Assessment of Assimilative Capacity of the River Dee

As part of the E.I.S for upgrading Ardee Wastewater Treatment Plant an assessment of the assimilative capacity of the River Dee was completed. The proposed upgraded WWTP is designed to give a final treated wastewater volume of 225 m³/day (average flow of 2.6 l/s) at a quality of 10 mg/l BOD, 10 mg/l suspended solids and 1 mg/l total phosphorus (as P). The data and calculations detailed below are used to determine the assimilative capacity of the River Dee with respect to the final treated wastewater quality.

Flow and Discharge

The 95-percentile flow on the River Dee at the Ardee WWTP is estimated to be 338 l/s. The design outflow for the proposed treatment plant is 2.604 l/s. This results in a dilution factor of 130.

In Dry Weather Flow conditions the flow in the River Dee is estimated to be about 165 l/s. In this instance the dilution factor is 63. Low flows such as these are rare and occur for relatively short periods.

BOD Assessment

From the EPA dataset and sampling undertaken as part of the E.I.S, the B.O.D value upstream of the proposed treatment plant is 1.4mg/l. The impact of the final effluent, from the proposed development, on the BOD concentrations of the receiving waters may be calculated using the mass balance equation:

\[
T_{95} = \frac{F_{95} \times Cr + Fe \times Ce}{F_{95} + Fe}
\]

where:

- \(F_{95}\) Q95% flow in the river (l/s)
- \(Fe\) effluent discharge volume (l/s)
- \(Cr\) BOD concentration in the river upstream of the discharge (mg/l)
- \(Ce\) BOD concentration of the effluent (mg/l)
A BOD concentration for the receiving waters, at the 95-percentile flow, of 1.466mg/l was obtained using this formula, i.e., an increase of 0.066mg/l.

For the purposes of calculating the waste assimilation capacity (WAC) a maximum value of 4 mg/l BOD, is allowed for salmonid receiving waters and 5 mg/l for cyprinid receiving waters.

A further criterion, i.e., of not raising the BOD of the receiving waters by more than 1 mg/l downstream (outside the mixing zone) of an effluent discharge is also commonly used.

The proposed development meets both of these criteria for BOD assimilation.

**Suspended Solids Assessment**

The suspended solids value from the sampling undertaken as part of the E.I.S upstream (and also downstream) of the proposed treatment plant is 2mg/l. The impact of the final effluent, from the proposed development, on the suspended solids concentrations of the receiving waters may be calculated using the mass balance equation (1)

$$
Cr\text{ Suspended solids concentration in the river upstream of the discharge location (mg/l)}
$$

$$
Ce\text{ Suspended solids concentration of the effluent (mg/l)}
$$

where:

A suspended solids concentration for the receiving waters, at 95% flow, of 2.06 mg/l was obtained using this formula, i.e., an increase of 0.06mg/l.

The proposed development meets this criterion for suspended solids assimilation.

**Total Phosphorus Assessment**

The total phosphorus value from the sampling undertaken as part of the E.I.S is <0.02mg/l upstream of the WWTP.
The impact of the final effluent, from the proposed development, on the total phosphorus concentrations of the receiving waters may be calculated using the mass balance equation (1)

\[ Cr + Ce = \text{total phosphorus concentration in the river upstream of the discharge location (mg/l)} \]
\[ Ce = \text{total phosphorus concentration of the effluent (mg/l)} \]

Based on these formulae (assuming a value of 0.02mg/l for the determinant <0.02mg/l total phosphorus) then the total phosphorus concentration for the receiving waters, at 95% flow, is calculated to be 0.027mg/l, i.e., an increase of 0.007mg/l.

The proposed development meets this criterion for total phosphorus assimilation.
Dundalk Bay is a large open shallow sea bay with extensive saltmarshes and intertidal sand/mudflats, extending some 16 km from Castletown River on the Cooley Peninsula, in the north, to Annagassan/Salterstown in the south. The bay encompasses the mouths and estuaries of the Rivers Dee, Glyde, Fane, Castletown and Flurry. The site contains five habitats listed under the EU Habitats Directive, i.e. perennial vegetation of stony banks, tidal mudflats, salt marshes, Salicornia mudflats and estuaries.

The extensive sand flats and mud flats (over 4,000 ha) have a rich fauna of bivalves, molluscs, marine worms and crustaceans which provides the food resource for most of the wintering waterfowl. The salt marshes, which occur in four main areas at Lurgangreen, Marsh South, Dundalk Harbour/Ballymascanlan Bay and Bellurgan, are used by the roosting birds at high tide. The marshes are dominated by wide expanses of Common Cord-grass (Spartina anglica), while Sea Purslane (Halimione portulacoides), Common Saltmarsh-grass (Puccinellia maritima) and Glasswort (Salicornia spp.) are other common species. The herbivorous waterfowl (notably Brent Geese and Wigeon) feed on the salt marsh grasses, as well as on areas of Zostera and green algae on the mudflats.

Shingle beaches are particularly well represented in Dundalk Bay, occurring more or less continuously from Salterstown to Lurgan White House in the south bay, and from Jenkinstown to east of Giles Quay in the north bay. The shingle supports such species as Spear-leaved Orache (Atriplex prostrata), Sea Mayweed (Matricaria maritima), Sea Beet (Beta vulgaris), Sea Rocket (Cakile maritima) and Sea Holly (Eryngium maritimum), as well as scarcer plants including Yellow Horned-poppy (Glaucium flavum), Sea Scutch (Leymus arenarius) and the Red Data Book species Sea-kale (Crambe maritima). At high tide, many birds roost on the shingle beaches.

The outer part of the bay provides excellent shallow-water habitat for divers, grebes, and sea duck. In summer, it is thought to be a major feeding area for auks from the Dublin breeding colonies. At night the wintering Greylag and Greenland White-fronted Geese, and Whooper Swans, from Stabannan/Braganstown (inland from Castlebelligham) and other inland sites roost in Dundalk Bay.

The site is internationally important for waterfowl on the basis that it regularly holds over 20,000 birds (average peak of 40,781 over five winters 1995/96-1999/00). In the same period it also qualifies as a site of international importance for supporting populations of Brent Goose (337), Black-tailed Godwit (1,067) and Bar-tailed Godwit (1,950). There is also a range of other species which occur in numbers of national importance – these are Great Crested Grebe (302), Greylag Goose (435), Shelduck (492), Mallard (763), Pintail (117), Red-breasted Merganser (121) (over 500 have
been recorded in August/September), Oystercatcher (8,712), Ringed Plover (147), Golden Plover (5,967), Grey Plover (204), Lapwing (4,850), Knot (9,710), Dunlin (11,515), Curlew (1,234) and Redshank (1,489) (all figures are average peaks over the period 1995/96 to 1999/00). Other wintering species which occur regularly in regionally important numbers include Red-throated Diver, Great Northern Diver, Cormorant, Grey Heron, Mute Swan, Wigeon, Teal, Goldeneye, Greenshank and Turnstone.

The site also supports large numbers of gulls during winter. In the 1995/96 to 1999/00 period, the following were recorded (figures are average peaks over the five winters): Black-headed Gull (6,630), Common Gull (551), Herring Gull (751) and Great Black-backed Gull (185).

In spring and autumn the site attracts a range of passage migrants, including Little Stint, Curlew Sandpiper and Ruff.

This site is one of the most important wintering waterfowl sites in the country and one of the few which regularly supports more than 20,000 waterfowl. It supports three species in numbers of International Importance and a further 15 species in numbers of National Importance. The populations of Golden Plover, Bar-tailed Godwit, Red-throated and Great Northern Divers are of particular note as these species are listed on Annex I of the EU Birds Directive. The site is also a designated Ramsar site. The site is monitored annually as part of I-WeBS.
Dundalk Bay, Co. Louth, is a very large open shallow sea bay with extensive saltmarshes and intertidal sand/mudflats, extending some 16km from Castletown River on the Cooley Peninsula in the north to Anngassan/Salterstown in the south. The bay encompasses the mouths and estuaries of the Rivers Dee, Glyde, Fane, Castletown and Flurry. The site contains five habitats listed under the EU Habitats Directive, i.e. perennial vegetation of stony banks, tidal mudflats, salt marshes, Salicornia mudflats and estuaries.

Saltmarsh vegetation occurs in four main areas: at Lurgangreen, Marsh South, Dundalk Harbour and Bellurgan. These are dominated by wide expanses of Common Cord-grass (Spartina anglica), while Sea Purslane (Halimione portulacoides) is common along the numerous channels. Common Saltmarsh-grass (Puccinellia maritima) is also abundant in places. Glasswort (Salicornia spp.) occurs on the lower zones of the salt marshes and in places extends out onto the sand flats. The salt marshes at Lurgangreen and Marsh South are partially fenced and grazed by sheep.

Shingle beaches are particularly well represented in Dundalk Bay, occurring more or less continuously from Salterstown to Lurgan White House in the south bay, and from Jenkinstown to east of Giles Quay in the north bay. The shingle is mostly stable, occurring on post-glacial raised beaches. The shingle often occurs in association with intertidal shingle, salt marsh and or shingle based grassland. The shingle supports species such as Spear-leaved Orache (Atriplex prostrata), Sea Mayweed (Matricaria maritima), Sea Beet (Beta vulgaris), Sea Rocket (Cakile maritima), Wild Carrot (Daucus carota), Sea Holly (Eryngium maritimum), Sea sandwort (Honkenya peploides) and Sea Radish (Raphanis maritimus). Yellow Horned-poppy (Glaucium flavum) and Sea Scutch (Leymus arenarius) occur here at their most northerly locality on the east coast, while the Red Data Book species Sea-kale (Crambe maritima) has recently been recorded.

The extensive sand flats and mud flats (over 4,000 ha) have a rich fauna of bivalves molluscs, marine worms and crustaceans and are the main food resource of the tens of thousands of waterfowl (including waders and gulls) which feed in the intertidal area of Dundalk Bay. The salt marshes are used as high-tide roosts by all these species, while the grazing birds (notably Brent Geese and Wigeon) feed on the salt marsh grasses, areas of Zostera and other grassland vegetation. The Brent Geese also feed on the mats of green algae on the mudflats. At night the wintering Greylag and Greenland White-fronted Geese, and Whooper Swans, from Stabannan/Braganstown (inland from Castlebelligham) roost in Dundalk Bay.

The site is internationally important for waterfowl (nos. in brackets refers to the average max. over the period 1994/95 to 1997/98) because it regularly holds over
20,000 birds (up to 57,000 have been recorded) and supports over 1% of the North-West European/East Atlantic Flyway populations of Brent Goose (366), Bar-tailed Godwit (2312) and Knot (11,948). Additionally, it is nationally important for Golden Plover (4266), Great Crested Grebe (193), Greylag Goose (312), Shelduck (463), Mallard (657), Pintail (100), Red-breasted Merganser (148), Oystercatcher (6940), Grey Plover (218), Ringed Plover (133), Wigeon (565), Dunlin (9112), Black-tailed Godwit (754), Curlew (1593), Lapwing (4822), Greenshank (20) and Redshank (1,455). Both Golden Plover and Bar-tailed Godwit are Annex I species. The site has been designated a Special Protection Area under the EU Birds Directive and is also a designated Ramsar site.

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