Chemistry Factsheet

Inner Clyde estuary monitoring buoy, Glasgow

The Scottish Environment Protection Agency (SEPA) established the inner Clyde estuary (ICE) monitoring buoy near Glasgow Harbour in the upper Clyde estuary in 2011. The buoy monitors dissolved oxygen in the surface waters (Figure 1) and near the river bed (Figure 2), as well as temperature, salinity, pH and turbidity.

Low dissolved oxygen concentrations are known to occur in the upper Clyde estuary especially during the warmer summer months. Oxygen is less soluble at higher temperatures and is also consumed by the microbial breakdown of organic matter from waste water discharges, urban diffuse pollution and organic matter retained in the sediment.

Figure 2: ICE buoy river bed deployment.

Figure 1: ICE buoy surface deployment

Inputs into the Clyde estuary from point discharges are quantified by the measurement of biochemical oxygen demand or BOD. Inputs of organic waste have declined over the years thanks to improvements in effluent treatment brought about by improved environmental legislation and investment by Scottish Water. The buoy in the upper Clyde continues to monitor these improvements to the water quality of the Clyde estuary.

Why monitor at the surface and bottom?

The upper Clyde estuary is a heavily modified water body as the channel has been straightened and deepened to accommodate the industrial growth of the City of Glasgow from the nineteenth century. The estuary is regularly dredged to a controlled depth to allow access for shipping, with the tidal limit defined by the Glasgow Tidal Weir. As a result of these modifications water currents in the upper Clyde are weak and the estuary is susceptible to stratification. This means that the oxygenated fresh water from the river Clyde does not mix and sits on top of the denser less oxygenated tidal marine waters from the Firth of Clyde.

Lack of mixing prevents re-suspension of organic rich sediments deposited over the decades except during periods of high river flow. This means the surface waters become well oxygenated whilst the denser marine waters, which remain in contact with the river bed, have lower oxygen content. This physical difference is the reason the inner Clyde estuary buoy measures these parameters at surface and bottom.

References:

http://www.sepa.org.uk/environment/environmental-data/monitoring-buoys-network

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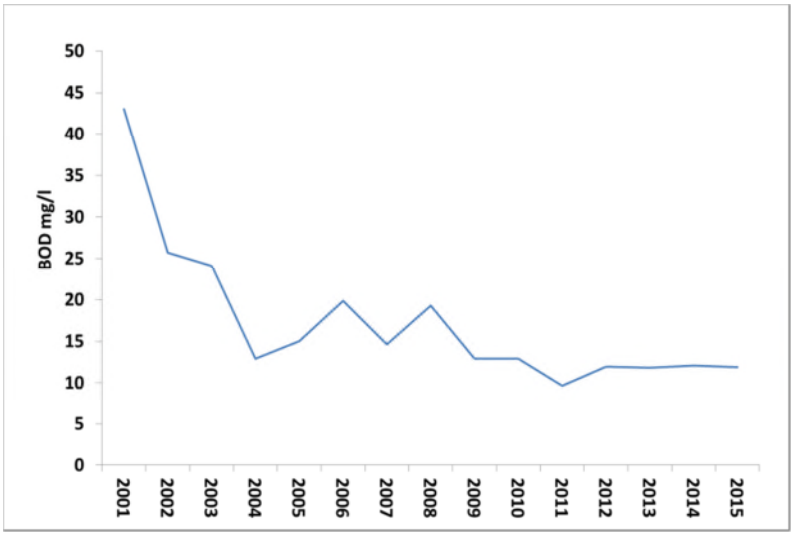

Figure 3: Annual average BOD in the upper Clyde estuary since 2001

If things are improving why monitor?

Although there has been a considerable improvement in water quality over past decades, as shown by a decline in BOD (Figure 3), it is still vulnerable to a number of factors. During warmer drier weather when river flows are lowest, dissolved oxygen levels can fall as a result of increased summer temperatures and salinities. These conditions can act as a barrier to fish, such as salmon, which require well oxygenated waters to migrate upstream.

Storm events can cause the re-suspension of the organic sediments held in the river bed through scour. Drains and sewers can also overflow and drain into the river and affect its water quality (Figure 4).

The buoy remains an important tool in environmental monitoring of the ongoing improvements of the Clyde estuary for these reasons. For further information please contact SEPA via Science.Advice@sepa.org.uk.

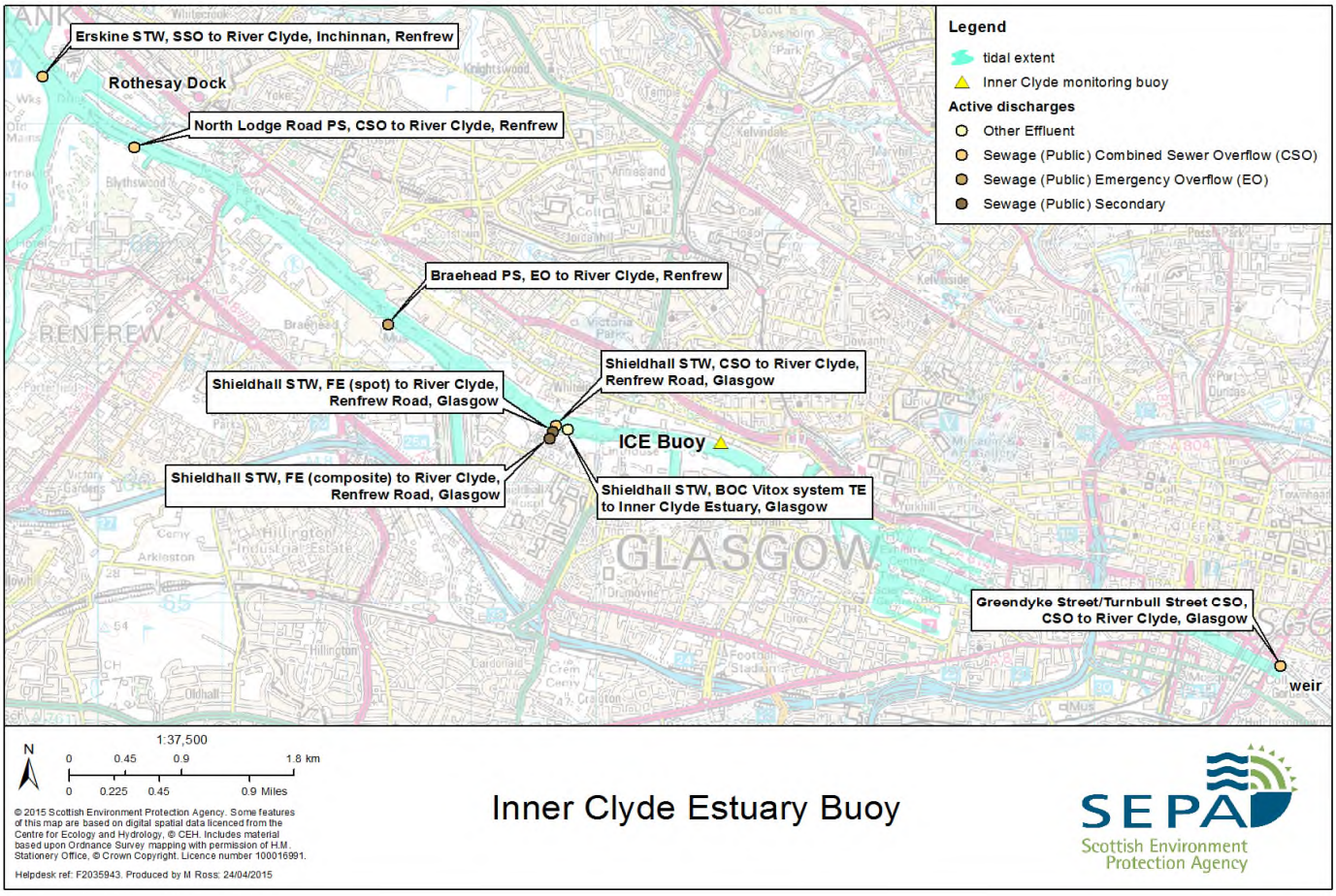

Figure 4: Location of the ICE buoy on the upper Clyde estuary with locations of active point source discharges

References:

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