headgate is not an easy decision, but it can improve the delivery of irrigation water, reduce costly channel modifications or engineered solutions to maintain water levels at the headgate, and improve the health of the stream. When choosing a new location, look for opportunities to combine with other ditches, or locate near another fixed point, such as a bridge abutment. Grading work may be necessary to connect the new diversion location to the irrigation ditch network.

Benefits of Implementing Recommended Practices

- More reliable water delivery and reduced annual labor to rebuild or maintain push-up dams
- Cost savings from fewer emergency repairs and more efficient use of diverted water
- Improved resilience of operations during drought years through reduced losses and better flow management
- Reduced maintenance
- Improved infrastructure, which also improves property values

Reference and Resource Materials

The Watershed Center's [Passage Playbook](#) provides guidance for how proponents can work collaboratively with landowners on passage projects by improving their understanding of landowners' perspectives.

Resource professionals can use [The Water Diversion Selection Tool](#) to help identify river- and site-compatible diversion mechanisms and the ecological and logistical tradeoffs of each compatible mechanism.

To explore how flood irrigation supports wetlands, read [Wetland Benefits of Flood-Irrigated Grass Hay](#) by the Intermountain West Joint Venture.

The CWCB developed the [R2Cross Model](#) with technical contributions from CSU to support ecological assessment and streamflow modeling for river health.