



PHOTO COURTESY OF THE ESB

# DEEPLY CH

**November 2004 sees the 75th anniversary of the completion of the building of Ardnacrusha. Paul Duffy looks at the challenges of its construction, and its impact on navigation**

**T**he power station complex at Ardnacrusha is the most conspicuous landmark on the Shannon navigation.

Built between 1925 and 1929 at a cost of IR£5.2 million, it was the nerve centre for the electrification of the Irish free state.

The basic concept of the Shannon scheme is simplicity itself. The river was dammed, and diverted into an artificial cut (the head race), and then conveyed to a point where an abrupt fall was created. Here, the power station complex was built, and the turbines installed. After passing through the turbine, the water is then brought back to the main river by another artificial cut – the tail race.

## NEW LAKE

Despite its simplicity, the translation of the concept into concrete reality was quite difficult. The weir or dam at Parteen Villa was constructed to raise the river level by 7.5 metres, to the level of Lough Derg. This created a

new lake south of Killaloe. As this area flooded, the oratory of Saint Molua had to be removed from Friars Island, and re-erected at Killaloe. The weir is designed to allow a minimum of ten tonnes of water per second to flow down the old river channel, catering for fishery interests. It can also discharge a maximum of 900 tonnes of water per second to cater for flood flows.

Built into the weir is a ladder type fish pass. The weir had to be constructed in stages across the river, each stage being constructed inside a coffer dam. Work continued right through the floods of 1927-28, when the dam height had to be raised using sand bags. Because of the construction of the weir and its associated embankment, the Kilmastulla River had to be diverted.

Linked to the weir, is the intake control for the head race canal. The intake has three openings, each 25 metres wide and 7.6 metres deep. Its fourth opening, the ships pass, can accommodate barges of up to 150

tons, and is 10 metres wide. The head race canal, as the name implies, not only delivers water to the power station but also serves as a navigation channel. Its cross-sectional area and gradient were designed to deliver 500 tonnes of water per second to the power station at a controlled speed of 1.5 metres per second.

This was to cater for the Bollinder-engined barges of the day. At top water level, the canal is 90 metres wide and 11 metres deep. At water level, the side slopes are dressed with a wide band of broken stone overlain with a concrete apron to avoid wave damage to the embankments. In places, the bed level of the canal is five metres above the surrounding ground level, so a breach would be catastrophic. There are three road bridges spanning the head race.

The power station complex consists of a large intake controlling the water flow of the penstocks, which lead to the turbines in the generating hall. Attached to this is the switch house and also the enormous

***'The initial proposal for the locks was a ship's lift'***





ARDNACRUSHA



**Clockwise from top left: Interior of the temporary generating station; standing in the spiral casing at the end of the penstock; interior of the mechanical repair workshop; excavating the foundation for the powerstation; and, the power station complex under construction**

# ALLENGING

navigation locks. In all some 80,000 tons of concrete were used in the construction of this range of buildings.

The initial proposal for the locks was a ships lift capable of dealing with barges of 150 tons. As the navigation usage was not sufficient for the expense involved, it was decided that twin locks should be provided instead. Each lock chamber is 32.2 metres long by 6.1 metres wide and have a combined drop of 34 metres. The locks are interconnected by a short tunnel. It takes 4,000 tonnes of water to fill the locks. The water feed for the locks is an indirect one. Water enters a specially constructed chamber, and is then fed through diffusers into the chamber to

minimise turbulence. The locks exit into a specially constructed navigation channel down stream of the power station. The cill level is four metres above the river level at this point. The discharge water creates a hydraulic plane down this channel, which is 300 metres long. At the end of the channel, boats enter the tail race.

## **SOLID ROCK**

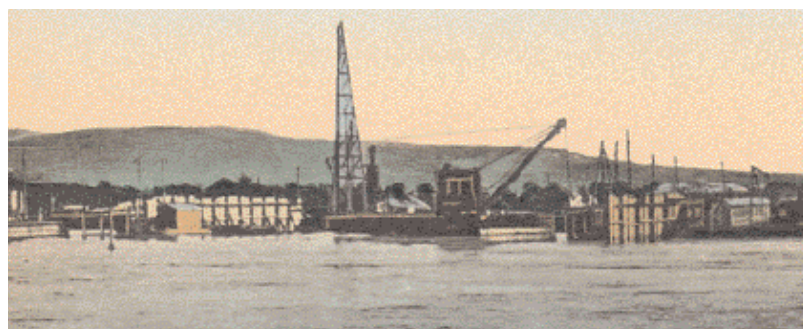
The tail race was cut through solid rock. It is tidal to the base of the power station. Just like the head race, it had to be designed to control the current to a maximum of 1.5 metres per second. However, as the velocity of the discharge water from the turbines had to be combined with an

ebb tide the achievement of this controlled maximum speed posed a major design problem. All of the rock excavated from both the tail race and the power station complex was crushed, and reused as broken stone for dressing the embankments, or as aggregate for the concrete. Similarly all of the earth which was excavated was reused in the construction of the embankments in the head race.

The construction of the Shannon scheme was the pivotal development of twentieth century Ireland. It made the country self-sufficient in energy production for a number of years. It generated huge employment for the period of its construction, and paved the way for future industrial development. It changed the international perception of Ireland as a backward country, and gave Irish people hope for the future after the War of Independence and a vicious civil war. It also finally opened up the Dublin – Shannon – Limerick navigation in a way that the inadequate Limerick-Killaloe Canal had failed to do. ■

*Paul Duffy is a Chartered Fellow of the Institute of Engineers of Ireland.*

**Anyone wishing to travel through Ardnacrusha and beyond should consult the *Inland Waterways News*, volume 28, number 2, where there are 15 pages of information and navigational tips. This issue is available to download on the IWAI website: [www.iwai.ie](http://www.iwai.ie). A very informative booklet *City Cruising* was also produced in 2001, written by Edgar Heenan, and may still be available from its joint publishers: *Afloat* magazine, *Waterways Ireland*, *Shannon Development* and *Limerick Corporation***



**The weir and coffer dam on the Shannon River at the intake**