

# THE CURRENT

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Welcome to the fall issue of **THE CURRENT**, the community newsletter for the Upper Lillooet Hydro Project (ULHP). With such an array of activity happening both on-site and in the community, this publication allows us to share the stories coming out of the project.

It's been a busy year thus far and as we head into the final months of the construction phase, we are reaching major construction milestones on a regular basis.

In this issue we'll explain how tunnel construction works, take a detailed look at our measures to mitigate any impact on Coastal Tailed frogs, detail the design and construction of the Alena Creek Fish Habitat Enhancement Project, how training programs developed from the project helped employ local community members and much more.

Despite two small fires nearby in mid-summer, this year has been relatively smoother for the construction crew as we continue to make up for lost time during the temporary closure from last year's serious Boulder Creek Wildfire (V30241), landslide and flood events.

As always, we'd love to hear your feedback on any issues, concerns or kudos you may have. Send us an email at [info@upperlillooethydro.com](mailto:info@upperlillooethydro.com)

## ABOUT INNERGEX

Innergex develops only renewable energy projects because we believe that the way to a cleaner future is through truly sustainable energy sources. We began developing, owning, and operating run-of-river hydroelectric facilities, wind farms, and solar photovoltaic farms in 1990. Today, we operate facilities in Quebec, Ontario, British Columbia, the USA and France. From the very beginning, our mission has been to produce clean and renewable energy by developing and operating high quality facilities while respecting the environment and balancing the best interests of the host communities, our partners, and our investors. For more info please visit [www.innergex.com](http://www.innergex.com).

## Upper Lillooet River HEF Tunnel Construction

### Quick Stats –

*Construction method:*

Conventional Drill and Blast

*Length:* 2,500 meters

*Shape:* 6 metre wide "D" shaped.

The Upper Lillooet River Hydroelectric Facility (ULRHEF) utilizes an approximately 2,500 metre long tunnel to convey water from the intake located just above Keyhole Falls to a steel pipe (commonly known as a penstock) that runs down to the powerhouse 3.5 kilometres downstream. As the water flows down the penstock, the kinetic energy created is transformed into usable electrical power.

The tunnel runs adjacent to the Mt. Meager Volcanic Complex, the most recently active volcano in the Coastal Volcanic Belt of Western Canada. Tunneling conditions were very challenging due to deposits associated with the most recent eruption (2300 yrs. B.P.) from Mt. Meager. The volcanic deposits encountered on the uppermost tunnel section were comprised of welded and poorly-welded breccia.

There was also unconsolidated deposits comprised of loose pumice, debris avalanches, and organics which once represented the old forest floor and into the pre-eruption valley side cover soils, and finally tonalite bedrock for the last 2,000 metres.

The unconsolidated zone was the most challenging section of the entire project as high groundwater inflows, above 2,000 gallons per minute, had to be managed while tunneling downhill into loose gravelly sand while 100 metres below the surface. In order to keep the water from washing out the surrounding ground and collapsing, the ground had to be solidified in advance of the excavation. This was accomplished by cover grouting; a series of holes were drilled around the tunnel core and pumped with grouts in order to create a protective outer shell and finally the center portion grouted. Each grout injection sequence was approximately 40 metres in advance of the



↑ Upper Lillooet Upstream Tunnel Portal

tunnel face before excavating could begin. In the end, three overlapping grouting programs were successfully completed.

In order to excavate and support the surrounding ground structure in the unconsolidated zone, an overlapping canopy support system was used which entailed drilling 12 metre steel tube sets around the circumference of the tunnel profile.

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# 3 Month Timeline

## OCTOBER 2016

- Completion of Upper Lillooet River and Boulder Creek Intakes
- Boulder Creek Diversion flip
- Both Tunnels now completed, continue with tunnel cleaning and final lining
- Complete the Penstock to Tunnel connection at Upper Lillooet River
- Complete the Civil Works around Upper Lillooet River Powerhouse
- Complete both substations
- Complete majority of reclamation works
- Demob equipment no longer required

## NOVEMBER 2016

- Tunnel Rocktrap and Tunnel Plug Complete at Boulder Creek
- Complete Turbine and Generator and Control work at Upper Lillooet River

## DECEMBER 2016

- Steel Liner installation into Boulder Creek tunnel
- Potential to start commissioning works at Upper Lillooet River
- Access road will most likely be snow plowed up to KM42 this winter

## Tunnelling *Continued from Page 1*

The drilled tubes were then pumped with high pressure grout which could escape the tubes via radial ports in order to bridge the space between tube sets. Excavation would advance using a roadheader; a rotating toothed drum, which pulverized the grouted material, then steel arches were placed every metre and finally the tunnel walls sprayed with 150 mm of fiber-reinforced shotcrete. This excavation sequence would be in 4 metre increments before the next overlapping canopy tubes would be installed. It took approximately 9 months to successfully advance through the 65 metre zone.

The remaining tunnel rock conditions were relatively good. Once the fragmented rock was bucketed out, the surrounding rock structure would be assessed for additional support. The support typically utilized an assortment of anchor bolts and fiber reinforced shotcrete wherever deemed necessary for long term stability as directed by the engineer.

The final running surface of the tunnel was graded smooth and covered with 150 mm of concrete in lieu of cleaning out the floor muck and will provide a better driving surface for future tunnel inspections.



↑ Applying shotcrete to the tunnel face and walls for stability

← Left: Typical tunnel section with utility services.

← Far left: Upper Lillooet Downstream Portal.



## Alena Creek Fish Habitat Enhancement Project

When we started construction of the ULHP in 2013, our Fisheries Act Authorization required us to design and construct 2,310 m<sup>2</sup> of instream habitat restoration, to offset potential impacts to fish and fish habitat that could not be avoided, minimized or mitigated during construction and operation of the ULHP.

The Alena Creek Fish Habitat Enhancement Project (FHEP) was

selected for fish habitat enhancement, based on its proximity to the project site and the unique opportunity to restore and enhance a stream heavily impacted by a natural, catastrophic event (i.e. August 2010 Meager Creek, Capricorn landslide). Alena Creek was extensively altered, as the Upper Lillooet River flow path extended over top of the Alena Creek alignment which deposited a large volume of sediment and debris in and around Alena Creek. As a result, fish habitat features such as roughness, instream cover, richness of the riparian vegetation community, spawning habitat and depth

complexity were limited in the Alena Creek channel.

The Alena Creek FHEP has been designed to specifically enhance spawning and rearing capacity for bull trout, coastal cutthroat trout, and coho salmon and consists of the following components:

- Creation of a new bypass channel
- Bulk sediment removal (mechanism to release/expose existing complex coarser sediments covered in fine sediment (e.g. sand and silt from the Meager slide))
- Pool habitats
- Rock weirs and boulder riffle complexes

# Coastal Tailed Frog Penstock Crossing

During construction of the Upper Lillooet Hydro Project (ULHP), Innergex followed a government-approved Construction Environmental Management Plan (CEMP) to help avoid, minimize, and mitigate potential effects to wildlife within the project area. The Coastal Tailed Frog (CTF), which is federally listed in the Species at Risk Act under Special Concern and in the provincial Wildlife Act as blue-listed, are found aquatically near fast flowing, permanent rocky step pool streams and terrestrially (usually within 100 metres of breeding streams). Migration to breeding areas occurs between June 1 and October 31 and tadpoles can be present year-round. Tadpoles range from 2 to 6.5 centimetres long and have a sucker like mouth, ventrally flattened bodies and laterally compressed tails. Their colour is black to brownish-grey with a white spot on the end of the tail. Adults are between 2.2 and 5.1 centimetres long, distinguished by their vertical, diamond-shaped pupils, large head and granular skin. Males also stand out with a short tail, and colours are variable (brown, green, grey, red, black) with a black eye stripe.

The Upper Lillooet River Hydroelectric Facility (ULRHEF) penstock crosses a CTF stream (i.e. ULL-ASTR04) which required a number of key measures to be implemented, including salvage and translocation, temporary diversion of the stream, and restoration. Note: Refer to Issue No. 4 for Clearing In Riparian Areas.

The salvage area (i.e. construction impact area including a buffer) was appropriately isolated prior to, during and post-salvage within the active construction period. The salvage of CTF tadpoles followed the CEMP CTF Salvage and Translocation protocol, which is based on provincial requirements, and in accordance with a provincial permit to salvage and translocate tadpoles during the diversion of the stream (i.e. temporary divert the stream around the construction area to allow construction to occur in the dry). All water extracted from the stream was immediately returned to the same stream. A Qualified Environmental Professional with experience handling amphibians (i.e. Ecofish), oversaw the translocation of salvaged individuals, in

- Removal of a large wood debris jam blocking stream connectivity
- Large woody debris complexes
- Riparian area thinning and infill planting

Components have been constructed either in isolation or in combination, depending on the local channel features and conditions present at the time of construction. The FHEP was constructed by Mumlegs Construction Ltd. (refer to Issue No. 4 of The Current) and was built this August/September 2016 with the final design and environmental monitoring completed by Ecofish Research Ltd.

A five-year monitoring program will be conducted by a QEP once the project is operational.

New Bypass Channel consisting of large woody debris and riffle habitat →



↑ Coastal Tailed Frog crossing

consultation with the Independent Environmental Monitor. Salvaged tadpoles and adults were moved to a similar habitat of equal or better habitat suitability relative to the salvage site, outside of the area of impact.

The Boulder Creek Wildfire (V30241) in the summer of 2015 destroyed the riparian habitat and heavily altered aquatic habitat at the stream crossed by the ULRHEF penstock (ULL-ASTR04). The fire burned along almost the entire length of the tributary; covering the area within and upstream of the penstock crossing. In contrast, the habitat downstream of the crossing was relatively untouched within an approximately 100 metre long strip of riparian habitat remaining up to the location where the stream descends over a cliff into the Upper Lillooet River. While some aquatic organisms, including stoneflies, mayflies and caddisflies were detected during a salvage conducted in September 2015, no CTF were detected at the site immediately following the fire, likely because of changes in water quality.

Post-construction, the stream has been reconstructed to support similar instream habitat quality and characteristics that existed prior to construction, including embeddedness, substrate size, gradient and structure. Substantial, layered, decay class three, coarse woody debris was installed within 10 metres of the CTF stream at the ULRHEF penstock crossing and then revegetated with riparian plants.

The habitat restoration monitoring program will be completed once the project is in operation to evaluate the effectiveness of the reconstruction of the penstock on the quality of CTF habitat.





↑ A \$5000 cheque presented to the PVTA

## Local Sponsorships & Community Updates

In late July, Innergex presented the Pemberton Valley Trails Association (PVTA) with a donation of \$5,000 towards the construction of a new uphill access to the popular Mosquito Lake Trail area. The funds will be used for a brand new trail section and also for upgrading some existing trails to connect to Mosquito Lake. The concept for the trail is to allow users to avoid having to go up the Mackenzie FSR as well as eliminate two-way traffic on the Dark Forest Trail. This will be a multi-use trail for hikers, bikers and equestrian users. Work is expected to be completed this fall.

Innergex also made a \$5,000 contribution to the Pemberton Wildlife Association (PWA) for a fish enhancement project at RoHb Creek, along the Lillooet South FSR. This project, led by the PWA, is intended to enhance the Coho spawning and rearing habitat in this area.

On February 15 and April 14, 2016, Innergex hosted a Slideshow & Information Session on the Upper Lillooet Hydro Project in the community of Mount Currie and the Village of Pemberton, respectively, where a general project update was provided by Innergex and a Mountain Goat Monitoring summary of results was provided by Satori Environmental Service (i.e. the IEM).

## Rutherford Creek Whitewater Park

Canoe Kayak BC (CKBC) and Rutherford Creek Power Limited Partnership (RCLP), owned by Innergex Renewable Energy Inc., have reached an agreement that transfers the operation of the Rutherford Creek Whitewater Park to the provincial sports organization.



↑ Whitewater competition on Rutherford Creek

Under terms of the agreement, RCLP will provide annual funding of \$7,500 for maintenance and upgrades as well as cover all property taxes. Additionally, real-time flow data will be provided online and users will have the opportunity to participate in determining the flow of the water through the diversion reach and in the downstream channel.

CKBC will coordinate the usage of and encourage participation in the long term development of the park. A volunteer committee will be set up to oversee use, safety, management, upgrades and scheduling. Anyone interested in sitting on the committee is encouraged to contact CKBC at [www.canoekayakbc.ca](http://www.canoekayakbc.ca).

Access to the 650 metre long kayak park is limited to CKBC members. The park will undergo some maintenance and safety upgrades this fall. Further information on the water park including up-to-date flow levels can be found at [www.innergex.com/kayak](http://www.innergex.com/kayak)

## Lil'wat Camp Kitchen Training Program

Melanie Williams, Community Services Advocate for the Lil'wat Nation has been working very hard to place members of her community in the workforce at the Upper Lillooet Hydro Project. Several community members work in both civil construction and camp services. Lil'wat Nation offered the *Stepping Stones, Workforce Accommodation and Catering Program* in the spring of 2016 which taught students the skills needed to gain employment in entry-level positions as prep cooks and housekeepers within the Remote Service Industry. More importantly, the training and experience gained will lead to future opportunities. Topics covered over the course of the program include:

- What to expect as a Remote Service Worker
- General Camp Policies
- Kitchen Safety
- Basic Cooking Theory
- Basic Food Preparation Techniques
- Basic Kitchen Equipment Training
- Occupational Health and Safety

In addition to the Stepping Stones curriculum, students also received certification for Occupational First Aid Level 1, Foodsafe Level 1 and the Workplace Hazardous Materials Information System (WHMIS).

### Stepping Stones Success Story!

Maadison Jones completed the Stepping Stones Program and was placed with Summit Camps at the Upper Lillooet Hydro Project in April 2016. He has since moved from night janitor to Housekeeping Supervisor. Maadison is a keen, organized and excellent team player.

## Keep up to date on what's going on!

Interested in receiving regular updates on the project, including construction highlights, road closures, and events? Send us an email at: [info@upperlillooethydro.com](mailto:info@upperlillooethydro.com) and we'll add you to our mailing list. Don't forget to check our website regularly for updates:

[www.upperlillooethydro.com/construction](http://www.upperlillooethydro.com/construction)