

## Attachment D1 Purpose of the Operation

The purpose of the maintenance dredging operations at Drogheda Port is to maintain the safe navigation depths for the commercial traffic, fishing and leisure users of the River Boyne, Drogheda Port Company, its facilities and the town of Drogheda.

To understand the requirement for maintenance dredging, it is important to understand the hydrodynamics of the river and the nearshore coastal cell in respect of siltation, sediment transport and material deposition and its impacts/effects at the river mouth, the seaward approaches and estuarial channel to the town to Drogheda.

The River Boyne rises in the north midlands and exits to the sea at Mornington, Co. Meath. The river flows through the towns of Kells, Trim, Navan, Slane and finally Drogheda where international commercial shipping traffic uses the river to service Drogheda Port and third party facilities.

From Drogheda town to the sea at Mornington, the river has been hard engineered by means of training walls constructed around the 1850s by the then Drogheda Harbour Commissioners. The purpose of these training walls was to create estuarine polders either side of the main river channel. On the rising tide these estuarine polders fill up and retain the incoming water. On the ebb tide through designated "guts" the retained water is released.

The creation of the estuarine polders had two important effects i.e. through the release of water on the ebb tide it increased the tidal exit velocity thus producing a scouring or dredge effect. Following the immediate creation of the estuarine polder, the natural channel depth increased. In recent times, the original river walls constructed have fallen into dis-repair and the designed engineering effects of the polders have considerably diminished as the polders have largely silted up. Their effectiveness to cater for the modern freight vessel has long passed from that of the sailing ship or paddle steamer.

The fresh water flow and tidal exit velocities from the River Boyne were further enhanced in the late 1960s by the Boyne Drainage Scheme of the upper reaches between Kells, Trim and Navan.

The river maintains high ebb tide exit velocities during winter fresh flows supplemented with spring tides, however these exit velocities quickly fall off at the river mouth where the river exit flow meets the sea at Mornington.

The high velocities experienced allows the Boyne to carry a very substantial quantity of sediment and fluvial material out to the river mouth providing a natural scour to the estuary. However, while the river through engineering has an increased scour effect this does not eliminate the need for maintenance dredging particularly at the berths, artificial berth pockets, ship turning basins, river bends and locations where river flow ebb/exit velocities drop due to increased channel width.

Maintenance dredging at the berths, ship swing basins, artificial dredged pockets etc, would be at a higher frequency than the maintenance dredging within the defined navigation channel due in part to the localised accretion effects of ships' propeller wash and bow thruster wash, where the river silts are agitated and displaced locally within the ship manoeuvring radius. The manoeuvring of ships is a twice daily activity.

The high ebb/exit velocities have little or no effect at the river mouth or port approaches, where the exit stream meets the sea, hence maintenance dredging is required and at a higher frequency than within the main estuary, berths, artificial berth pockets and swing basins. This is primarily due to silt deposition where the exit velocities very quickly fall to zero.

The soft shallow entrance to the Boyne estuary lies roughly midway within the coastal cell between the hard rock outcrops of Clogherhead in the north and Bremore to the south. The coastline characteristic is one of a shallow shoaling sandy horseshoe bay where there is net annual nearshore sediment transport movement of material from south to north.

Since the late 1960's the Drogheda Port Company and formally the Drogheda Harbour Commissioners have carried out a considerable amount of coastal process and sediment movement analysis, studies and elevations, including the construction of a full physical river entrance simulation model (HR Wallingford 1969) and numerous modern day mathematical models with the latest modelling software lead by HR Wallingford (UK) Delft Hydraulics (Belgium) and KMM/RPS (Northern Ireland). A deep and detailed understanding of the coastal process and sediment transport regime of the shallow shoaling coastline within the coastal cell from Bremore in the south to Clogherhead in the north has been garnered.

This knowledge and understanding is absolutely essential to maintaining the port entrance safe for navigation from the impact of the (a) flood plain siltation but more importantly (b) the weather impacts and tidal surges.

In 1970 the Drogheda Harbour Commissioner constructed the training walls both north and south at the river mouth. At that time it was forecasted that the reserve capacity of the south training wall to retain sand would have a time frame or life span of circa 30-40 years, before full sediment bypassing would take place across the river entrance.

Both physical and mathematical studies have determined that circa 120,000m<sup>3</sup> of sand sediment is the net northerly movement of material within the near shore coastal cell annually, accelerated in storm events (see Attachment C1.(V) RPS - Drogheda Port Company Maintenance Dredging Licence Application Hydraulic Modelling Study, 25 May 2019). Estimated annual quantities of maintenance dredging of the berths, artificial berth pockets, ship swing basins, channel, river mouth and seaward approaches can also be drawn from the last 19 years of data on actual quantities dredged (see Attachment D1.(I) Dredging history 2001 - 2019).

The engineered navigational entrance to the port is particularly vulnerable to gales from the northeast through to the southeast which deposits mobile sediments from the shallow gradient shoreline north and south into the engineered deeper dredged port approach channel. This engineered channel from at the breakwaters is circa 100metres in width and 700mtrs in length, on an east/west axis and immediately adjacent to the shallow shoaling coastline that stretches to Bremore in the south and Clogherhead in the north (the coastal cell). This deposition of mobile sediment is compounded by the fact that the sediment storage reservoir behind the south training wall constructed in 1970s has now been exhausted allowing full sediment bypass, accelerated by south easterly storm events and tidal surges. This immediately impacts the navigation channel, reducing the safe warranted depth thus affecting safe navigation. The stronger the winds, the greater the depth loss due to accelerated sediment deposition.

The following survey extracts serve to illustrate the weather impact of the river entrance & seaward approaches on the safe navigational depths, see Attachment D1.(II) Dredging after Weather Events for further illustration of the below information.

<b>17<sup>th</sup> December 2017</b>	Good channel depth
<b>16<sup>th</sup> January 2018</b>	Storm Dylan – severe impact on channel safe navigation depth across the breakwaters
<b>31st January 2018</b>	Storm Eleanor – severe impact on channel safe navigation depth across the breakwaters
<b>17<sup>th</sup> February 2018</b>	Safe navigational depths restored following dredging

<b>5<sup>th</sup> March 2018</b>	Storm Emma - severe impact on channel safe navigation depth across the breakwaters and over the length and width of the entrance and seaward approaches
<b>28<sup>th</sup> March</b>	Safe navigational depths restored following dredging.
<b>8<sup>th</sup> April 2018</b>	Severe impact on channel safe navigation depth across the breakwaters
<b>20<sup>th</sup> April</b>	Safe navigational depth in restoration during dredging campaign

The above illustrates the vulnerability to storm events and the unpredictability of such events. It is difficult to actively pre-plan or forecast maintenance dredging activity other than to know that weather events will impact on the safe navigational depths particularly when the wind direction is from the north east through to south east.

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**ATTACHMENT D1.(I)**  
**DREDGING HISTORY 2001 - 2019**

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**Maintenance Dredging History 2001 - 2019 (Beneficial Reuse)**

Date	Material dredged from Bar (m3)	Material dredged from Channel (m3)	Material dredged from Tom Roes Point Terminal (m3)	Material dredged from Swing Basin	Other	Total m3	Permit No	End Use	Landed Ashore (m3)
May-13	62,604					62,604.00	EPA Dump at Sea Permit S0015-02	Lough Foyle - beneficial reuse	36814
Summer 16	9,463					9,463		1st Argus beneficial re-use	9463
Summer 17	47,398					47,398	Foreshore Licence	2nd Argus beneficial re-use	
Summer 18	38,909					38,909	Foreshore Licence	3rd Argus beneficial re-use	46,814

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Maintenance Dredging History 2001 - 2019 (Dumped at Sea)

Date	Material dredged from Bar (m3)	Material dredged from Channel (m3)	Material dredged from Tom Roes Point Terminal (m3)	Material dredged from Swing Basin	Other	Total m3	Permit No	End Use	Landed Ashore
Feb-01	53,963					53,963	329		
May-01	40,493					40,493	329		
Oct-01	29,726					29,726	329		
Feb-02	36,022					36,022			
Aug-02	10,395					10,395	345		
Sep-02	26,339	3,570	8,495	6,819		45,223	345		
Jan-03	70,701		3,586			74,267	345		
Apr-03	23,266					23,266	345		
May-03	4,121					4,121	345		
Nov-03	59,623	6,332	9,245			75,200	345		
Apr-04	60,784		11,740	7,275		79,799	345		
Dec-04	30,000	8,532	14,444			52,976	345		
May-05	49,095		15,011			64,106	345		
Nov-05	34,434		11,341			45,775	345		
Mar-06	53,057		14,487			67,544	345		
Jun-06	42,911		8,591			51,502	345		
Dec-06					126,844	126,844	378	Capital work Tom Roes Point to Maxol	
Feb-07	70,000		2,521			72,521	345		
Mar-08	63,017		11,053			74,070	387		
Mar-09	58,074		3,992	2,552		64,618	387		
Jan-10					348	348	387	Hebble Sand material from Flogas intake	
Mar-10	44,962					44,962	387	Lough Foyle	
Jul-10	31,131					31,131	387	1st Lough Foyle recovery campaign	24055
Nov-10	33,042					33,042	387	2nd Lough Foyle recovery campaign	18260
Feb-11	30,735		3,924			30,735.00	387	3rd Lough Foyle recovery campaign	26811
Jul-11	3,227					3,227.00	387	Lough Foyle - sea disposal	
Dec-11	38,162				291	38,453.00	387	4th Lough Foyle recovery campaign	25344
Apr-12	38,656					38,656.00	387	5th Lough Foyle recovery campaign	9572
Nov-12	13,080					13,080	387	Lough Foyle - sea disposal	

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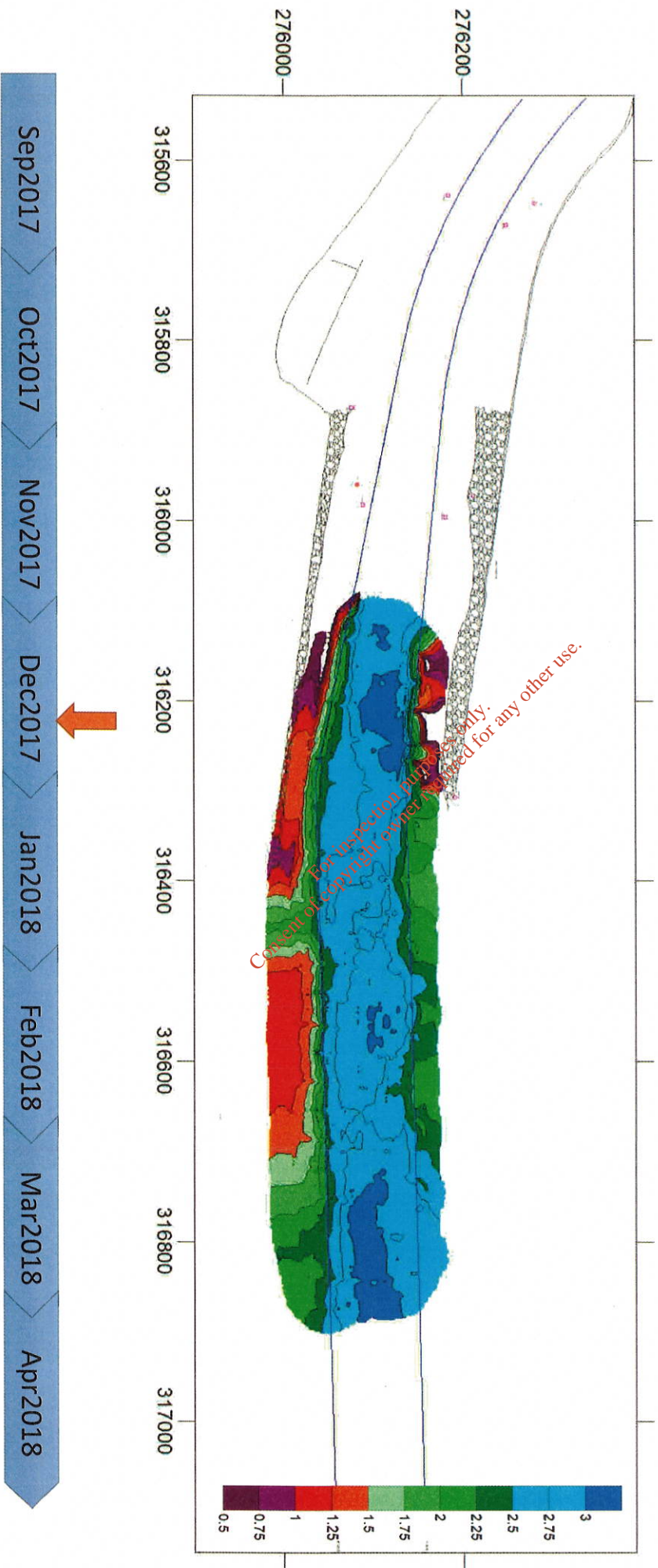
Feb-13	53,961				53,961			
May-13	62,604				62,604.00	EPA Dump at Sea Permit S0015-02	Lough Foyle - beneficial reuse	36814
Mar-14	64,726				64,726.00	EPA Dump at Sea Permit S0015-02	Sospan	
Jun-14	39,871		4,319		44,190	EPA Dump at Sea Permit S0015-02	Sospan	
<b>Note: Dec 04, May 05, Nov 05, Tom Roes Point Berth &amp; Swing basin combined in one figure</b>								
Jan-15	40,619				40,619	EPA Dump at Sea Permit S0015-02	Sospan	
Sep-15	35,587		11,740		47,327	EPA Dump at Sea Permit S0015-02	Sospan	
Jan-16	49,354				49,354	EPA Dump at Sea Permit S0015-02	Deo Gloria	
Summer 16	9,463				9,463		1st Argus beneficial re-use	9463
Dec-16	18,962	27,594			46,558	EPA Dump at Sea Permit S0015-02	Sospan	
Feb-17	56,992				56,992	EPA Dump at Sea Permit S0015-02	Sospan	
Summer 17	47,398				47,398	Foreshore Licence	2nd Argus beneficial re-use	
Oct-17	18,217	18,594			36,811	EPA Dump at Sea Permit S0015-02	Sospan	
Feb-18	16,989	20,487			37,476	EPA Dump at Sea Permit S0015-02	Sospan	
Mar-18	38,281				38,281	EPA Dump at Sea Permit S0015-02	Sospan	
Summer 18	38,909				38,909	Foreshore Licence	3rd Argus beneficial re-use	
Nov-18	4,968	18,371			23,339	EPA Dump at Sea Permit S0015-02	Sospan	
Dec-18	47,703				47,703	EPA Dump at Sea Permit S0015-02	Sospan	
Apr-19	27,067		1404		28,471	EPA Dump at Sea Permit S0015-02	Sospan	

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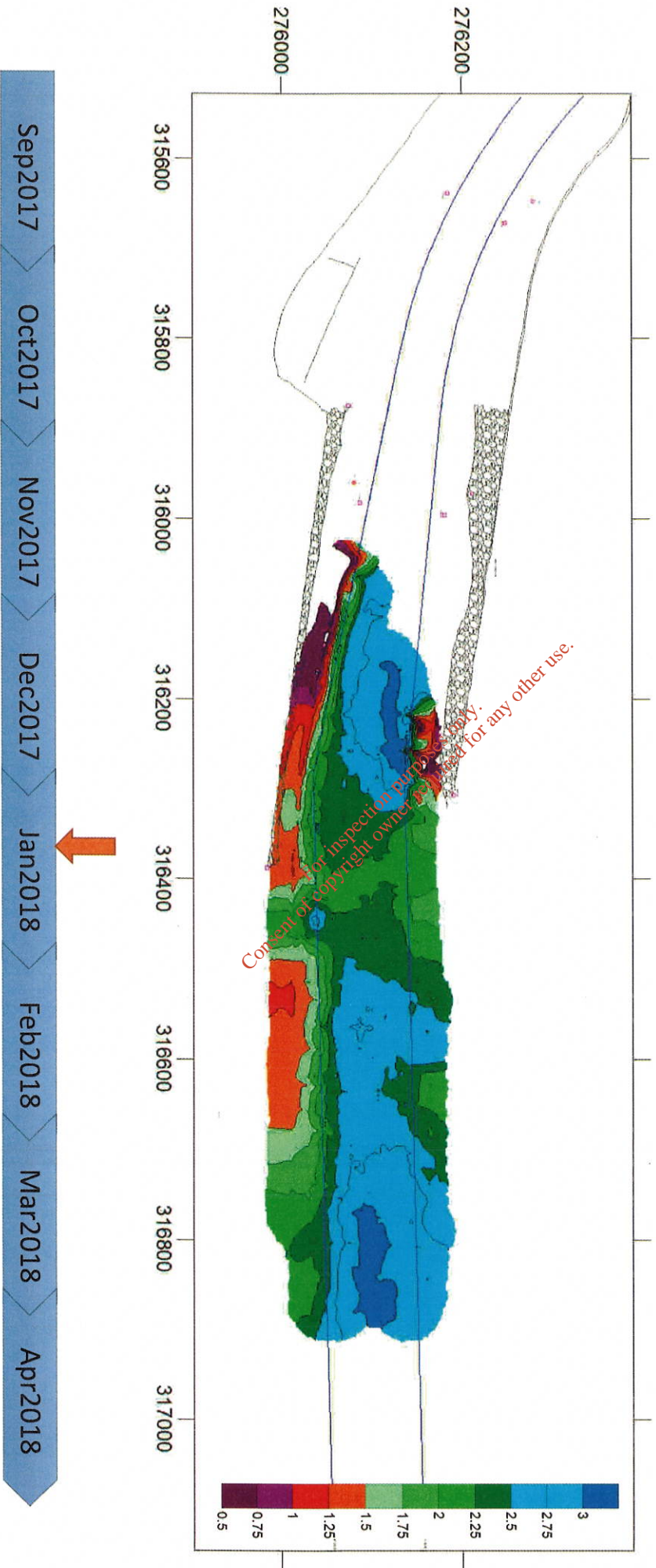
**ATTACHMENT D1.(II)**  
**DREDGING AFTER WEATHER EVENTS**

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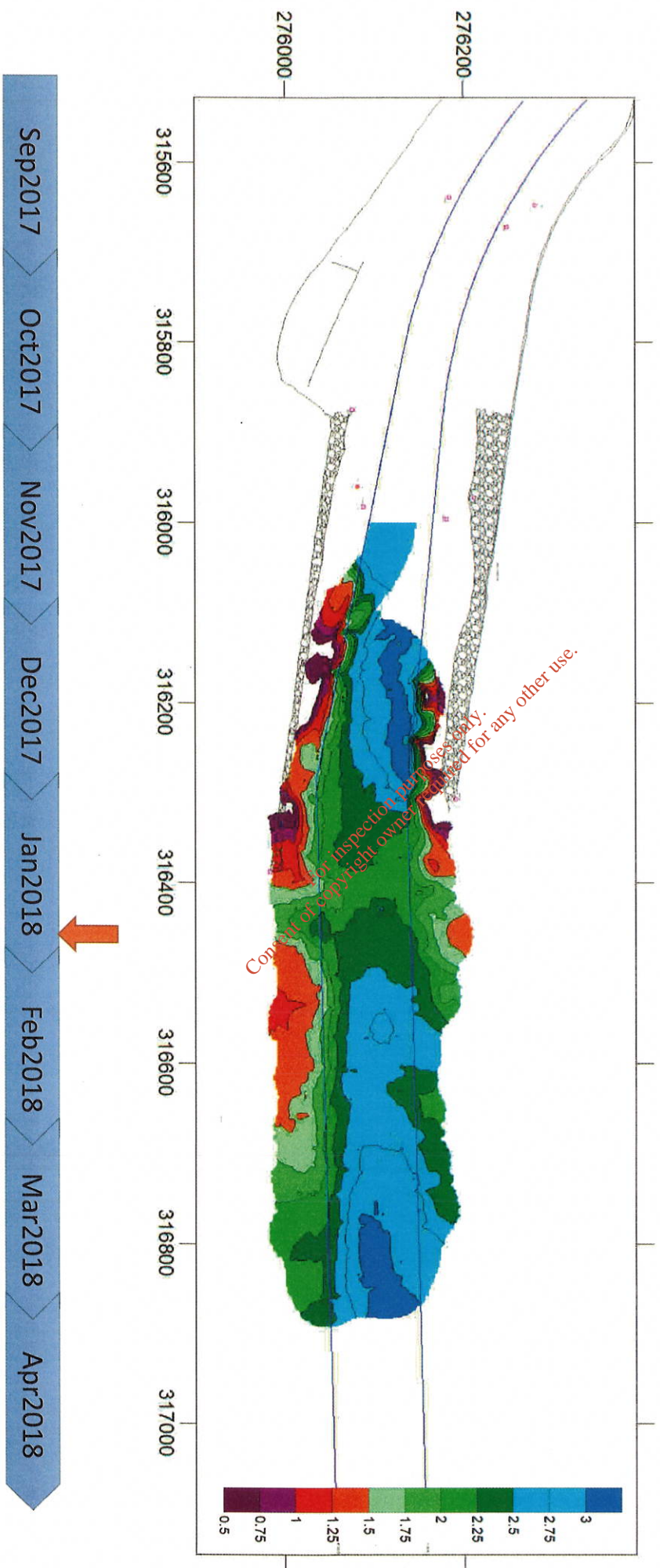
# 17<sup>th</sup> December 2017



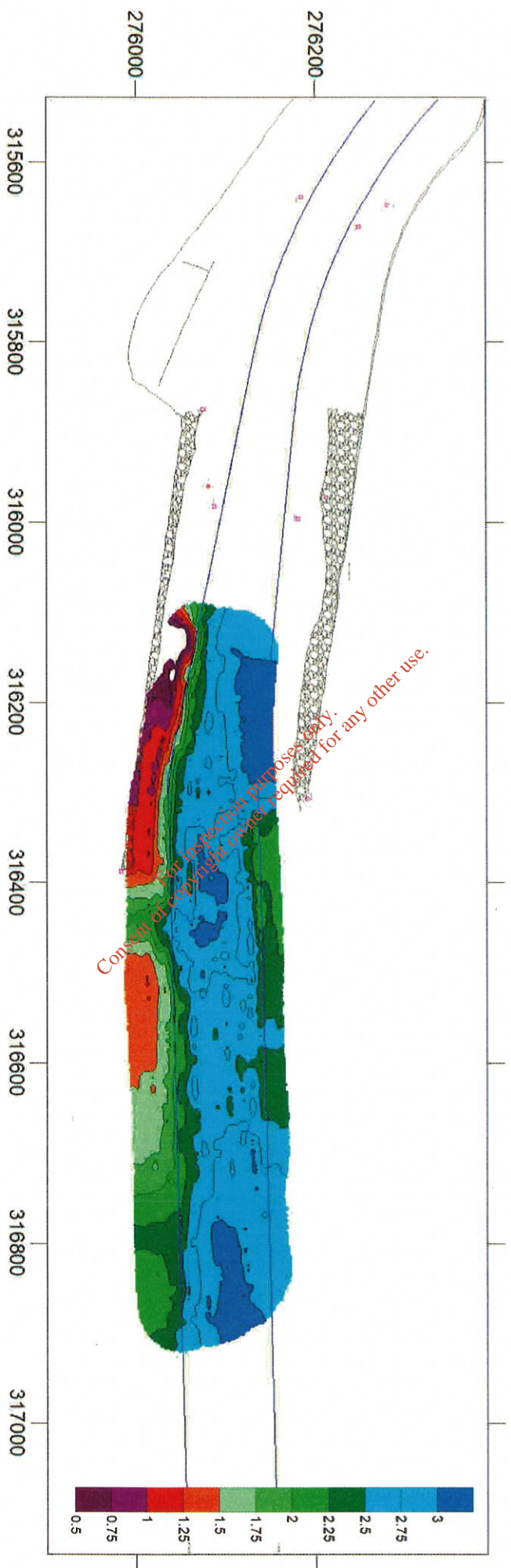
# 16<sup>th</sup> January 2018 Post Storm Dylan / Storm Eleanor



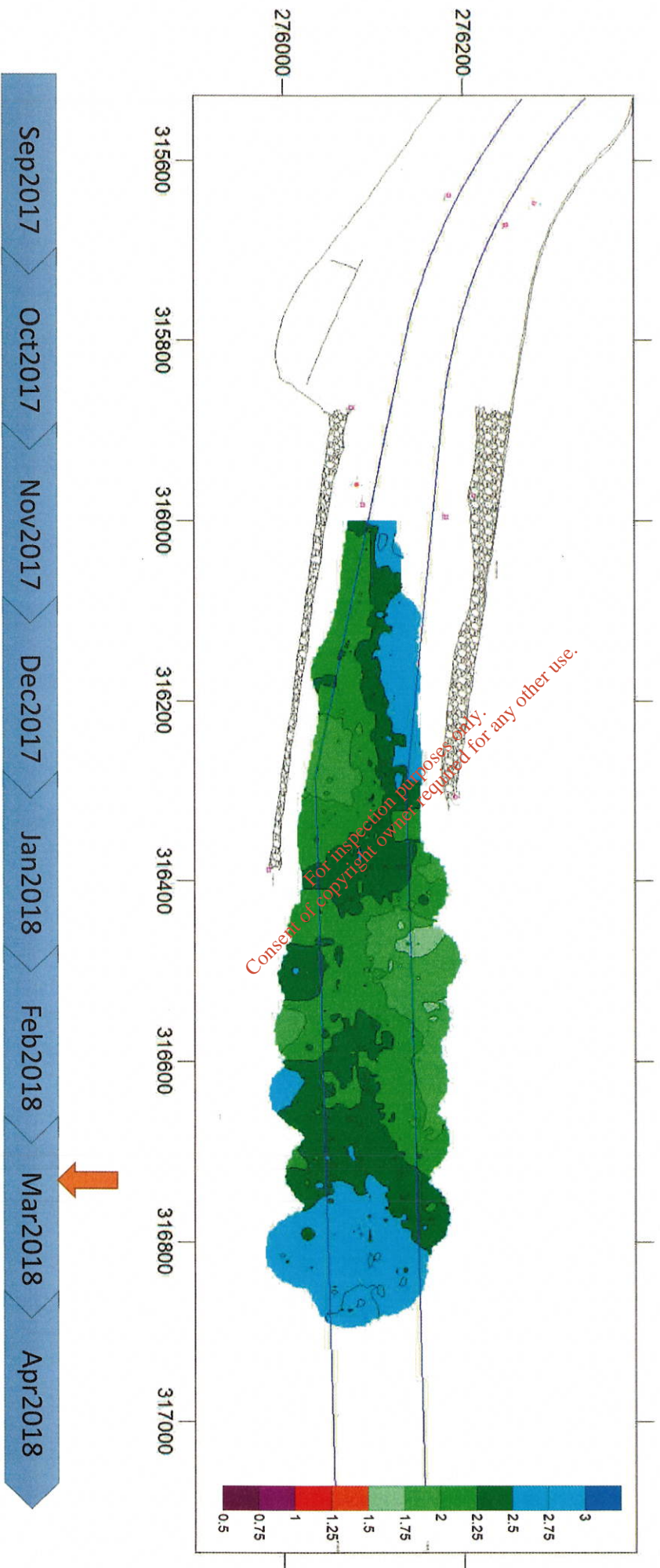
# 31<sup>st</sup> January 2018 Post Storm Dylan / Storm Eleanor



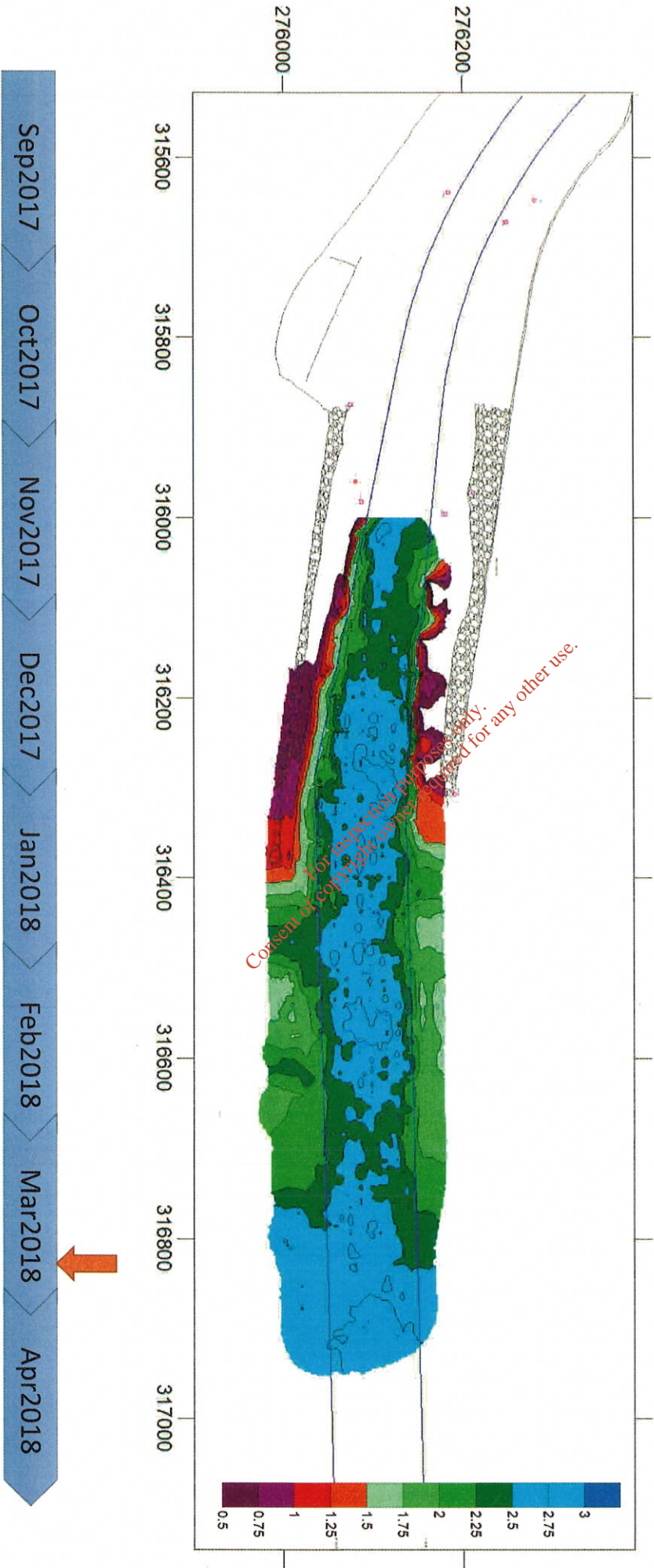
# 17th February 2018 Post Dredging Campaign



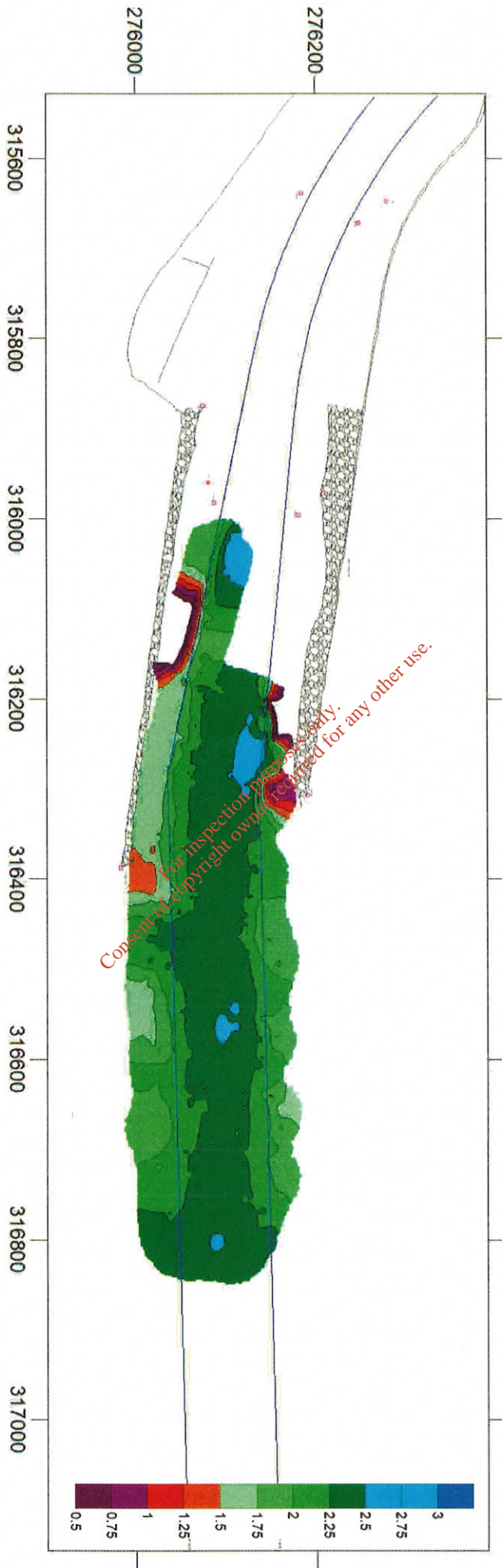
# 5<sup>th</sup> March 2018 Post Storm Emma



# 28<sup>th</sup> March 2018 Post Dredging Campaign



8<sup>th</sup> April 2018



20<sup>th</sup> April 2018

