

Lough Ree draw down experiment – October / November 2013

Objective

To test the extent to which draw down of Lough Ree in advance of a significant rainfall event can be used to manage flooding in the Shannon callows.

Data collection exercise by OPW Hydrometric Section

The consultants for the Shannon CFRAM Study, Jacobs, issued a “draw down of Lough Ree experiment” proposal on 08/03/2013. This proposal outlined the trigger conditions for the proposed experiment; a level downstream of Lough Ree of less than 36.12mAOD Poolbeg, and a forecast of significant rainfall with an ESB modelled prediction (based on Met Eireann forecast rainfall) of a rise in level of Lough Ree of greater than 100mm in 5 days. Following clarification as to what exactly was required, it was established that the Hydrometric Section should undertake flow measurement on the Shannon at the outfall of Lough Ree at Athlone (Stn.26027), and further downstream at Banagher (Stn.25017) on a daily basis for the duration of an event that would see the effects of the rainfall event wash through the system.

On 24/10/2013, the ESB issued a modelled forecast predicting that the aforementioned trigger conditions would be satisfied. Following consultation with Waterways Ireland on the morning of 25/10/2013, it was established that 7 of the 15 gates at Athlone weir were already closed, and that it was intended to close a further six gates later that day, leaving the remaining two to be closed over the course of the weekend. All boards had already been removed from weirs located downstream of Banagher. It was agreed with Waterways Ireland that the closure of the 6 gates at Athlone would occur at 1 p.m. on the 25/10/2013 to allow the flow to be measured at Athlone both before and after the gate closing operations. The final two gates at Athlone weir were closed on the 26/10/2013.

Hydrometric Section commenced flow measurement activities on the Shannon at Athlone weir and at Banagher on the 25/10/2013. Flow measurements were taken over a number of days up to 04/11/2013. Two flow measurements were carried out at Athlone weir on the 25/10/2013 (one before and one after the scheduled closing of the 6 gates), and one flow measurement on the 29th, 30th & 31st October and 01st & 04th November. Flow measurements were also carried out at Banagher on the same dates. Unfortunately, post processing and secondary validation exposed a persistent equipment issue with the flow measurements taken at Banagher. Consequently, the flow measurements taken at Banagher had to be disregarded. However, it has been possible to estimate the flow for the period from the established stage-discharge relationship in place for the Shannon at Banagher.

Validation exercises undertaken

Two further flow measurements were taken at Banagher on the 28/11/2013 to validate the established stage-discharge relationship. These confirmed the validity of the rating in place for Banagher since the mid-1950's to date. The instantaneous flow estimates generated for Banagher and presented in Table 1 below are within the valid gauged range of the stage-discharge relationship.

As a validation exercise on the flow measurements taken at Athlone weir and in response to a request from the CFRAM consultants to measure the flow at Athlone at a number of locations, two teams undertook simultaneous flow measurement at Athlone weir on 31/10/2013 using alternative flow measurement methodologies (Stationary v Transect (bank to bank), see notes under Table 1 below). The resulting flow estimates matched very closely, displaying a variation of less than 1%. This provides validation of the primary flow measurement methodology used at Athlone weir over the course of the experiment and previously. On the preceding day (30/10/2013), an attempt was made to measure the flow downstream of the Athlone bypass bridge; however, the conditions at this site proved to be unsuitable due to the depth, width and low velocities observed at this location. The flow estimate produced was much lower than might have been expected. Owing to the obvious limitations associated with this flow measurement, the measurement was disregarded and while listed in Table 1, a flow value is not supplied.

Results

A full listing of the flow measurements taken by Hydrometric Section over this period is shown in Table 1 below. For reference, spot flow estimates for Banagher have been provided for the dates / times of flow measurement at Athlone. Continuous flow time series data are available for Banagher if required.

Date	Time (mean)	Stn. No.	Stn. Name	WL (m)	Flow (m ³ /s)	Method	Comment
25/10/2013	11:11	26027	Athlone	2.86	51.74	Stationary	7 gates closed / 8 gates open.
	11:15	25017	Banagher	2.179	83.9*	---	
25/10/2013	14:18	26027	Athlone	2.88	22.46	Stationary	13 gates closed / 2 gates open.
	14:15	25017	Banagher	2.182	84.3*	---	
29/10/2013	11:57	26027	Athlone	3.24	73.83	Stationary	All gates closed
	12:00	25017	Banagher	2.44	125.8*	---	
30/10/2013	11:39	26027	Athlone	3.30	74.02	Stationary	All gates closed
	11:45	25017	Banagher	2.417	121.4*	---	
	15:18	---	Athlone bypass	---	---	Transect (bank to	All gates closed, measurement disregarded due to unsuitability of location for flow measurement.

			bridge			bank)	
31/10/2013	13:05	26027	Athlone	3.36	88.96	Transect (bank to bank)	All gates open
	12:52	26027	Athlone	3.36	88.07	Stationary	All gates open
	13:00	25017	Banagher	2.431	124.2*	---	
01/11/2013	12:15	26027	Athlone	3.44	96.95	Stationary	All gates open
	12:15	25017	Banagher	2.47	131.2*	---	
04/11/2013	11:47	26027	Athlone	3.62	112.02	Stationary	All gates open
	11:45	25017	Banagher	2.559	147.8*	---	
28/11/2013	13:00	25017	Banagher	2.40	140.43	Stationary	All boards out at Meelick
	15:30	25017	Banagher	2.39	139.79	Stationary	All boards out at Meelick

Table 1. Flow measurements taken at Athlone and flow estimates generated for Banagher as part of the experiment.

**Estimated from stage-discharge relationship (rating) for the Shannon at Banagher*

Key:

Stationary flow measurement methodology is similar to the conventional current meter deployment but using Acoustic Doppler Profiler (ADP) technology to measure and record the velocity and depth at known points across the river. This information is then used to calculate the cross sectional area and resulting flow.

Transect (bank to bank) flow measurement methodology also utilises ADP technology, the instrument is pulled across the river from bank to bank. The position, velocity of the vertical water column and the depth are continuously recorded, and the cross sectional area and resulting flow calculated.

Datum levels:

<u>Station Name</u>	<u>Number</u>	<u>Staff gauge zero (mAOD Poolbeg)</u>
Hodson's Bay (L.Ree)	26088	35.36
Athlone Weir U/S	26333	35.35
Athlone	26027	33.24
Shannonbridge	26028	33.21
Banagher	25017	33.19

Time series data

Figure 1 below presents a graphical representation of water levels at various points on Lough Ree and the lower Shannon over the course of the experiment.

Figure 2 presents flow estimates for the Shannon and contributing sub-catchments. Shown are the Shannon at Banagher (Stn.25017), the Brosna at Ferbane (Stn.25006), the Inny at Ballymahon (Stn.26021) and the Suck at Bellagill (Stn.26007).

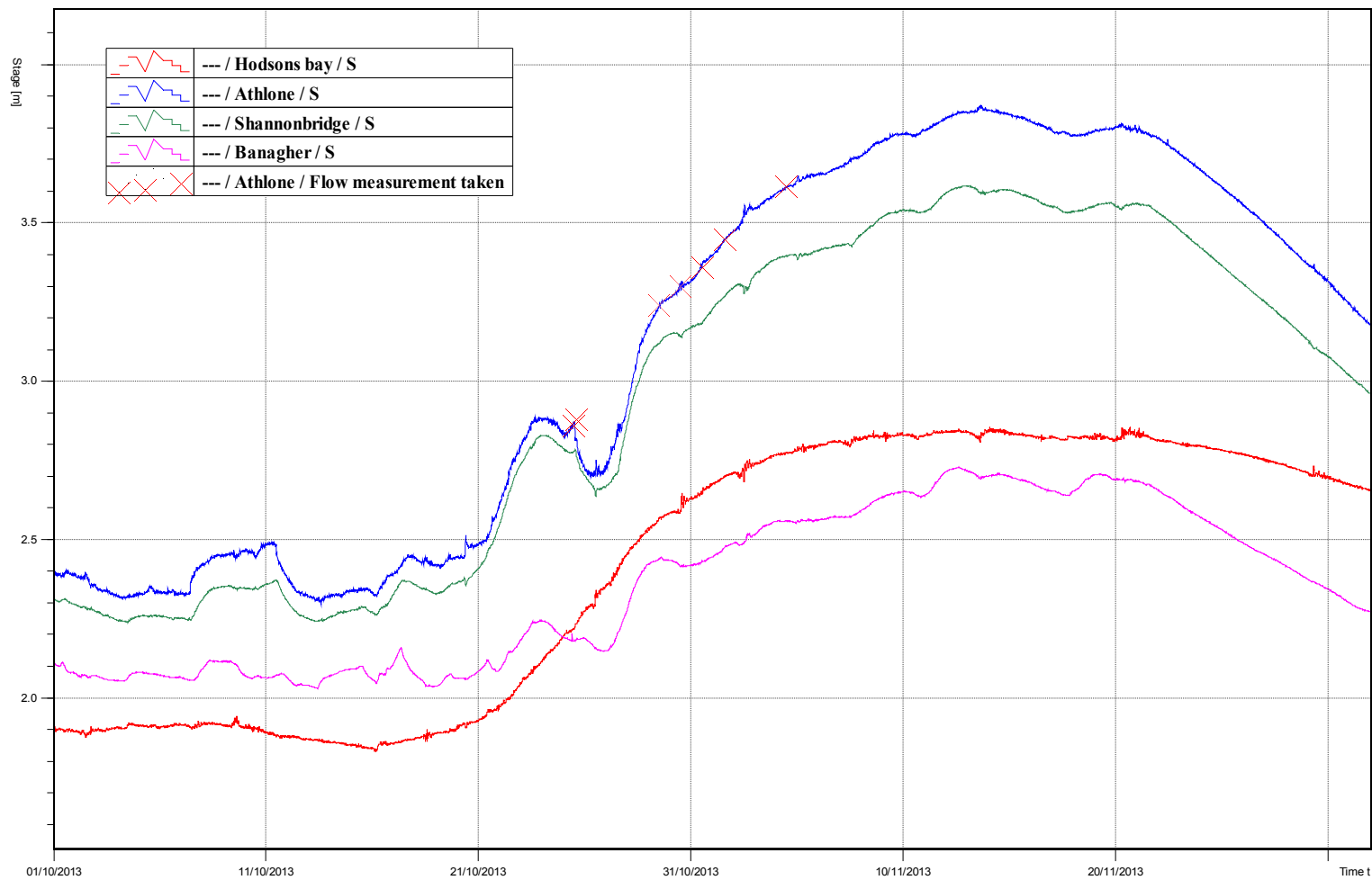


Figure 1. Water level records for period 01/10/2013 to 01/12/2013 (presented to local datum) for Hodson’s Bay (Stn. 26088) on Lough Ree, Athlone d/s (Stn.26027), Shannonbridge (Stn.26028) and Banagher (Stn.25017) on the Shannon. S = Stage Parameter. Flow measurements taken at Athlone are indicated by a red “x” on the graph.

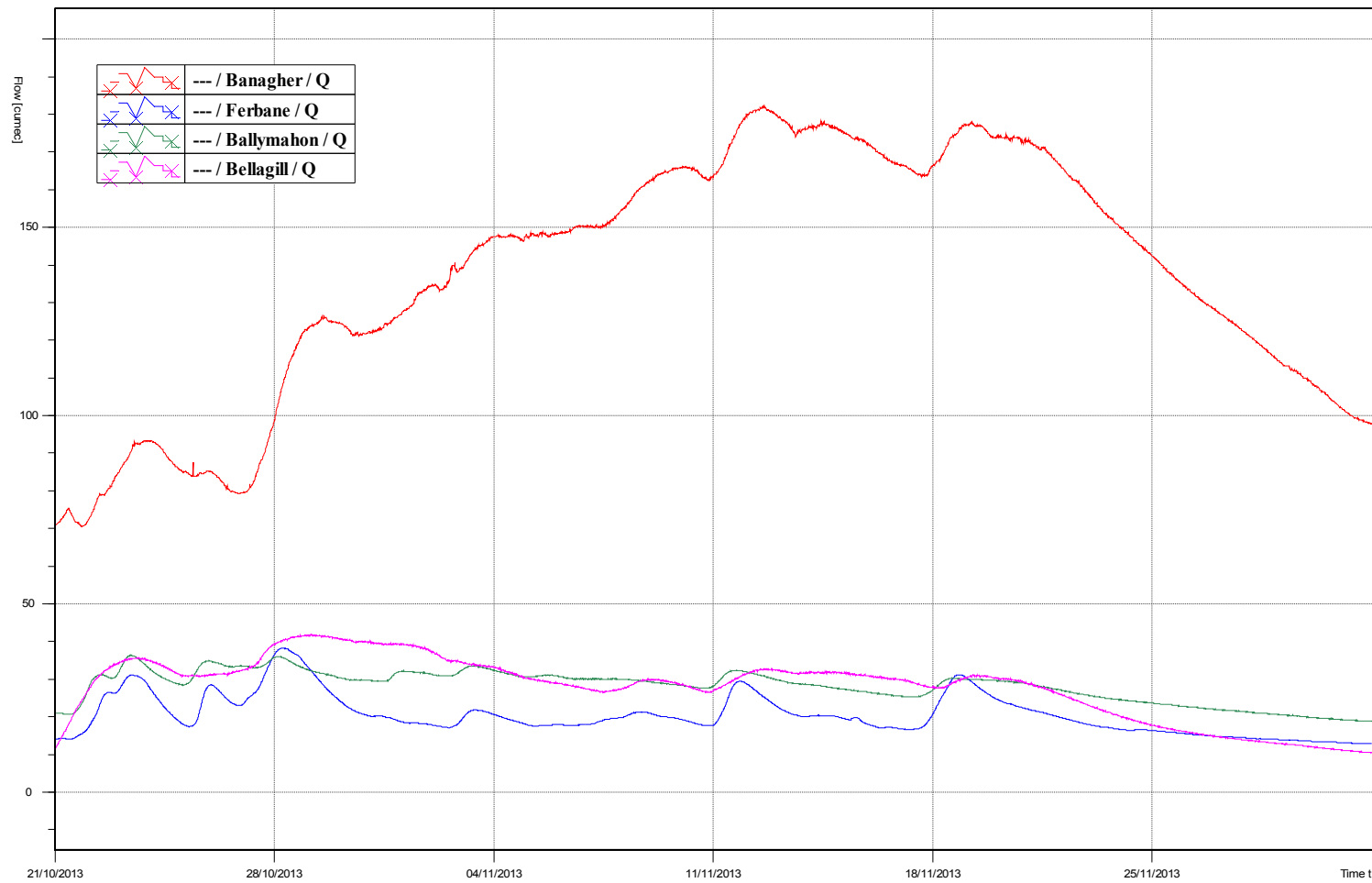


Figure 2. Flow estimates for the Shannon at Banagher (Stn.25017), and contributing catchments including the Brosna at Ferbane (Stn.25006), the Inny at Ballymahon (Stn.26021) and the Suck at Bellagill (Stn.26007) for the period 21/10/2013 to 01/12/2013. Q = Flow Parameter.

Conclusion

From the water level records, it is apparent that the closing of the gates at Athlone weir in anticipation of a rise in water levels on Lough Ree led to a temporary lowering of the Shannon water levels immediately downstream of Athlone. This possibly delayed inundation of the Shannon callows downstream of Athlone by a number of days. To determine whether the extent or depth of eventual inundation was in any way reduced by the experiment will require more detailed analysis by the CFRAM consultants. Data is available on request from Hydrometric Section if required.

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