COMHLACHT CHALAFORT ÁTHA CLIATH
DUBLIN PORT COMPANY

Dublin Port Post 2040 Dialogue – Paper 1

WHY DUBLIN PORT IS WHERE IT IS

28th September 2020

The Danish academic, Bent Flyvbjerg, defines megaprojects as large-scale, complex ventures that typically cost $1 billion or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people[1].

The 20 year project to build new port infrastructure on the east coast of Ireland is, by this definition, a megaproject. The definition applies equally to the project to build new port facilities to augment the existing facilities in Dublin Port or to the project to build a replacement port which would allow the lands of Dublin Port to be redeveloped for other purposes. Dublin Port Company is planning on the basis that it may have to build the former. Some people believe that the latter should be built. Both are megaprojects.

Whichever port project might ultimately be built, it needs to be thought through very carefully. Megaprojects are environmentally challenging and, as a general rule, tend to be far more expensive to build than ever envisaged when being planned. In many cases, megaprojects end up being even more expensive than anticipated at the time construction contracts are awarded because of unforeseeable risks which cannot be transferred to contractors except at enormous cost, and at levels most project promoters would balk at.

The capacity of megaprojects to waste capital is enormous and, particularly where public money is involved, it is unquestionably a good thing to avoid a megaproject if at all possible.

A good starting point to thinking about the project to build new port facilities on the east coast of Ireland is to understand why Dublin Port is where it is.

All ports are the product of large scale anthropogenic interventions into the natural environment and it is in the nature of ports that the scale of this intervention, being underwater, is not readily visible nor easily appreciated. Such interventions are needed to provide the fundamental prerequisite for any port – an access channel into a sheltered area where berths for ships can be provided.

In some cases, such as in Cork, Falmouth and Sydney, nature provides a natural harbour with deep water where port facilities can be constructed.

On the east coast of Ireland, however, there are no deep water harbours and most of the ports are built on small rivers.

1 *The Oxford Handbook of Megaproject Management*, edited by Bent Flyvbjerg, 2017

The single most important attribute of any port is its depth of water. In Dublin Port, there is 7.8 metres of water available at the lowest tide[2]. This is the ruling depth for the port and the rise of the tide is additional to this.

With a ruling depth of 7.8 metres, the depth of water available in Dublin Port varies across the annual phases of the tides between two extremes:

- The Highest Astronomical Tide (HAT) expected in Dublin Port is 4.5 metres (implying a depth of water in the approach channel and fairway of 12.3 metres).
- The Lowest Astronomical Tide (LAT) is -0.1m giving 7.7 metres of water[3].

Between these two extremes, the depth of water is best described by reference to the mean levels of spring tides and neap tides.

The current ruling depth of 7.8 metres allows Dublin Port accept ships with draughts of up to 10.2 metres on most days in the year but within a tidal window.

Ships with draughts of up to 7.5 metres can enter the port without tidal restriction on most days over the course of the year. In practice, the maximum draught for ships operating daily fixed time schedules (notably Ro-Ro ferries) is 6.8 metres.

The channel depth in Dublin Port is currently being increased to 10.0 metres and this will increase the maximum draught of ship that can be accommodated on most days during the year from 10.2 metres to 12.4 metres (with a tidal restriction).

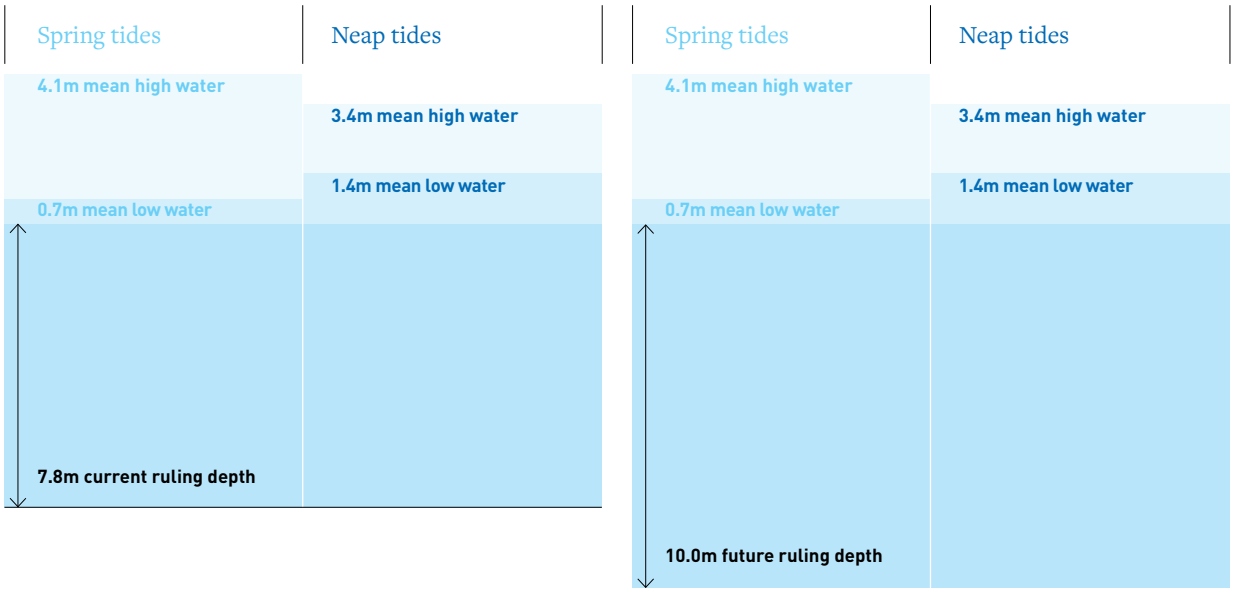
It will also allow ships with draughts of up to 9.7 metres enter the port at any stage of the tide on most days of the year (with no tidal restriction). In practice, a channel of 10.0 metres will allow ships with draughts of up to 9.0 metres to enter Dublin Port on every day of the year.

Current ruling depth: 7.8m	**Mean high water**	**Channel depth**	**Max draught***	**Mean low water**	**Channel depth**	**Max draught***
Spring tides	4.1m	11.9m	10.9m	0.7m	8.5m	7.5m
Neap tides	3.4m	11.2m	10.2m	1.4m	9.2m	8.2m

* Assumes an under keel clearance of 1.0m

Future ruling depth: 10.0m	**Mean high water**	**Channel depth**	**Max draught***	**Mean low water**	**Channel depth**	**Max draught**
Spring tides	4.1m	14.1m	13.1m	0.7m	10.7m	9.7m
Neap tides	3.4m	13.4m	12.4m	1.4m	11.4m	10.4m

* Assumes an under keel clearance of 1.0m



2 Where heights on land are measured against Ordnance Datum (OD), the depth of water in ports is normally measured against a local datum referred to as Chart Datum. Chart Datum normally equals or is very close to lowest astronomical tide. In Dublin LAT is 0.1 metre Chart Datum. Chart Datum is 2.51 metres below OD. The figure of 7.8 metres used here is 7.8 metres below Chart Datum.

3 HAT and LAT are the highest and lowest tides which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions. Extreme weather conditions can add or take away up to one metre of water depth.

By international standards, Dublin Port is a shallow port. For example, Europe's largest port, Rotterdam, has a channel 24 metres deep, Barcelona has 16 metres and Helsinki's Vuosaari Harbour has 11 metres.

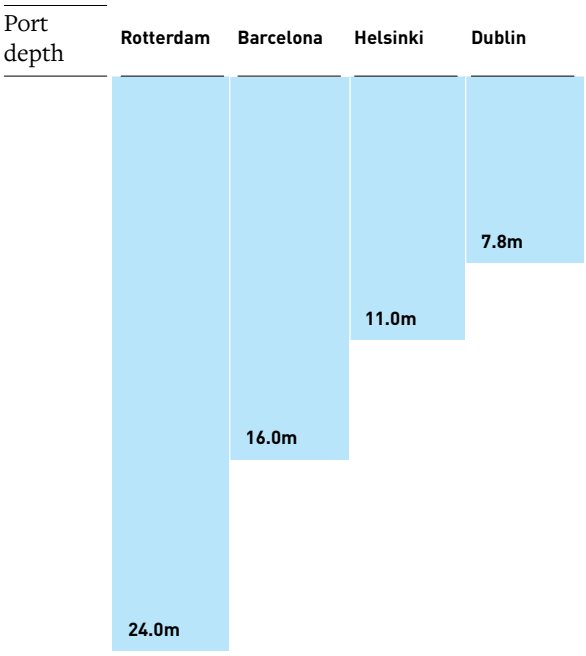
However, by the standards of the east coast of Ireland, Dublin Port is a deepwater port with considerably greater water depth available than in any of the eight other ports in the range from Greenore to Waterford.

Where Dublin Port has 7.8 meters of water plus whatever is on the tide, all of the other eight ports have less and, in most cases, considerably less. Worst off of all is Dundalk where there is almost no water at all in the approach channel at low tide and where the berths at the port's quay walls dry out altogether and ships have to rest on the river bed.

Port / Harbour	Location	Owner	Ruling Depth metres below CD	Relative scale[4]
Greenore	Carlingford Lough	Doyle Shipping Group	5.9m	3.9%
Dundalk	Castletown River	Dublin Port Company	Dries out	0.3%
Drogheda	River Boyne	Drogheda Port Company	2.2m	5.8%
Dublin	River Liffey	Dublin Port Company	7.8m	100.0%
Wicklow	Leitrim River	Wicklow County Council	2.7m	0.6%
Arklow	Avoca River	Wicklow County Council	3.4m	0.0%
Rosslare	Harbour on the Irish Sea	Irish Rail	6.2m	7.7%
New Ross	River Barrow	Wexford County Council	3.0m	1.4%
Waterford	River Suir	Port of Waterford Company	6.5m	7.0%

Because of this greater depth, Dublin Port has a far higher cargo throughput than any of these eight ports either individually or in aggregate. Dublin Port's scale is fundamentally a function of the port's depth of water.

Where deep water was available (or created), population centres grew and, as a consequence, trade volumes grew. Dublin City and Dublin Port have a basic underlying relationship which needs to be understood and appreciated. Even though the availability of deep water was limited, proximity to Britain motivated the development of settlements on the east coast of Ireland. Whereas the Vikings landed at a number of locations on the east coast, including at Annagassen in Co. Louth, it was in Dublin that their settlement prospered and grew for over a thousand years.



4 Based on cargo throughputs as reported by the CSO for 2019

Over these many years, the Liffey was canalised, the port moved eastwards to access deeper water as ships got bigger and two sea walls were built. The idea of moving Dublin Port to another location requires a project that in relatively few years would replicate developments which have taken centuries to achieve. The project is, of course, feasible but only at an enormous cost and subject to all of the well-understood risks associated with megaprojects.

New port facilities for the hinterland served by Dublin Port today will need to be in reasonable proximity to that hinterland. This implies an east coast location. To this day, the country’s population is concentrated on the east coast and specifically around Dublin Port.

The locations of ports are inherently related to settlement patterns – one drives the other in a feedback loop – and this is very clear from a comparison of Ireland with Britain.

Ireland is sparsely populated with only 70 people per square kilometre and with no short sea trading routes to the west and relatively long distances on trading routes to the south.

Britain, on the other hand, is a relatively densely populated island (282 people per square kilometre in Britain as a whole and 430 in England alone) with large populations and ports on its west, south and east coasts corresponding to the short trading distances to Ireland, on the one hand, and to France, Belgium and the Netherlands on the other.

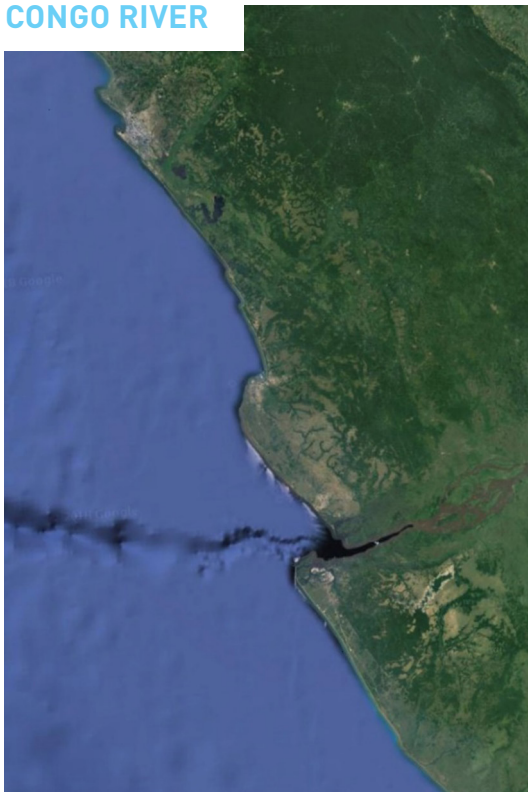
It is no trivial matter to sunder the relationship between a port and its hinterland in pursuit of any objective however attractive or worthy that objective might appear to be. If a new port for Dublin is to be built, then the location will need to be chosen so as to replicate as closely as possible all of the advantages which the location of the current port on the banks of the River Liffey gives.

The core challenge to build a new port is to create a sheltered area with access to deep water. This was possible in Dublin, firstly, because of the shelter of Dublin Bay and of the River Liffey and, secondly, because of the building of Dublin's two sea walls.

The depth of water in a river port is primarily determined by the flow in the river. The more tonnes of water that flow out of the mouth of the river, the greater the depth of water. This is most easily seen in a huge river such as the Congo. The Congo River is 4,700 kilometres long and drains an enormous land area in Central Africa. The average flow rate over the course of the year is 41,000 tonnes of water per second and this huge and powerful flow of water scours out a deep channel. At the mouth of the Congo River, depths vary between 200 metres and 300 metres as the river's torrential outflow surges into the Atlantic. The 130 kilometre long Congo plume (30 kilometres longer than the sailing distance from Dublin to Holyhead) gives some sense of the incredible power of this scouring flow.

Ireland is a small island, no more than 480 kilometres from top to bottom and no more than 280 kilometres from side to side. Being a small island, the rivers are also small and our largest river, the Shannon, is 360 kilometres long with an average annual flow rate of 208 tonnes per second.

CONGO RIVER



© Google Earth

	Length km	Average flow rate tonnes per second
Congo	4,700	41,000
Shannon	360	208
Liffey	125	14

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Even by comparison with the Shannon, the River Liffey is a puny river. It is only 125 kilometres long and has an average flow rate of 14 tonnes of water per second. With such a low flow rate, a bar of sand and sediment inevitably forms across the mouth of a river and so it was in Dublin that the channel into the port was shallow and meandering until the North Bull Wall was built in the early part of the nineteenth century.

The story of the building of the North Bull Wall and the earlier construction of the Great South Wall is one of considerable engineering ingenuity and these two walls succeeded in increasing the port's ruling depth from two metres to almost five metres in just 54 years.

Even by the standards of modern large port projects, the training walls built in the eighteenth and nineteenth centuries to define the shape of Dublin Port as it is today are impressive structures. The Great South Wall is 4,800 metres long and the North Bull Wall is 2,700 metres long. Their combined length is 7,500 metres.

From 2007 to 2013, the Port of Barcelona completed a major port expansion project which included the building of 6,900 metres of new quay walls.

In the absence of a natural harbour or another large river to accommodate a new port on its banks anywhere along the east coast of the country, the building of a new port will require the construction of very long harbour walls. The training walls in Dublin Port are more than two and a half times the length of the walls that were needed to create Dun Laoghaire Harbour. Dun Laoghaire Harbour's East Pier is 1,300 metres long and its West Pier is 1,500 metres long. Their combined length is 2,800 metres.

Even before new quays, jetties and berths are built elsewhere, the creation of a new harbour by the construction of enormous walls reaching out into deep water in the Irish Sea is itself a megaproject. Before any decision is taken to initiate such a megaproject, it is worth looking at what happened in other port cities for precedents that might be relevant and relatable to Dublin.

Dublin City is what it is because of Dublin Port and Dublin Port is where it is because of the combination of natural shelter (afforded by Dublin Bay and the River Liffey) and engineering ingenuity (in the eighteenth and nineteenth centuries).

We are at an inflection point in the long history of Dublin and its relationship with its port. The port is approaching its maximum capacity and we must plan now for the provision of additional port capacity elsewhere on the east coast to be available 20 years from now in 2040. In deciding where such additional capacity might be developed, it is worthwhile looking to see what lessons can be drawn from other European port cities.

DUBLIN PORT