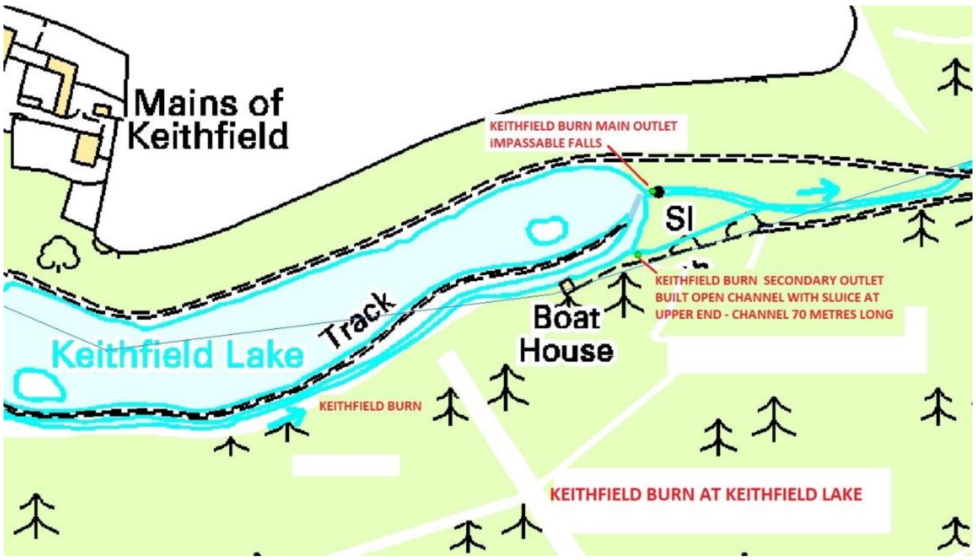
KEITHFIELD BURN FISH PASS AT KEITHFIELD LAKE.

The Keithfield Burn is one of the two main tributaries of the Kelly burn which flows through the Haddo Country Park.

The 2012 habitat surveys identified that two obstacles to upstream fish migration existed on the Keithfield Burn at the lower end of Keithfield Lake – one being the main outflow which had impassable falls and at the secondary outlet, which at one time had a fish pass that had fallen into disrepair, probably caused by flood events over many years.



Keithfield Burn Main Outlet. 2012. Impassable Falls.

Keithfield Burn Top Weir. 2012. Shows the sluice. Insufficient Water Going Down the Channel.

Options for Easing the Obstacles.

The Keithfield Burn Main Outlet.

We very briefly considered the installation of an Alaskan A Denil fish pass; however, the cost would have been in excess of £30000.00, therefore this option was immediately discarded.

The Keithfield Burn Secondary Outlet and Downstream Channel.

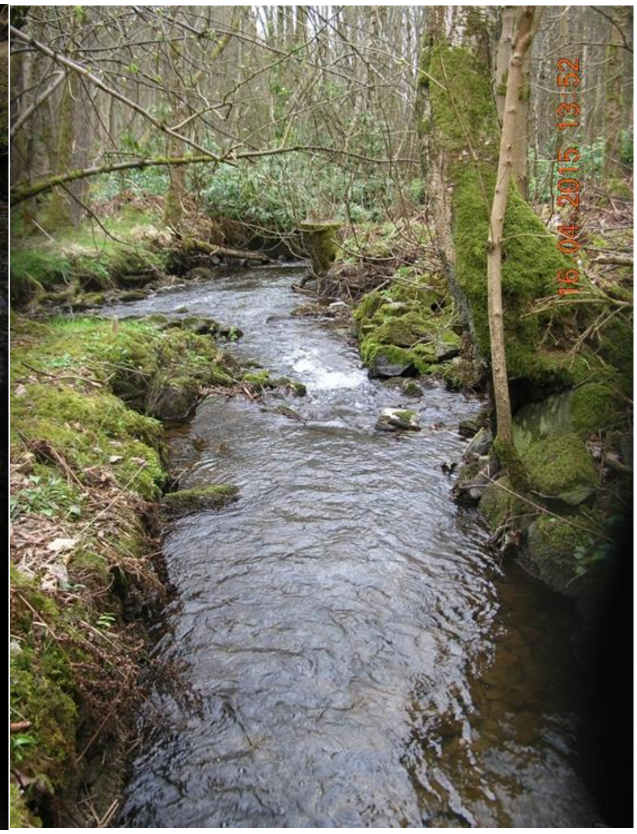
We decided to carry out a detailed survey of the channel in 2015 to determine the weir hights, slope of channel, depth of water and height of channel sides to determine how we could improve the situation without spending large amounts of our extremely limited funds.

The left hand photo below shows an upstream view from about 10 metres downstream of the top weir. The top weir (sluice) has a head height of around 420 mm – the height a fish has to jump, and a water depth below of around 450 mm, unfortunately, for a pool and weir fish pass for trout the head height should not exceed 300 mm, ideally 200 mm. The water depth below the second and third weirs were so shallow that trout would not be able to gain sufficient speed to jump the weirs.

The right hand photo shows an upstream view of the channel from about 30 metres downstream – note the partial collapse of the bank on the right hand side, but most importantly the depth of the water – 10 metres from the top weir down to the bottom of the 70+ metre channel, the water depth averaged 176.5 mm, the smallest depth recorded was a mere 110 mm.

Secondary Outlet 2015. Secondary Channel 2015. (Note the part collapsed wall).

Secondary Channel Upstream View. 2015. 50 Metres Below the Top Weir.



Secondary Channel. 2015. 70 Metre Mark. **Secondary Channel. 2015 Downstream Junction.**

Slope of the Channel.

Having established the slope of the channel, thanks to the surveying skills of Iim Adie and Mike Stuart, both directors of the Trust, the next step was to determine what the water velocity would be and how far fish could swim upstream during different water level conditions – we did not consider any water levels below 200 mm – migrarory trout need a water depth of around 200 mm ft swim uostream, salmon need a water depth of 300 mm.

Average Velocity of Water in the Channel at Differing Water Depths.

We calculated the average velocity of the water in the channel shown below.

Average velocity of water in the channel at a water depth of 200 mm = 1.207 m/s.

Average velocity of water in the channel at a water depth of 300 mm = 1.463 m/s.

Average velocity of water in the channel at a water depth of 400 mm = 1.652 m/s.

Calculated Distances Fish Can Travel up the Channel at Differing Water Depths.

(Channel length 75 m)

From SNIFFER Extended Field Manual.

- 300 mm long trout burst speed = 3 m/s for 9 s.
- 600 mm long salmon burst speed = 4 m/s for 60 s.

Channel water depth 200 mm/velocity 1.207 m/s.

- Trout maximum distance travelled = (3 – 1.207) m/s x 9s = 16.137 m. Say 15 -16 m.
- Too shallow for salmon.

Channel water depth 300 mm/velocity 1.463 m/s.

- Trout maximum distance travelled = (3 – 1.463) m/s x 9s = 13.833. Say 13 – 14 m.
- Salmon maximum distance travelled = (4 – 1.463) m/s x 60s = 152 m.

Channel water depth 400 mm/velocity1.652 m/s.

- Trout maximum distance travelled = (3 – 1.652) m/s x 9s = 12.132. Say 12 m.
- Salmon maximum distance travelled = (4 – 1.652) m/s x 60s = 140 m.

The Issues.

Due to the slope of the channel and the velocity of the water coming down it, even at the minimal depth of 200 mm, trout are unable to travel upstream for any significant distance before becoming exhausted – at water depths of 400 mm the velocity of the water is such that trout will become exhausted after travelling upstream for as little as 12 metres.

The velocity of the water in the channel at dept of 300mm – 400 mm presents no problem for salmon – they can swim the whole length of the channel without resting.

The Solution. 2015

The solution arrived at was to install a sufficient number of weirs with staggered slots to increase both the water depth to a minimum of 300 mm and to provide resting places between the weirs for trout to recover whilst on their upstream journey. Due to the small head height between weirs, around 200 mm, most of the time little fish jumping will be required.

The Construction. 2017/18.

The construction was delayed until 2017 due to the huge amount of flood damage caused to Jim Adie's property in Inverurie at the beginning of 2016 which made it impossible to proceed earlier.

The construction was carried out by Mike Stewart and Jim Adie, both experienced builders and Trust Directors, working as volunteers – firstly Mike rebuilt the collapsed side wall of the channel. then together they built the weirs using steel rebars fixed into the channel walls, the timbers for the weirs fixed onto the rebars – pointing was used to complete the fixing into the channel walls and in a few places the channel walls were heightened. The lowest part of the channel at the confluence with the stream from the main outfall was adjusted using boulders found on site to create suitable access for migrating fish.

Project Nearly Complete. View Upstream Early November 2018