

ATTACHMENT No F.1-2

DISCHARGE MODELLING & IMPACT ON ENVIRONMENT

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ANNEX 6

DROGUE TRACKING

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**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on July 28th 2004
Neap Tide**

Released at HW
Courtmacsherry Tide
on July 28th 2004

Courtmacsherry Levels

BST	CD (m)
02:00	3.1
08:54	0.9
14:34	3.2
21:24	0.8

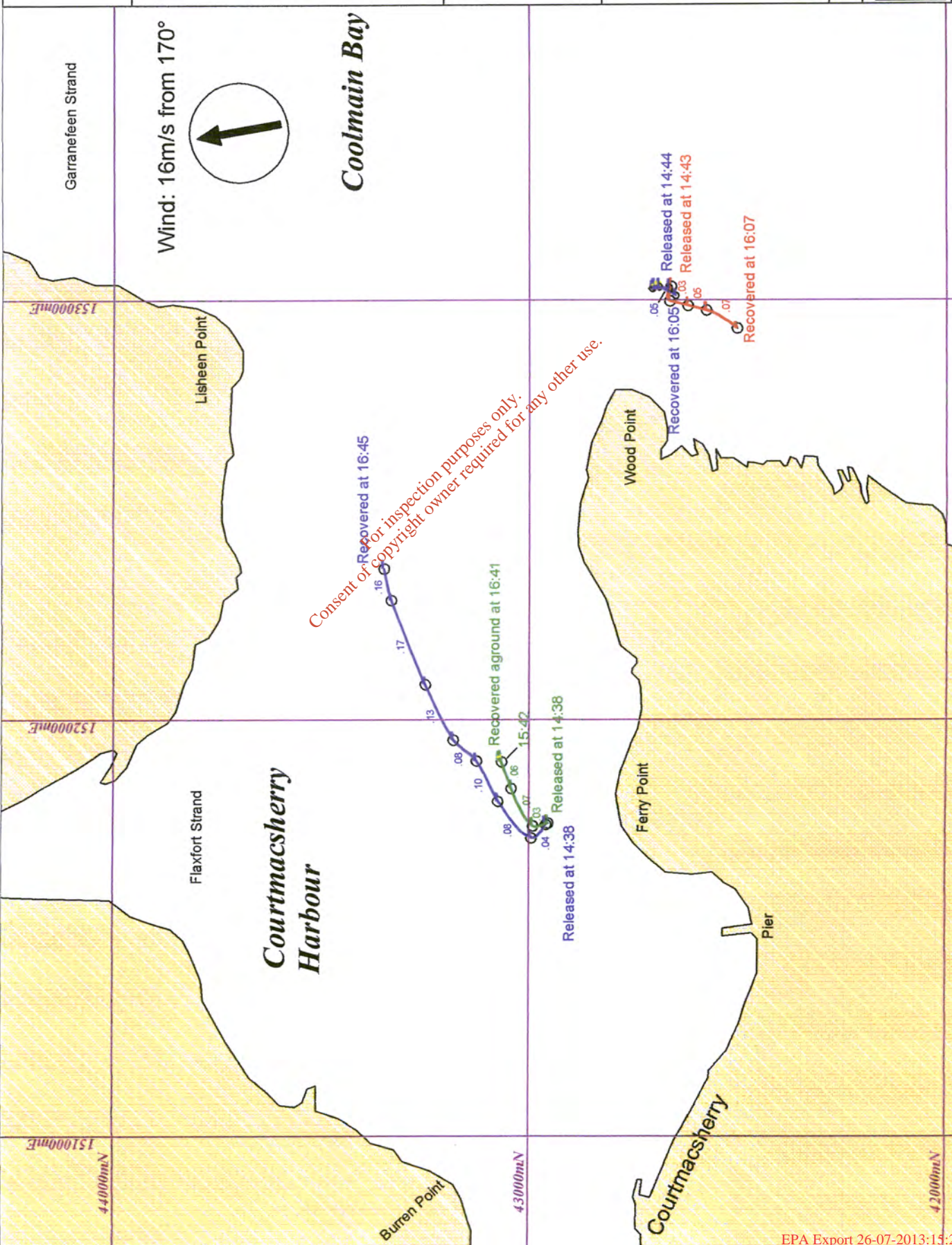
KEY

- POSITION FIXED
- SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

**IRISH
HYDRODATA Ltd**
Rathmacullig West
Ballygarvan Co. Cork
info@hydrodata.ie

FIGURE



*Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes*
MARINE SURVEY

**Drogue Tracking
on July 28th 2004
Neap Tide**
Released at HW+1.5

Courtmacsherry Tide
on July 28th 2004

BST	CD (m)	
02:00	3.1	
08:54	0.9	
14:34	3.2	
21:24	0.8	

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

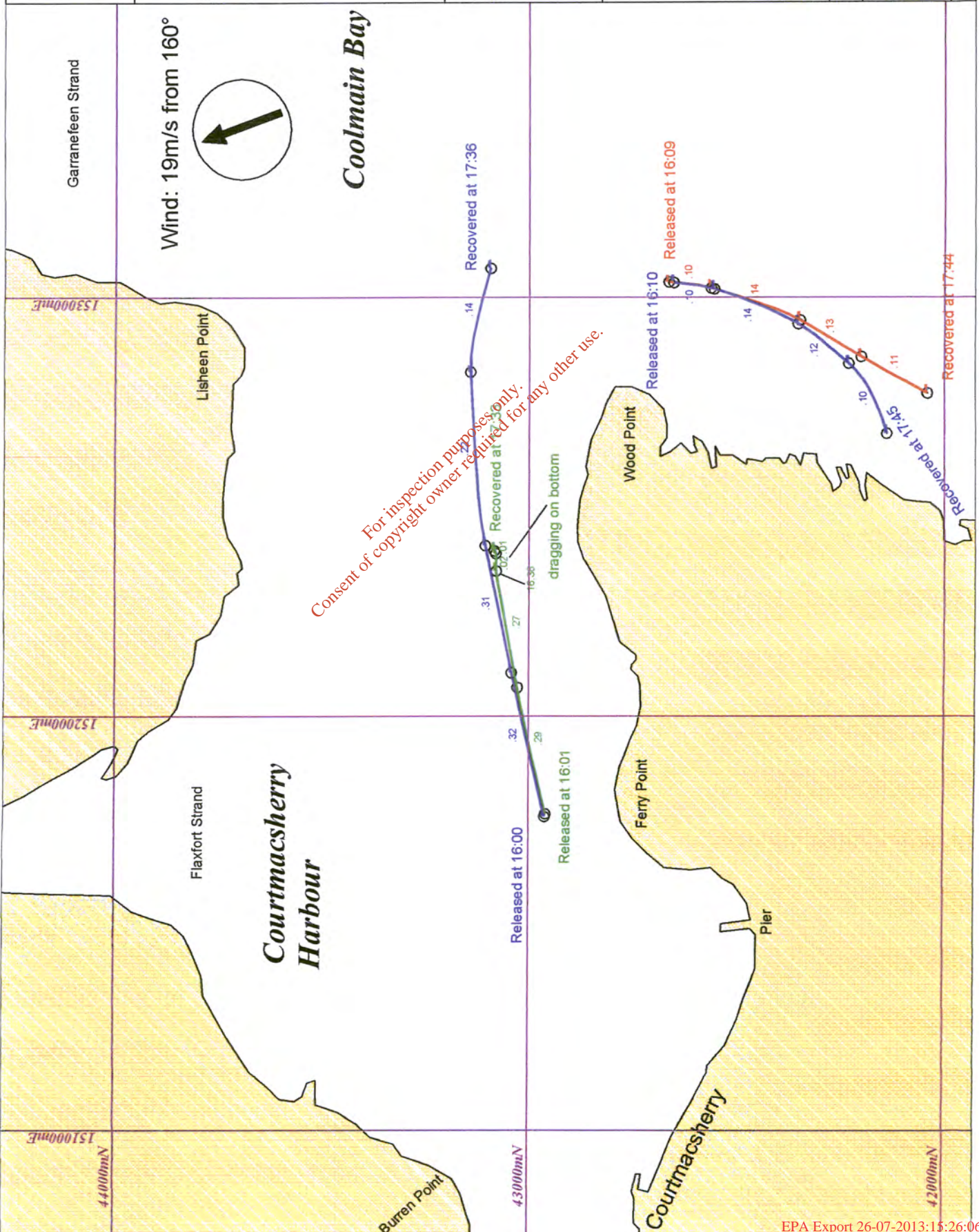
- POSITION FIXED
- SPEED (m/sec)
- TRACK

Surface
2m depth
3m depth

Scale 1 : 12,500

**IRISH
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Rathmacullig West
Ballygarvan Co. Cork
info@hydrodata.ie

FIGURE



Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY

Drogue Tracking
on July 28th 2004
Neap Tide

Released at HW+3

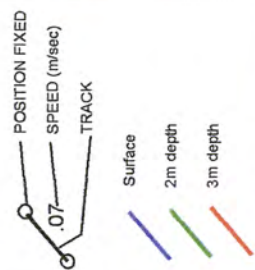
Courtmacsherry Tide
on July 28th 2004

BST	CD (m)
02:00	3.1
08:54	0.9
14:34	3.2
21:24	0.8

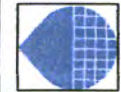
Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

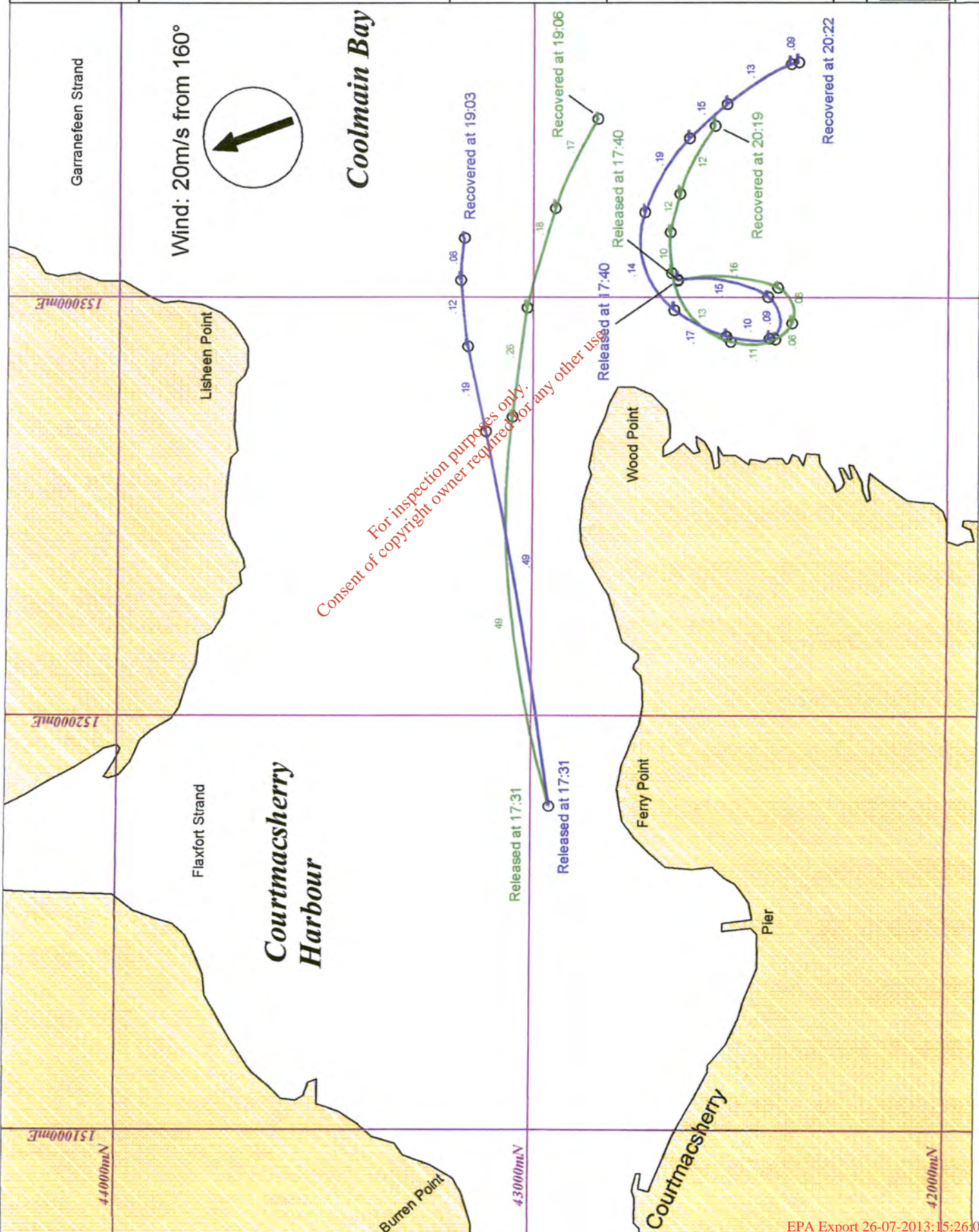
KEY



Scale 1 : 12,500



FIGURE



Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes MARINE SURVEY

Drogue Tracking on July 28th 2004 Neap Tide
Released at HW+4.5

Courtmacsherry Tide on July 28th 2004

BST	CD (m)
02:00	3.1
08:54	0.9
14:34	3.2
21:24	0.8

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

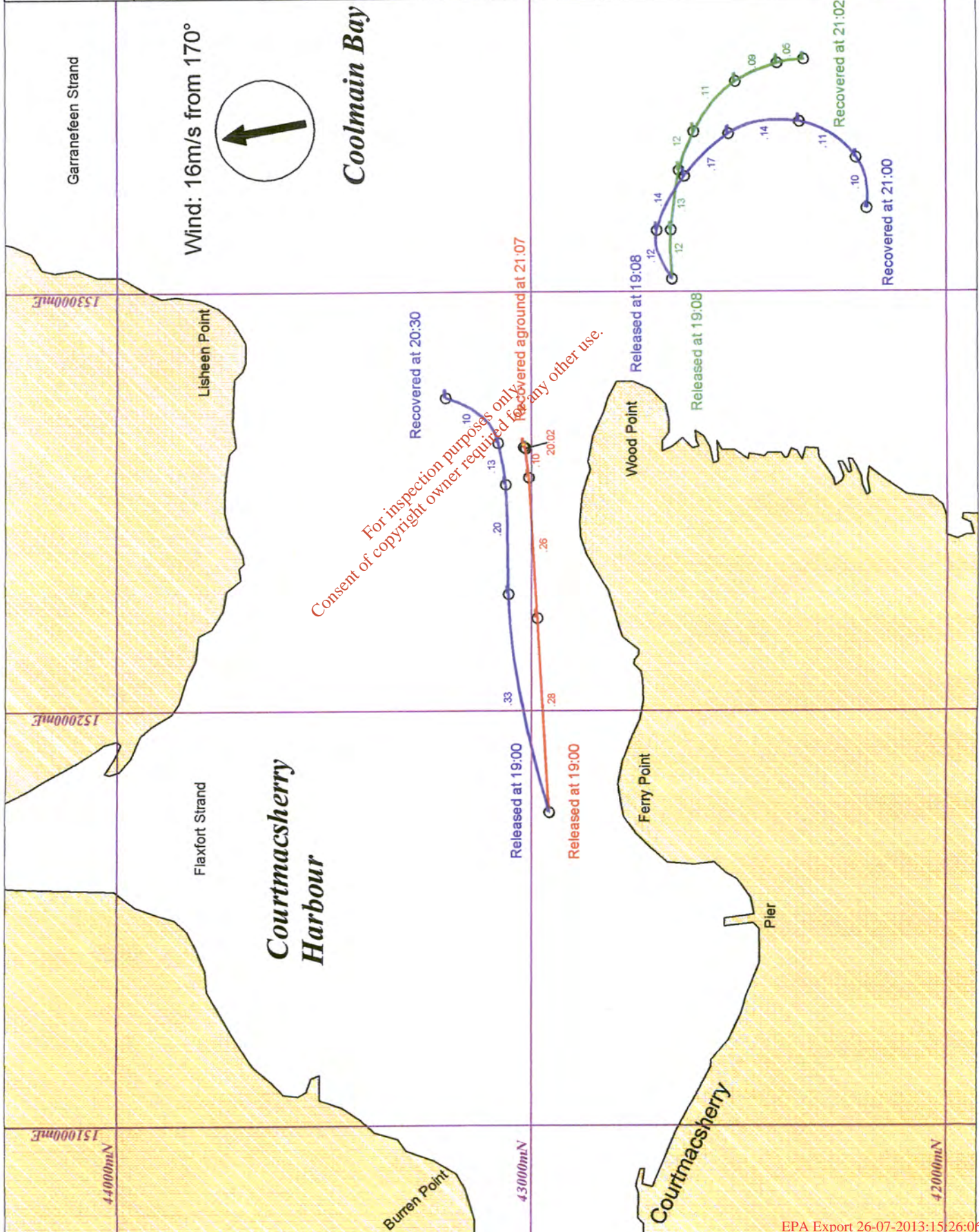
- POSITION FIXED
- SPEED (m/sec)
- TRACK

Surface
 2m depth
 3m depth

Scale 1 : 12,500

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FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Droge Tracking
on July 28th 2004
Neap Tide
Released at HW-1**

Courtmacsherry Tide
on July 28th 2004

BST	CD (m)
02:00	3.1
08:54	0.9
14:34	3.2
21:24	0.8

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

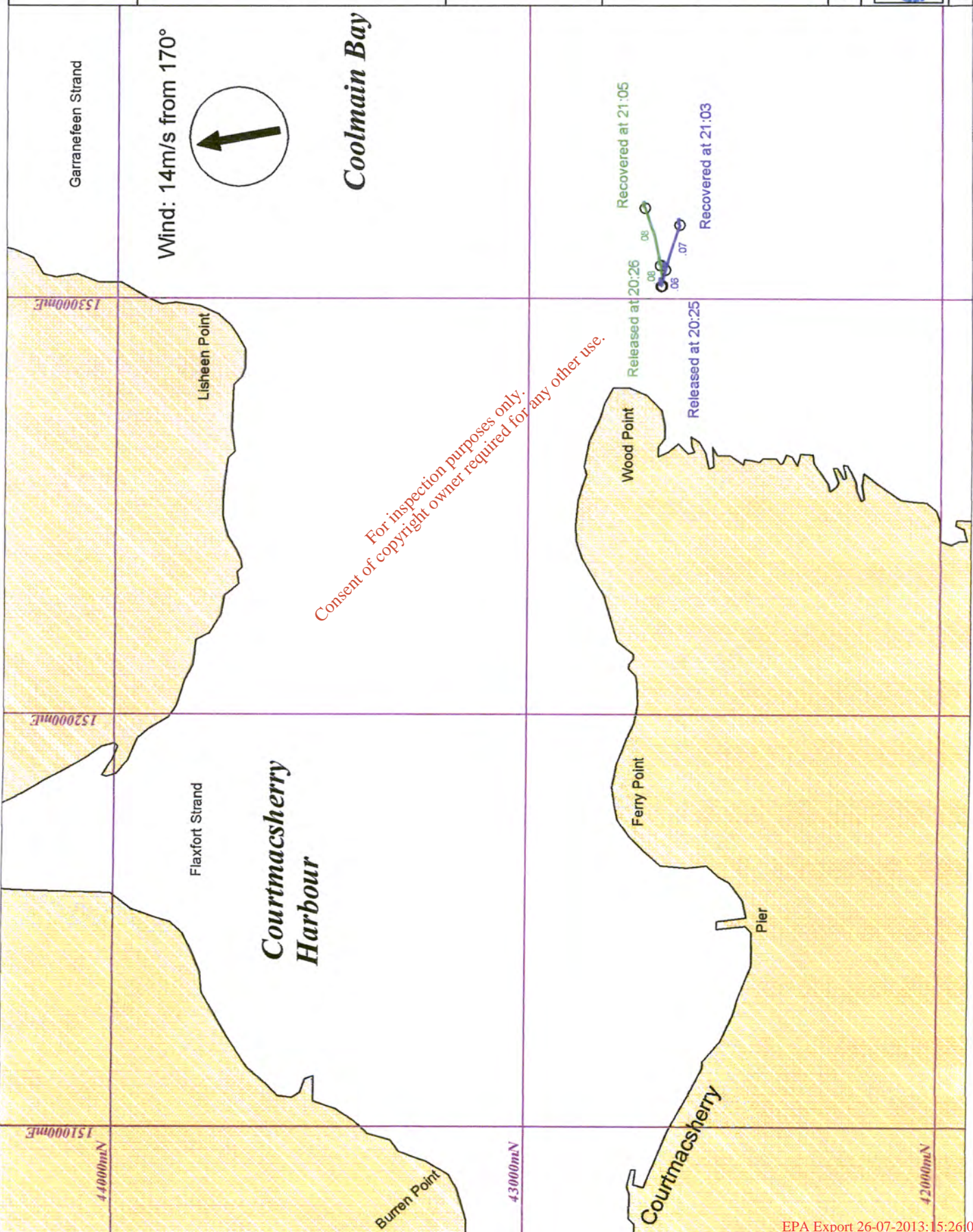
- POSITION FIXED
- SPEED (m/sec)
- TRACK

Surface
2m depth
3m depth

Scale 1 : 12,500

**IRISH
HYDRODATA Ltd**
Rathmacullig West
Ballygarvan Co. Cork
info@hydrodata.ie

FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on July 29th 2004
Neap Tide**

Released at LW

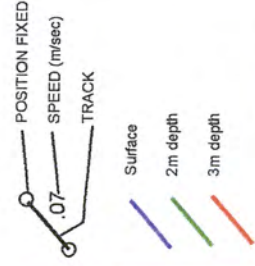
Courtmacsherry Tide
on July 29th 2004

BST	CD (m)
03:09	3.2
10:02	0.8
15:43	3.3
22:33	0.7

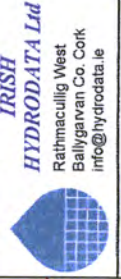
Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

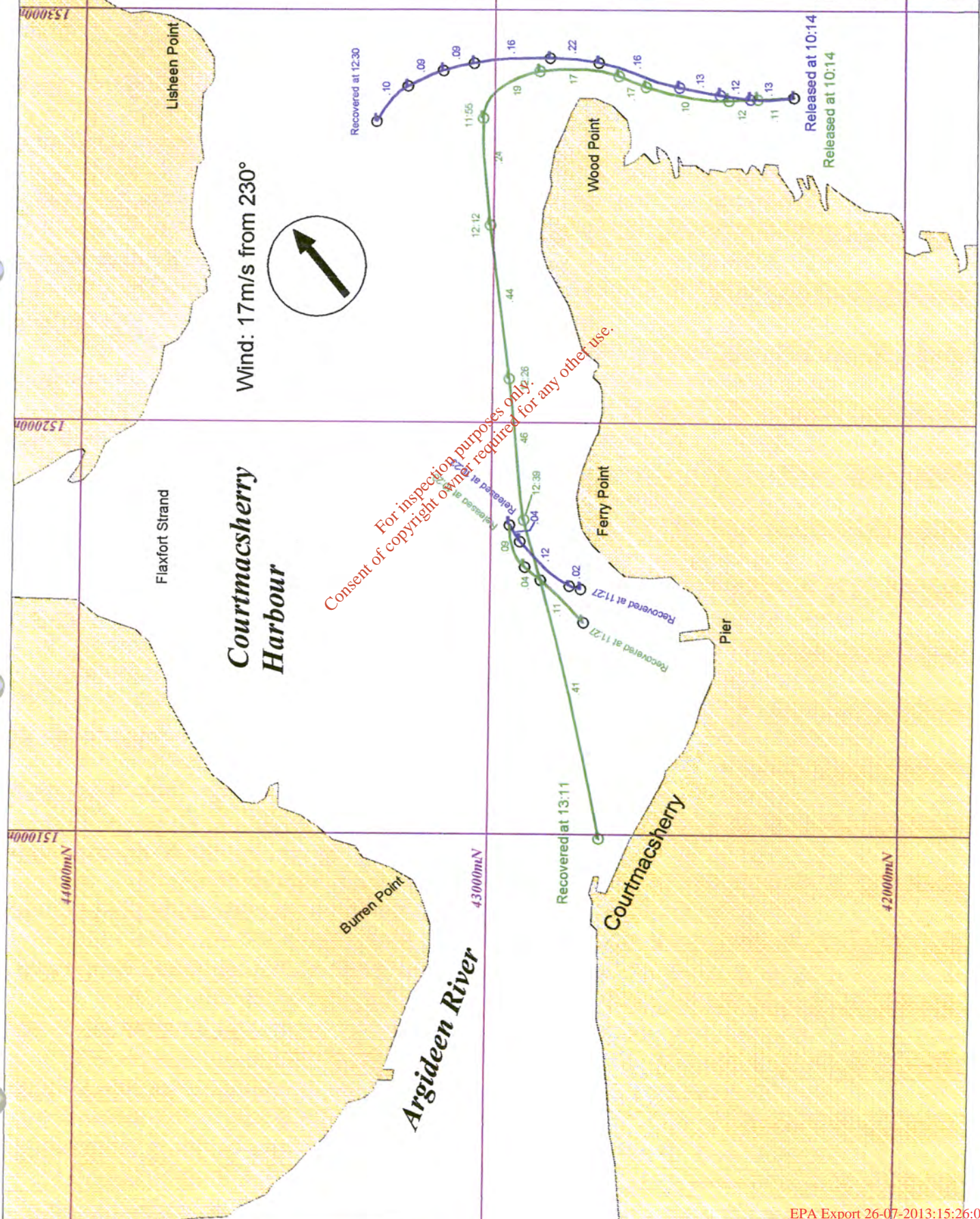
KEY



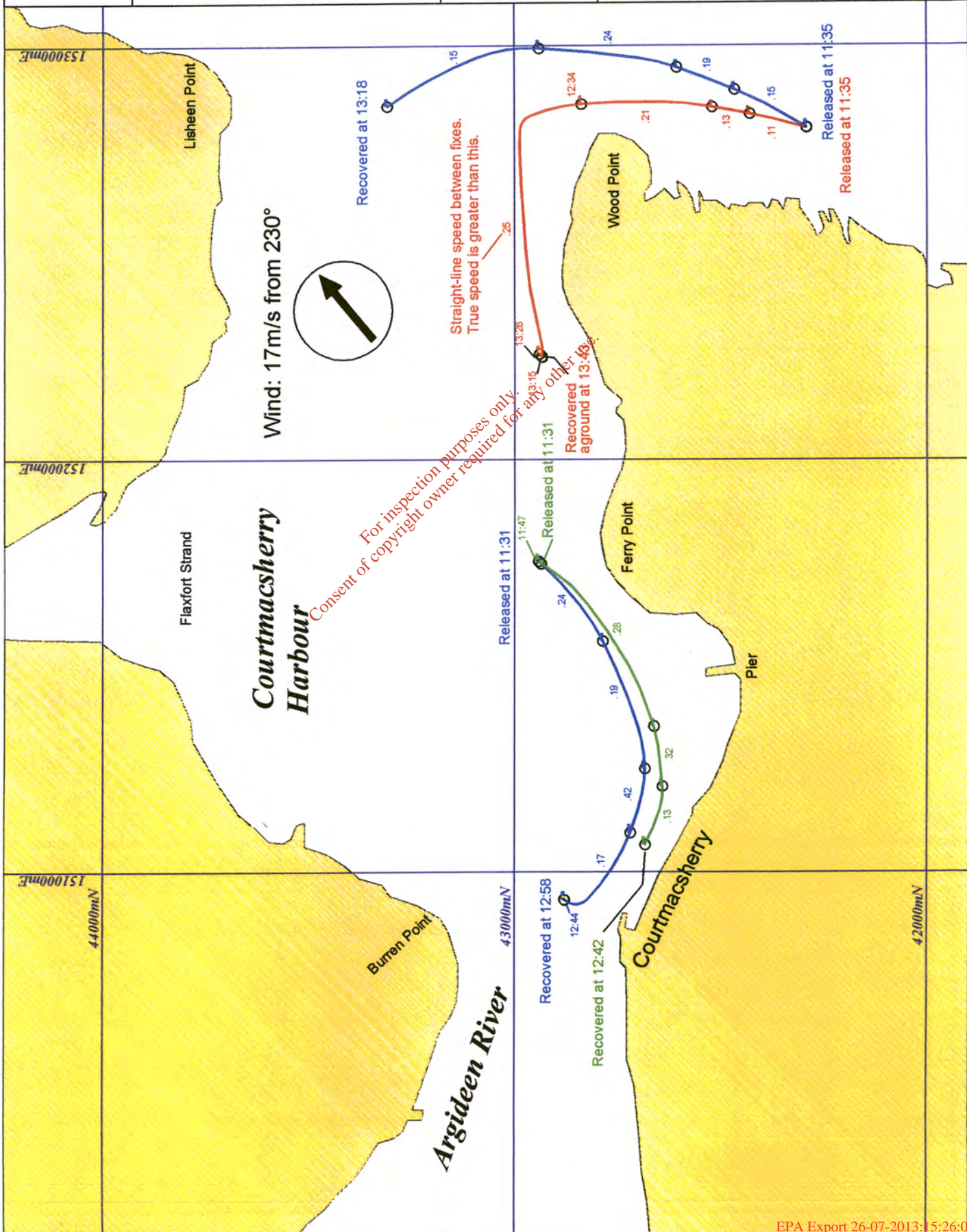
Scale 1 : 12,500



FIGURE



<p><i>Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes</i></p> <p>MARINE SURVEY</p> <p>Drogu Tracking on July 29th 2004 Neap Tide</p> <p>Released at LW+1.5</p> <p>Courtmacsherry Tide on July 29th 2004</p> <p>BST CD (m) 03:09 3.2 10:02 0.8 15:43 3.3 22:33 0.7</p> <p>Courtmacsherry Levels</p> <p>MHWS 3.7 MHWN 2.9 MLWN 1.1 MLWS 0.3</p> <p>KEY</p> <p>POSITION FIXED SPEED (m/sec) TRACK</p> <p>Surface 2m depth 3m depth</p> <p>Scale 1 : 12,500</p> <p>IRISH HYDRODATA Ltd Rathmacullig West Ballyganan Co. Cork info@hydrodata.ie</p> <p>FIGURE</p>



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes**

MARINE SURVEY

**Droge Tracking
on July 29th 2004
Neap Tide
Released at LW+3**

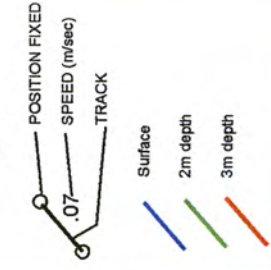
Courtmacsherry Tide
on July 29th 2004

BST	CD (m)
03:09	3.2
10:02	0.8
15:43	3.3
22:33	0.7

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

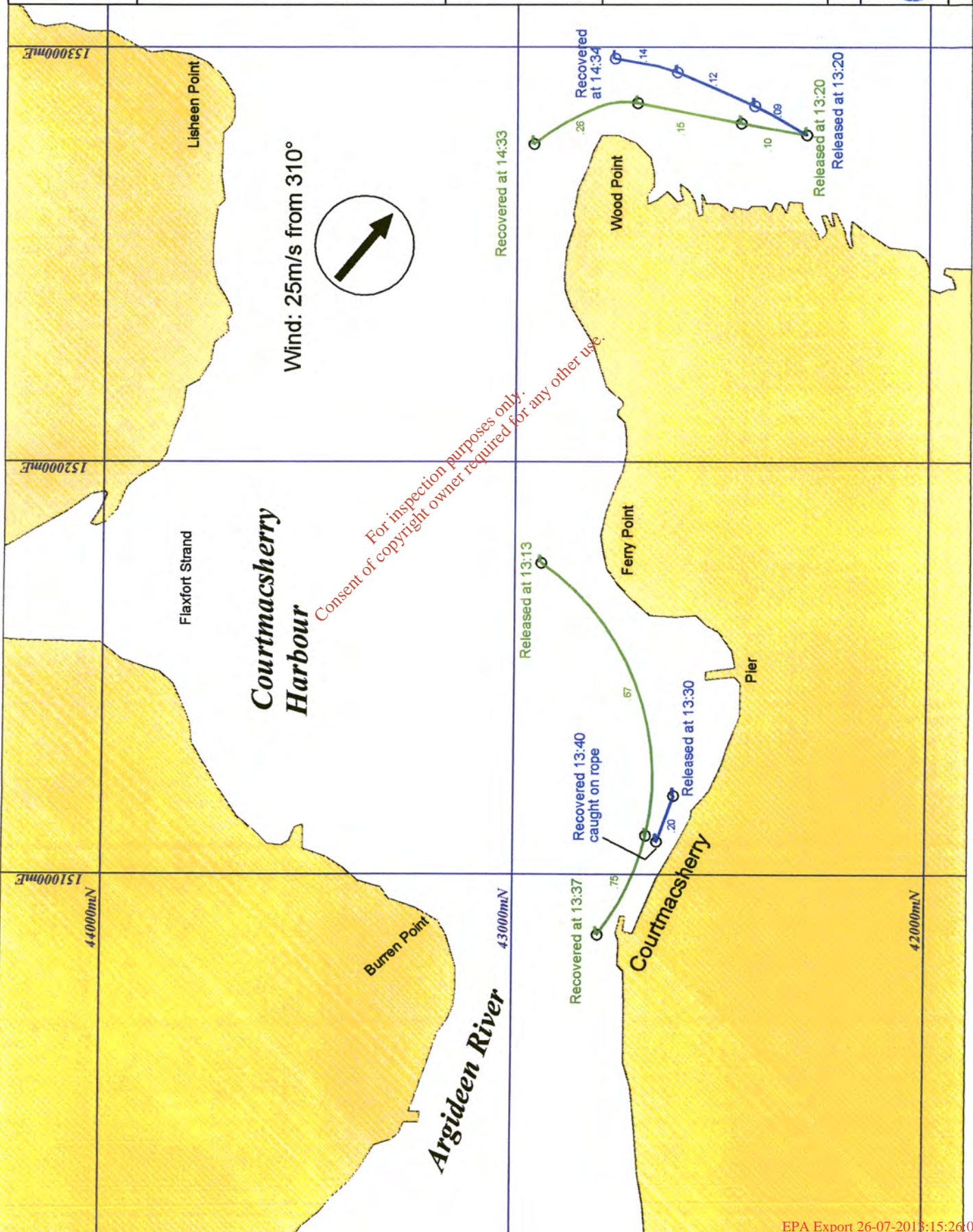
KEY



Scale 1 : 12,500

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FIGURE



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*Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes*
MARINE SURVEY

**Droge Tracking
on July 29th 2004
Neap Tide
Released at LW+4**

Courtmacsherry Tide
on July 29th 2004

BST	CD (m)
03:09	3.2
10:02	0.8
15:43	3.3
22:33	0.7

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

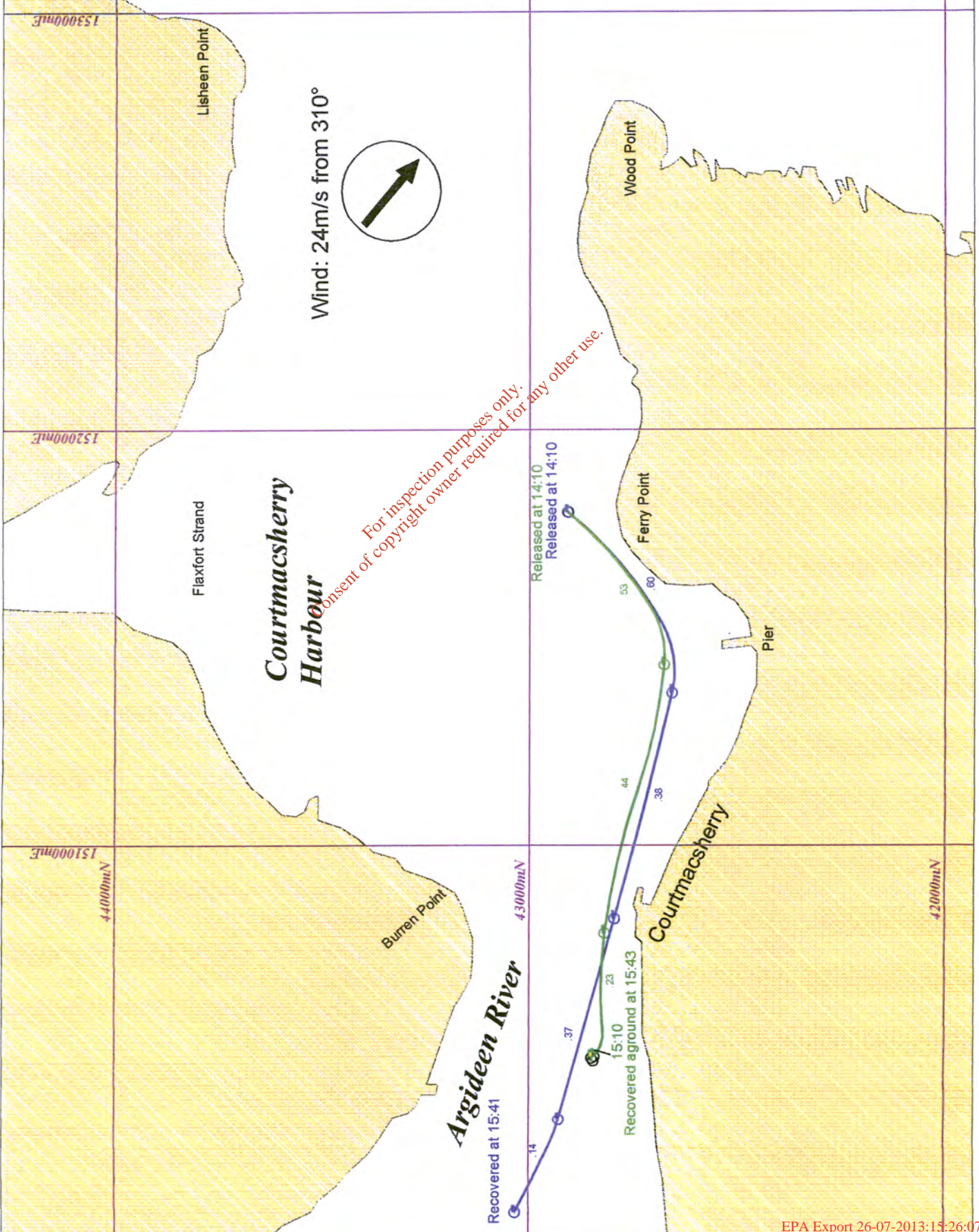
KEY

- POSITION FIXED
- SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

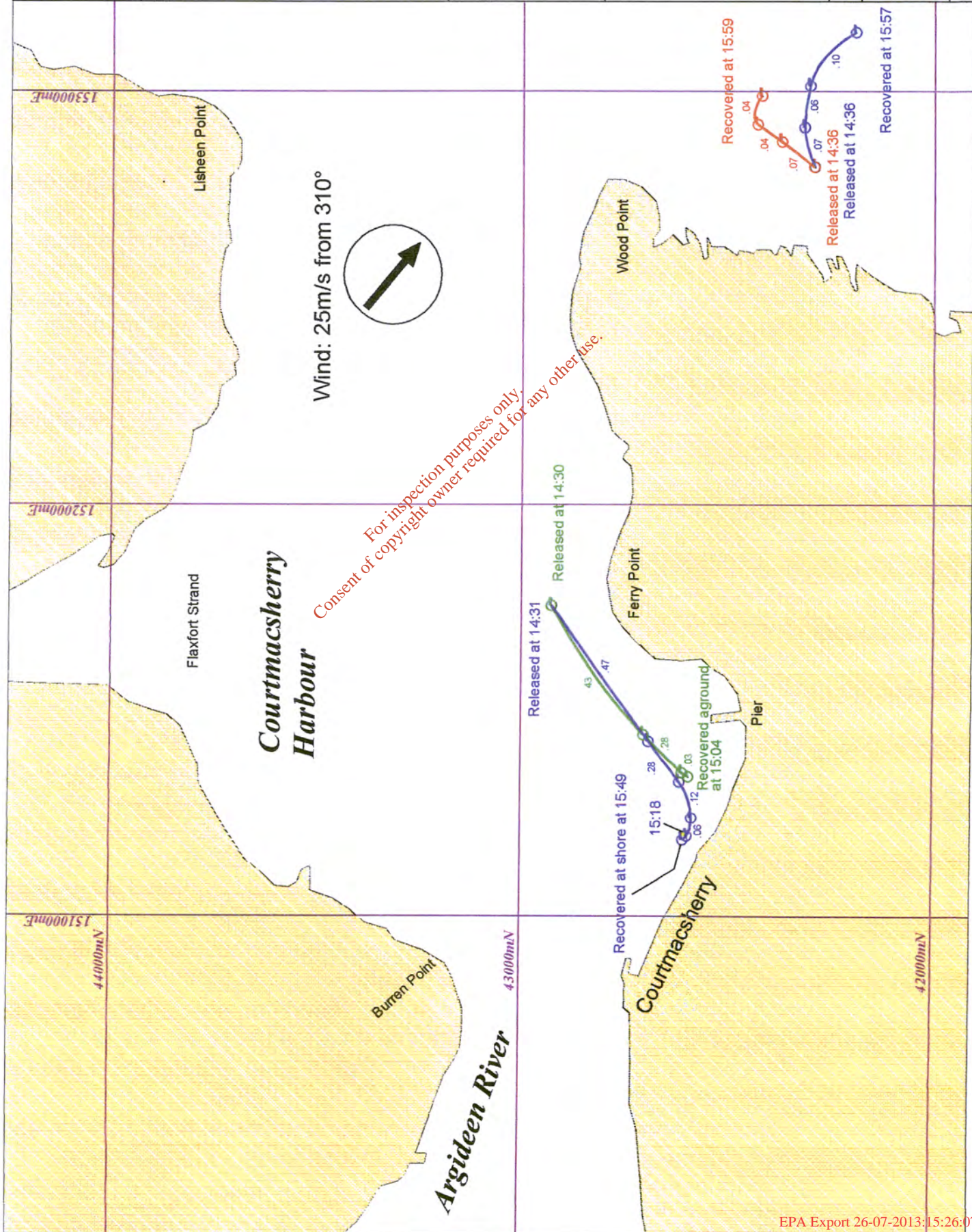
Scale 1 : 12,500

**IRISH
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Ballygarvan Co. Cork
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FIGURE



<p>Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes</p> <p>MARINE SURVEY</p> <p>Droque Tracking on July 29th 2004 Neap Tide</p> <p>Released at LW+4.5</p> <p>Courtmacsherry Tide on July 29th 2004</p> <p>BST CD (m) 03:09 3.2 10:02 0.8 15:43 3.3 22:33 0.7</p> <p>Courtmacsherry Levels MHWS 3.7 MHWN 2.9 MLWN 1.1 MLWS 0.3</p>
<p>KEY</p> <p>POSITION FIXED SPEED (m/sec) TRACK</p> <p>Surface 2m depth 3m depth</p> <p>Scale 1 : 12,500</p> <p>IRISH HYDRODATA Ltd Rathmacullig West Ballygarvan Co. Cork info@hydrodata.ie</p>



FIGURE

ATTACHMENT No F.1-3

DISCHARGE MODELLING & IMPACT ON ENVIRONMENT

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Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes

MARINE SURVEY

Drogué Tracking
on August 17th 2004
Spring Tide

Released at HW-1

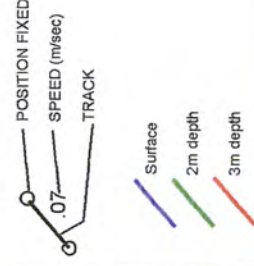
Courtmacsherry Tide
on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

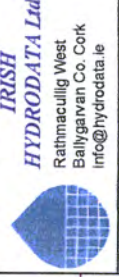
Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

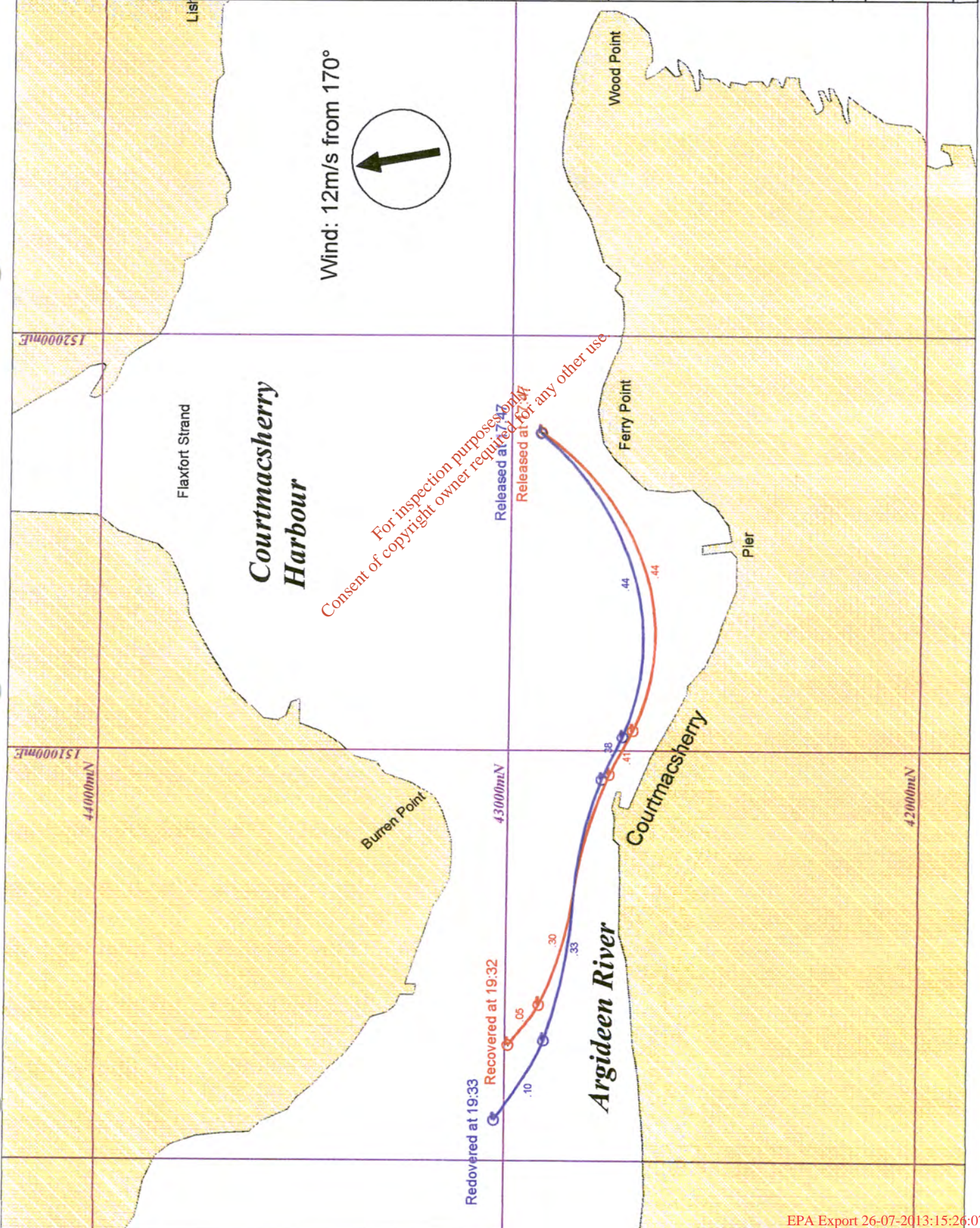
KEY



Scale 1 : 12,500



FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 17th 2004
Spring Tide
Released at HW-1**

Courtmacsherry Tide
on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

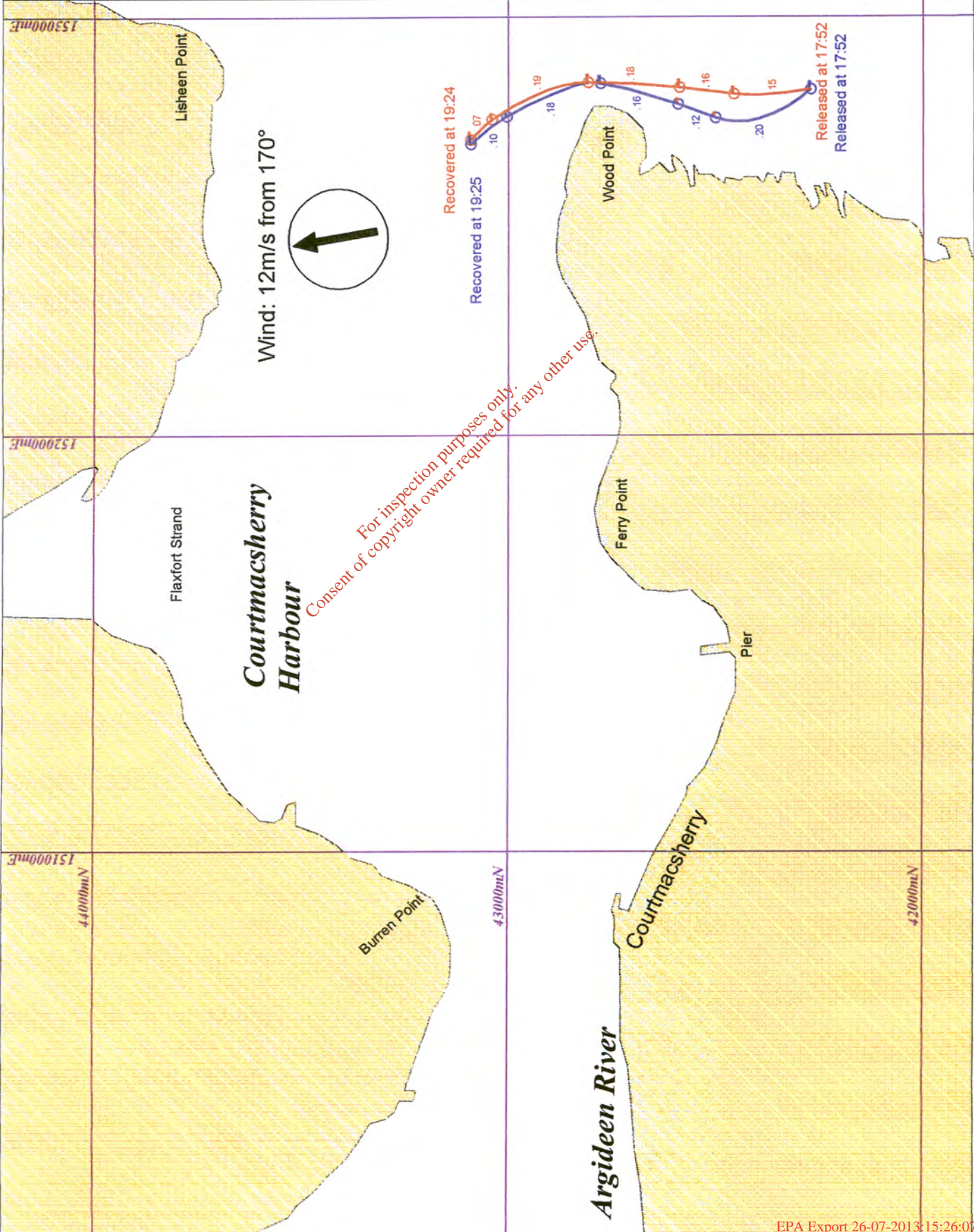
- POSITION FIXED
- SPEED (m/sec)
- TRACK

- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

**IRISH
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FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 17th 2004
Spring Tide
Released at HW-3**

Courtmacsherry Tide
on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

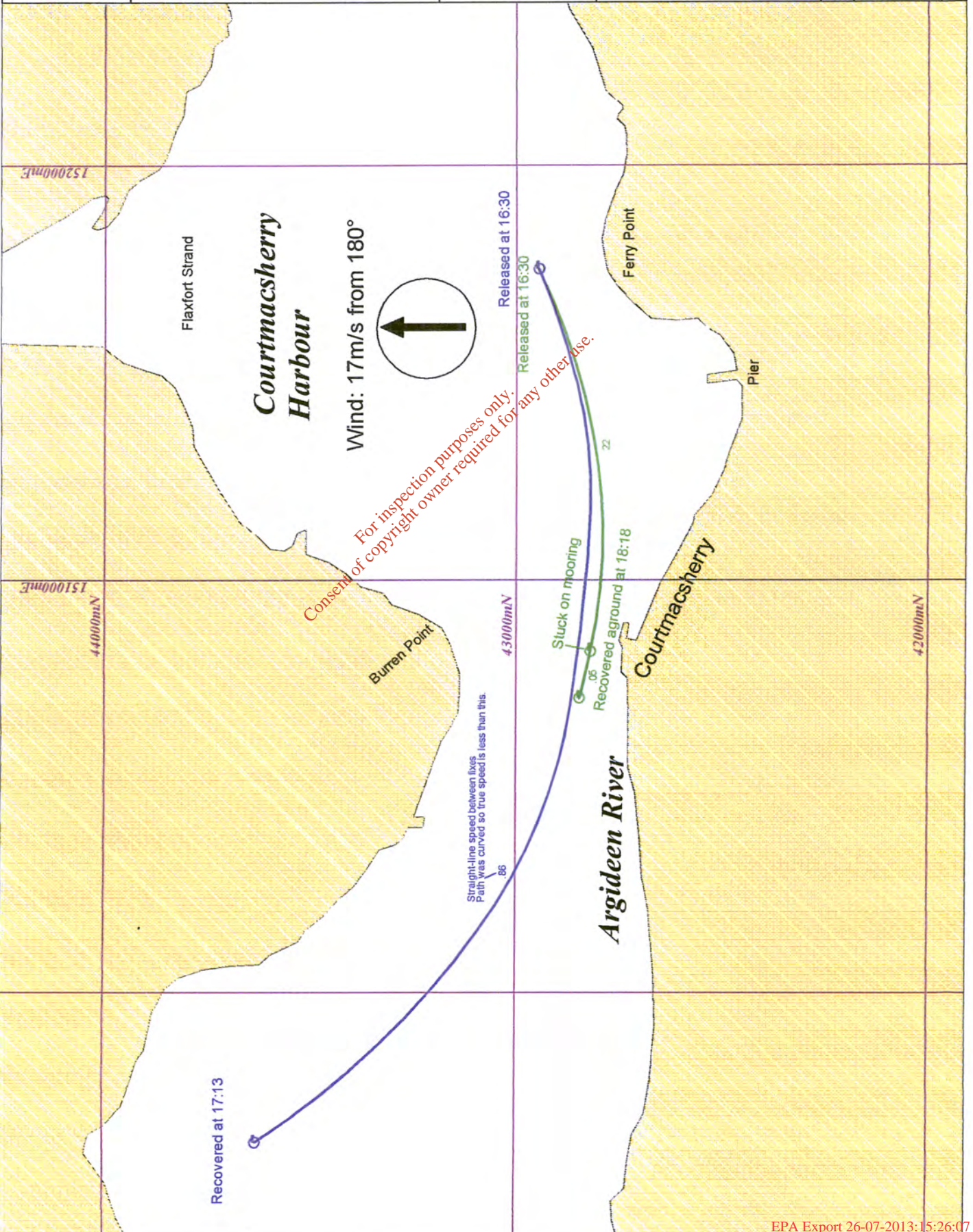
- POSITION FIXED
- SPEED (m/sec)
- TRACK

Surface
2m depth
3m depth

Scale 1 : 12,500

**IRISH
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Rathmacullig West
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info@hydrodata.ie

FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 17th 2004
Spring Tide
Released at HW-3**

Courtmacsherry Tide
on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

Courtmacsherry Levels

MHWS 3.7
MHWN 2.9
MLWN 1.1
MLWS 0.3

KEY

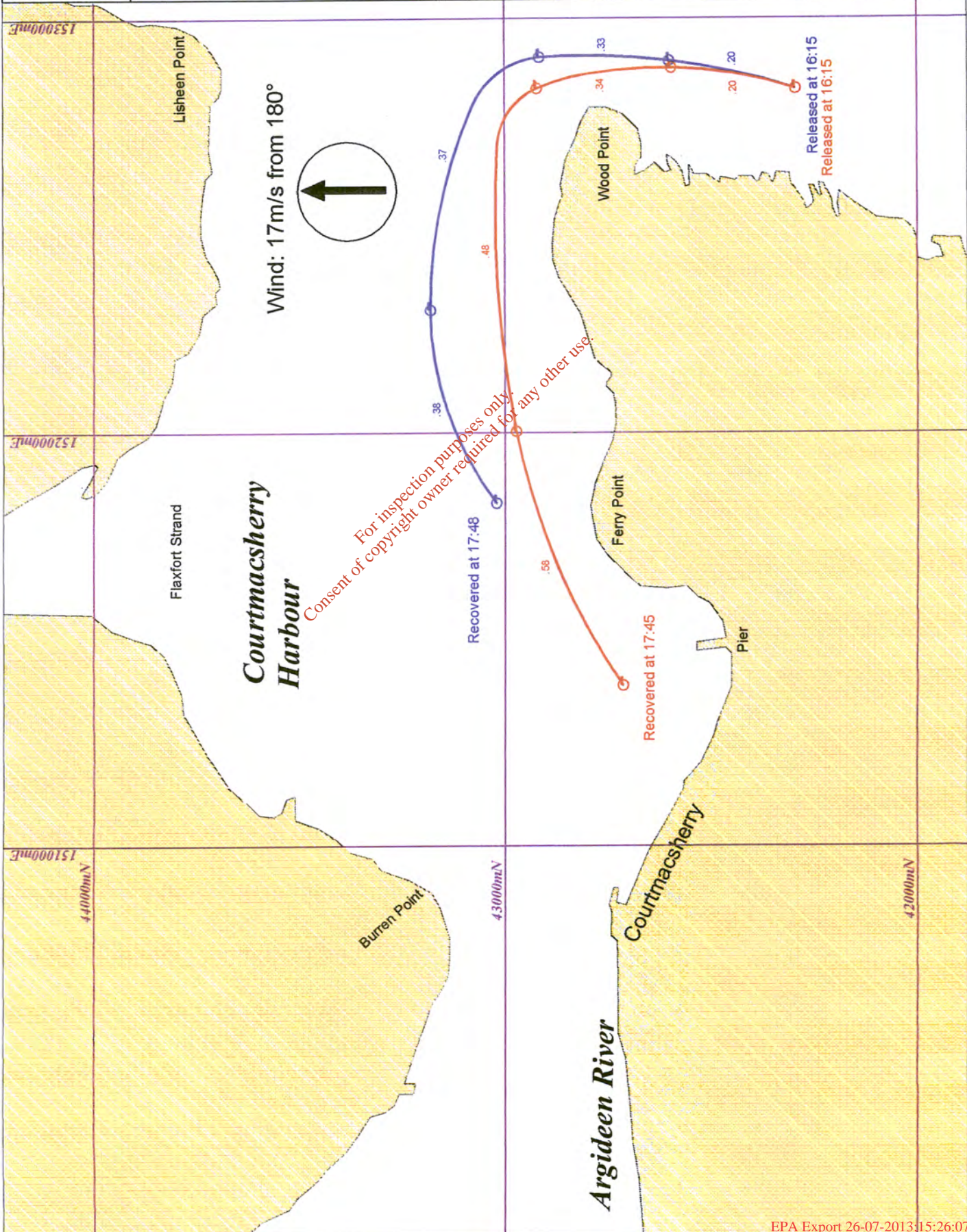
- POSITION FIXED
- SPEED (m/sec)
- TRACK

Surface
2m depth
3m depth

Scale 1 : 12,500

**IRISH
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FIGURE



Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes
MARINE SURVEY

Droguie Tracking on August 17th 2004 Spring Tide
Released at LW+1.5

Courtmacsherry Tide on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

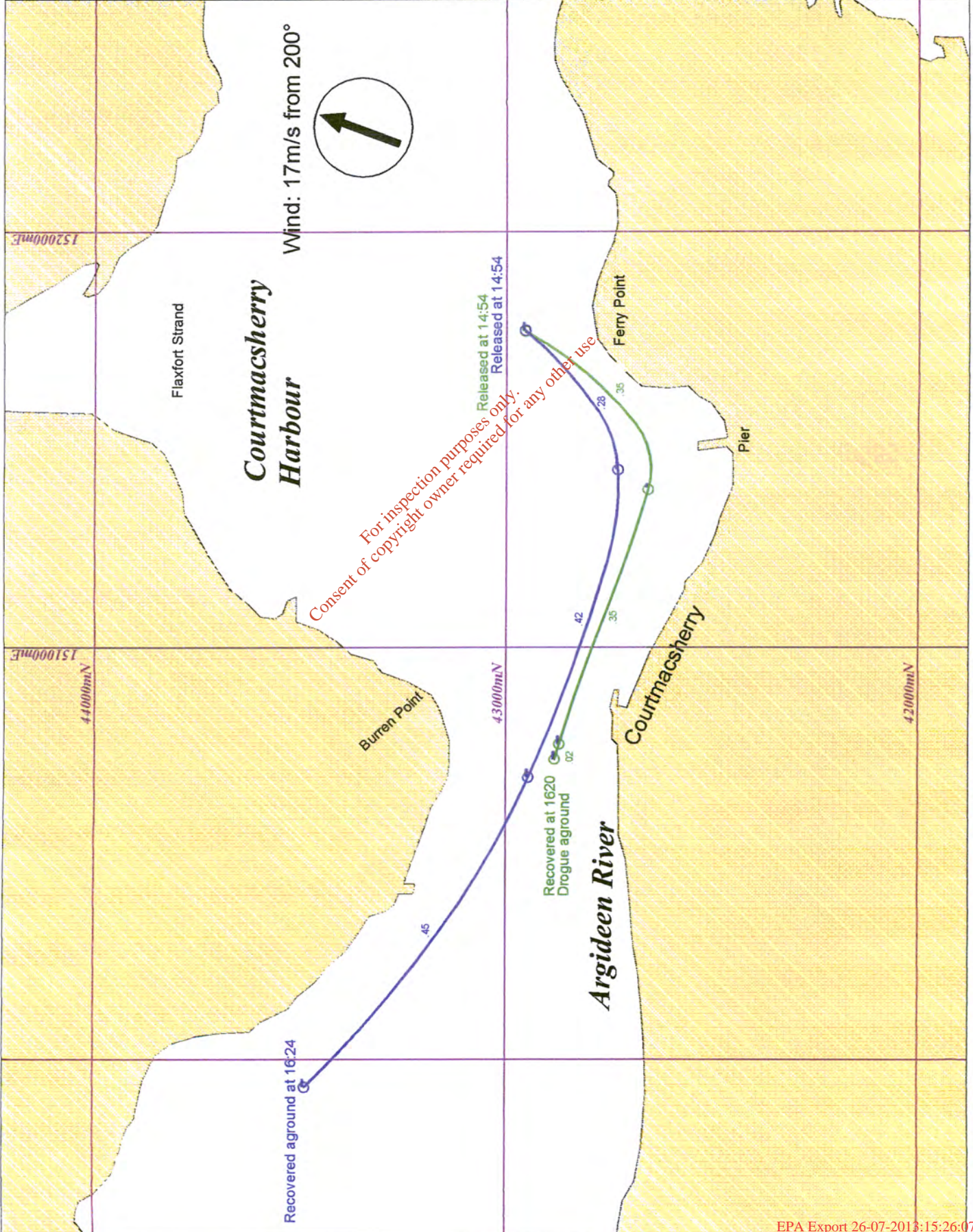
- POSITION FIXED
- SPEED (m/sec)
- TRACK

Surface
 2m depth
 3m depth

Scale 1 : 12,500

IRISH HYDRODATA Ltd
 Rathmacullig West
 Ballygarvan Co. Cork
 info@hydrodata.ie

FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes**

MARINE SURVEY

**Drogue Tracking
on August 17th 2004
Spring Tide**

Released at LW+1.5

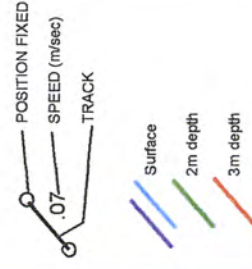
Courtmacsherry Tide
on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

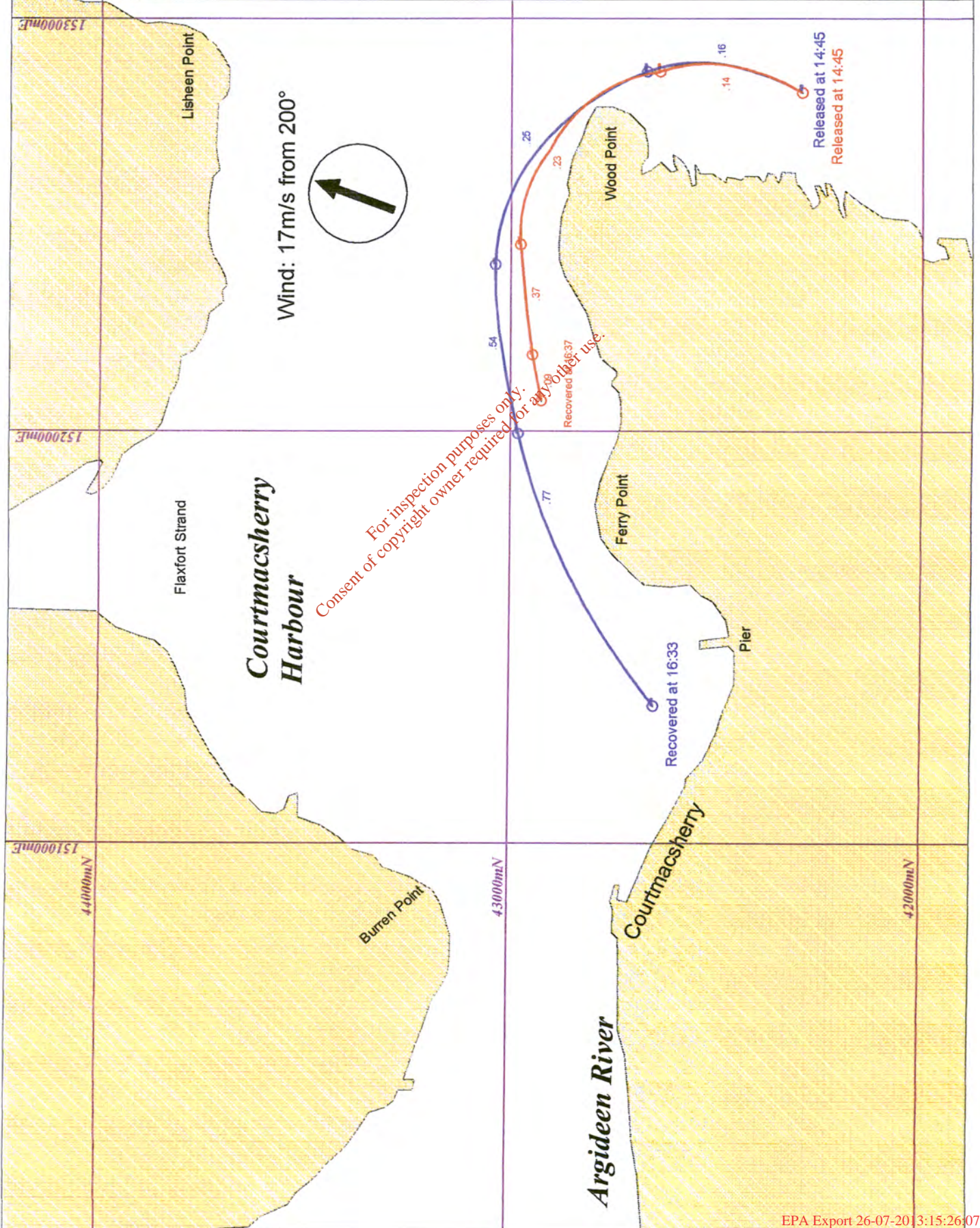
KEY



Scale 1 : 12,500

**IRISH
HYDRODATA Ltd**
Rathmacullig West
Ballygarvan Co. Cork
info@hydrodata.ie

FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 17th 2004
Spring Tide**

Released at LW

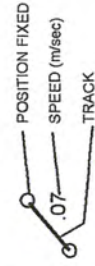
**Courtmacsherry Tide
on August 17th 2004**

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

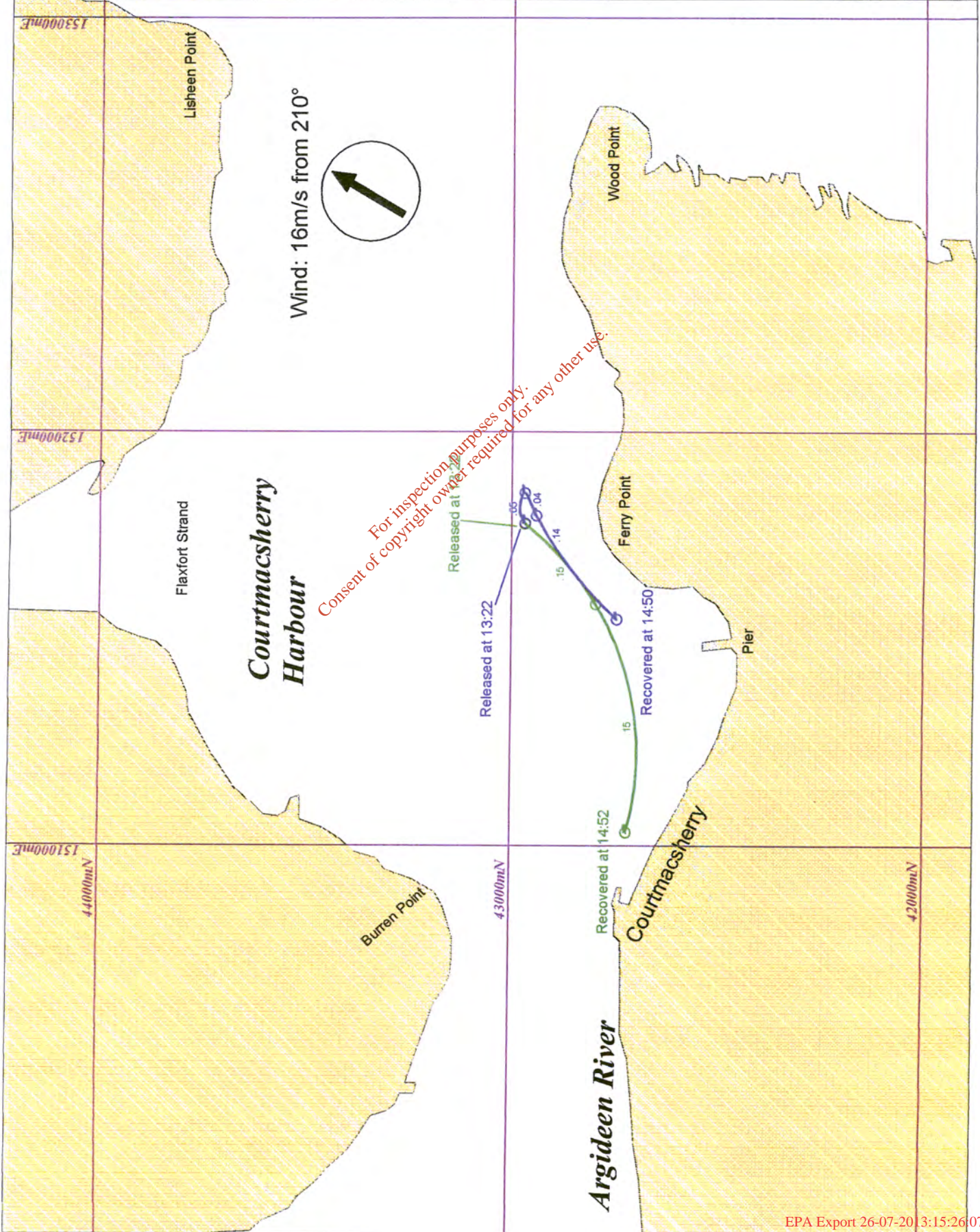
KEY



Scale 1 : 12,500



FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 17th 2004
Spring Tide**

Released at LW

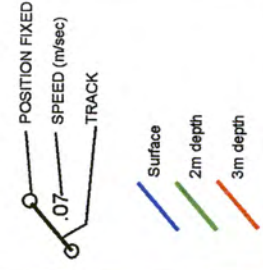
Courtmacsherry Tide
on August 17th 2004

BST	CD (m)
00:59	0.5
06:47	3.5
13:13	0.5
19:04	3.6

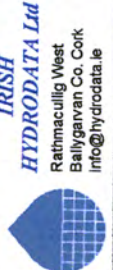
Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

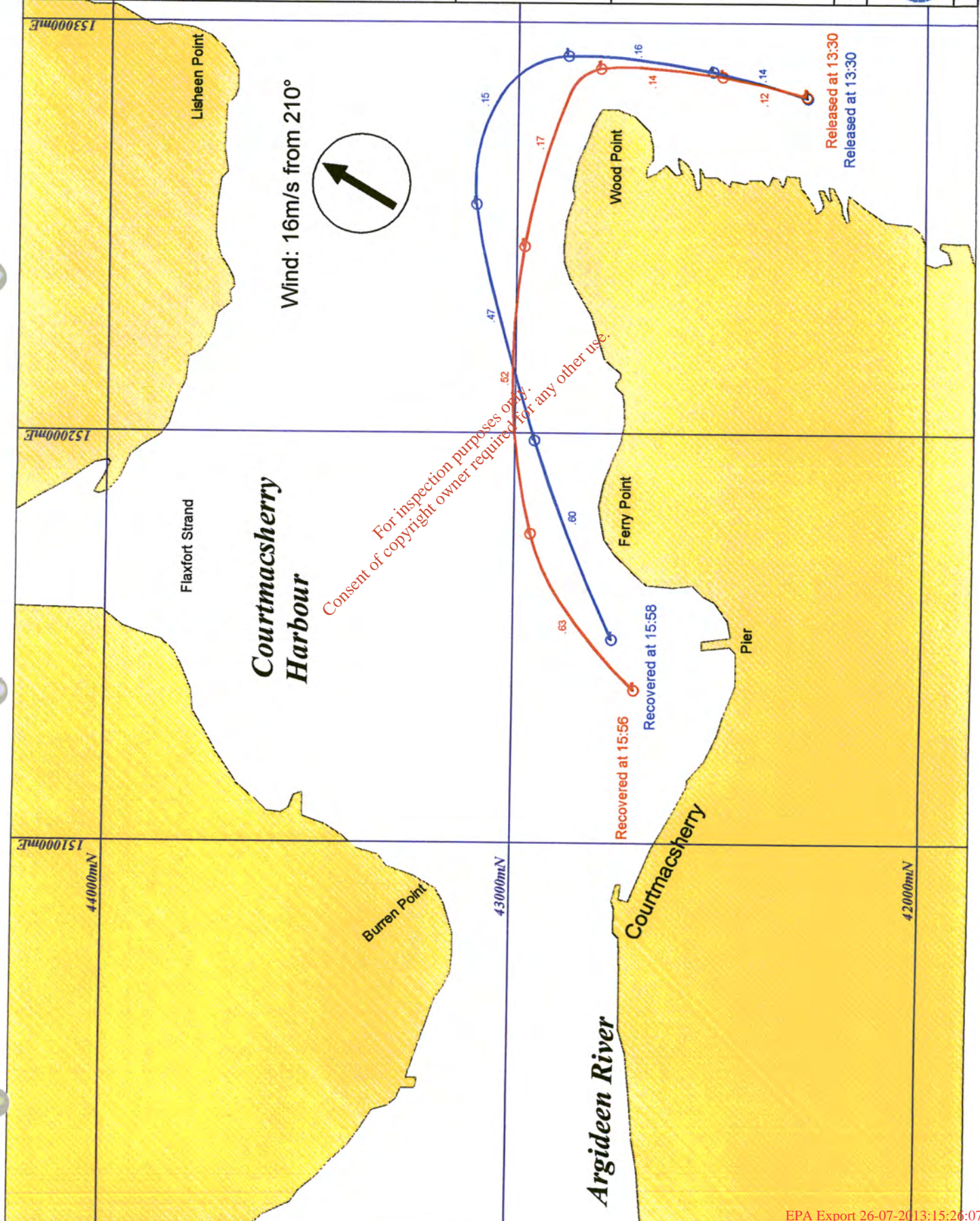
KEY



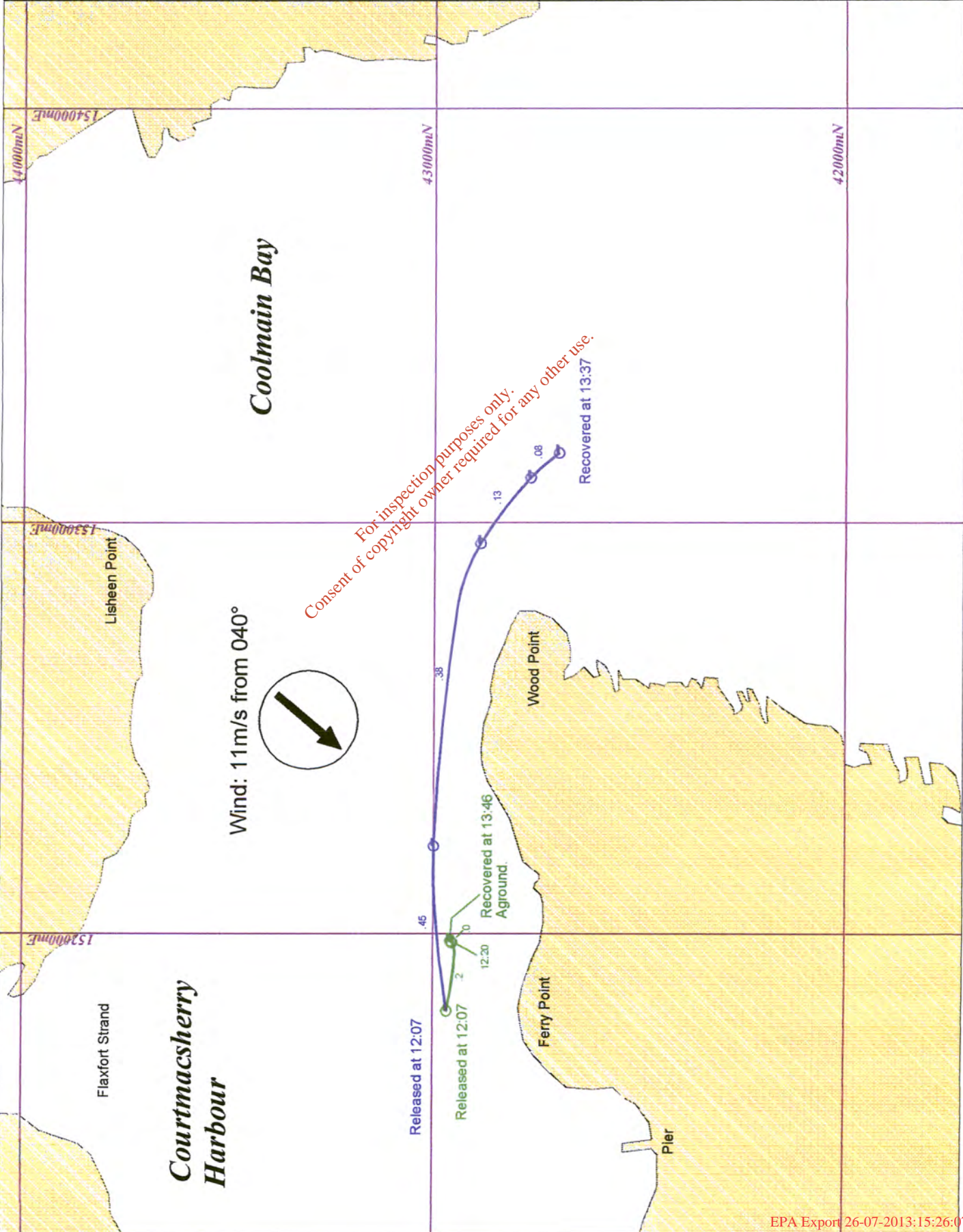
Scale 1 : 12,500



FIGURE



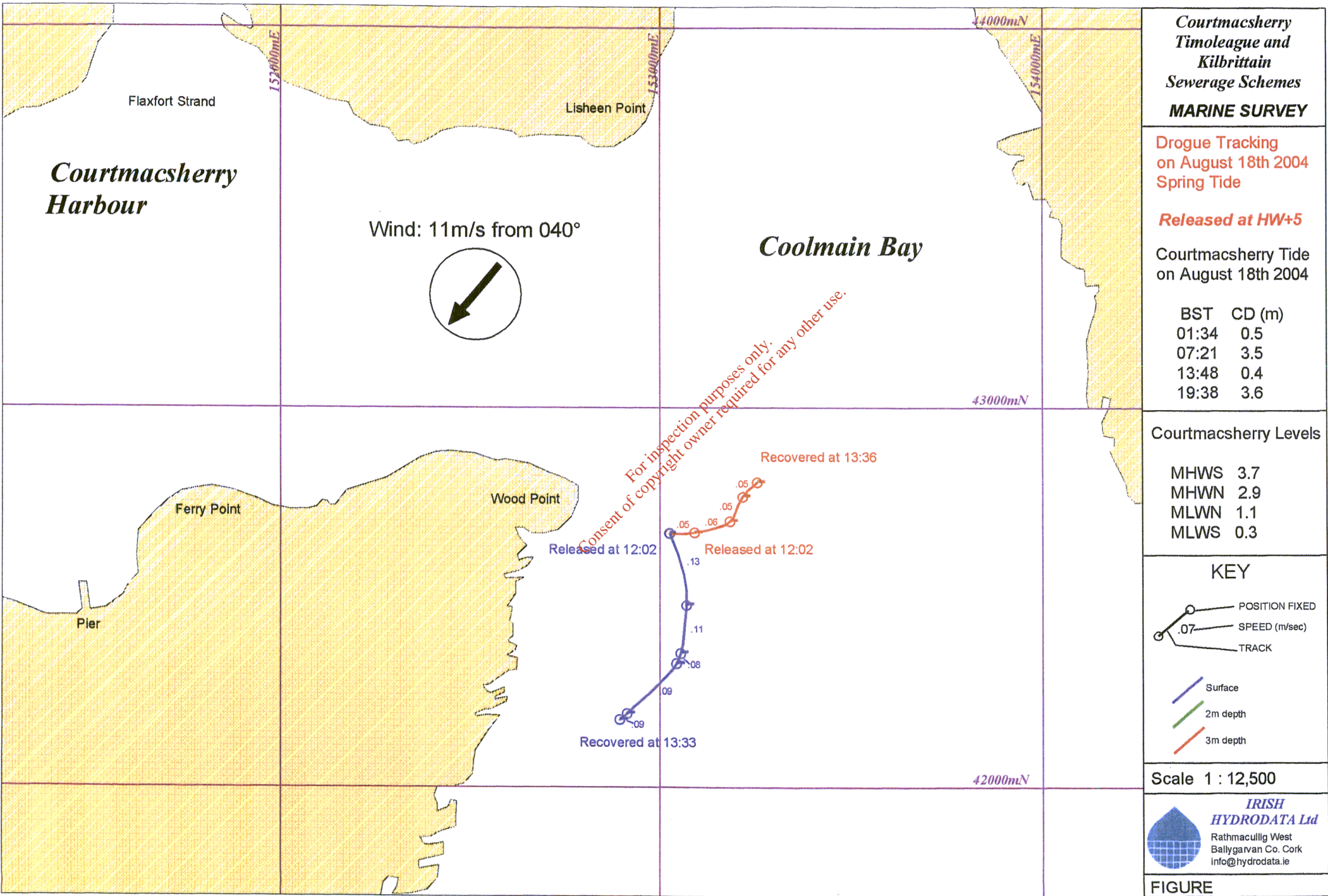
<p>Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes MARINE SURVEY</p>	<p>Drogue Tracking on August 18th 2004 Spring Tide</p> <p>Released at HW+5</p> <p>Courtmacsherry Tide on August 18th 2004</p>	<p>BST CD (m)</p> <table border="1"> <tr><td>01:34</td><td>0.5</td></tr> <tr><td>07:21</td><td>3.5</td></tr> <tr><td>13:48</td><td>0.4</td></tr> <tr><td>19:38</td><td>3.6</td></tr> </table>	01:34	0.5	07:21	3.5	13:48	0.4	19:38	3.6	<p>Courtmacsherry Levels</p> <table border="1"> <tr><td>MHWS</td><td>3.7</td></tr> <tr><td>MHWN</td><td>2.9</td></tr> <tr><td>MLWN</td><td>1.1</td></tr> <tr><td>MLWS</td><td>0.3</td></tr> </table>	MHWS	3.7	MHWN	2.9	MLWN	1.1	MLWS	0.3	<p>KEY</p> <ul style="list-style-type: none"> POSITION FIXED SPEED (m/sec) TRACK <p>Surface 2m depth 3m depth</p> <p>Scale 1 : 12,500</p> <p>IRISH HYDRODATA Ltd Rathmacullig West Ballygarvan Co. Cork info@hydrodata.ie</p> <p>FIGURE</p>
01:34	0.5																			
07:21	3.5																			
13:48	0.4																			
19:38	3.6																			
MHWS	3.7																			
MHWN	2.9																			
MLWN	1.1																			
MLWS	0.3																			



ATTACHMENT No F.1-4

DISCHARGE MODELLING & IMPACT ON ENVIRONMENT

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**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 18th 2004
Spring Tide**

Released at HW+5

Courtmacsherry Tide
on August 18th 2004

BST	CD (m)
01:34	0.5
07:21	3.5
13:48	0.4
19:38	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

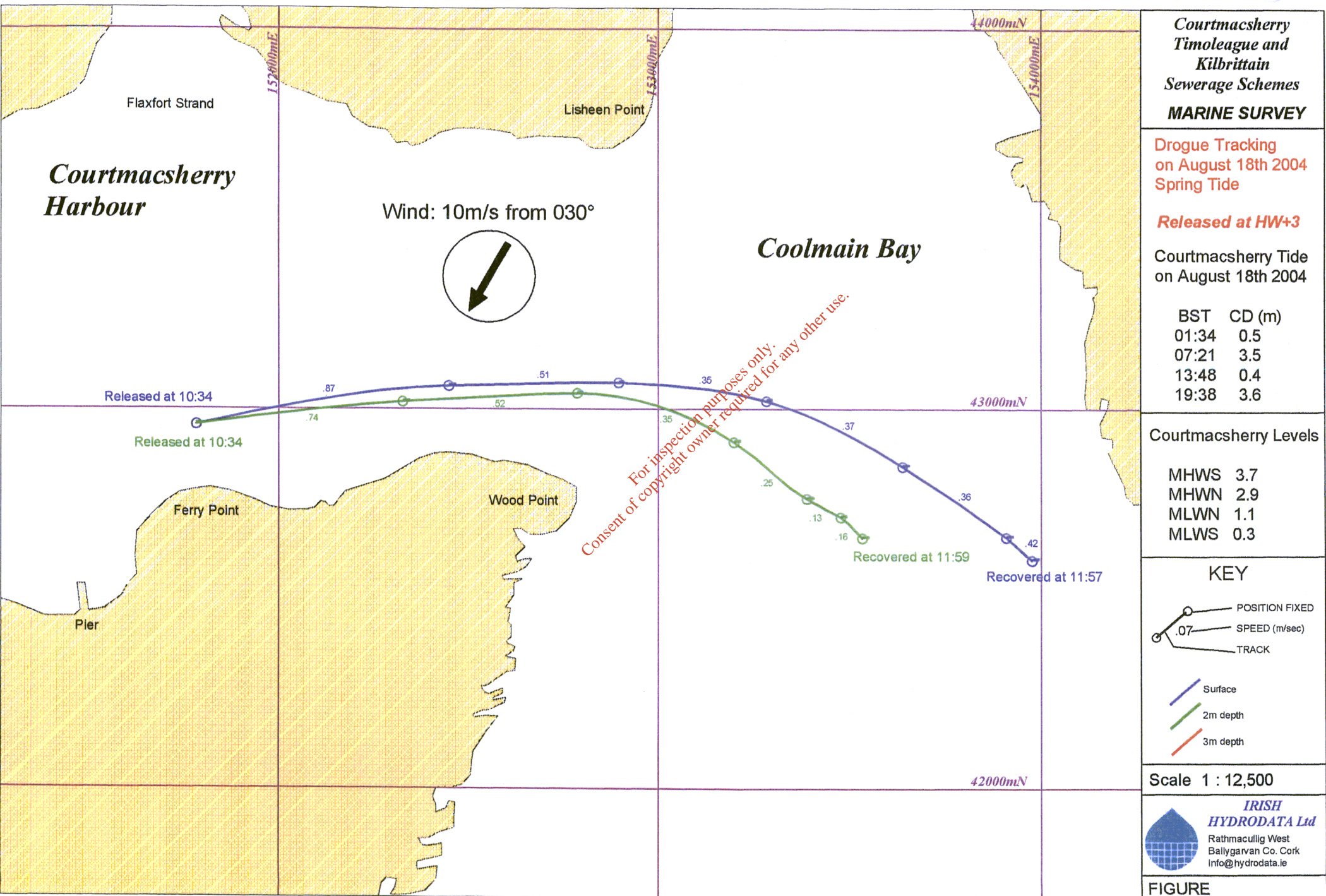
KEY

- POSITION FIXED
- SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

**IRISH
HYDRODATA Ltd**
Rathmacullig West
Ballygarvan Co. Cork
info@hydrodata.ie

FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

Drogue Tracking
on August 18th 2004
Spring Tide

Released at HW+3

Courtmacsherry Tide
on August 18th 2004

BST	CD (m)
01:34	0.5
07:21	3.5
13:48	0.4
19:38	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

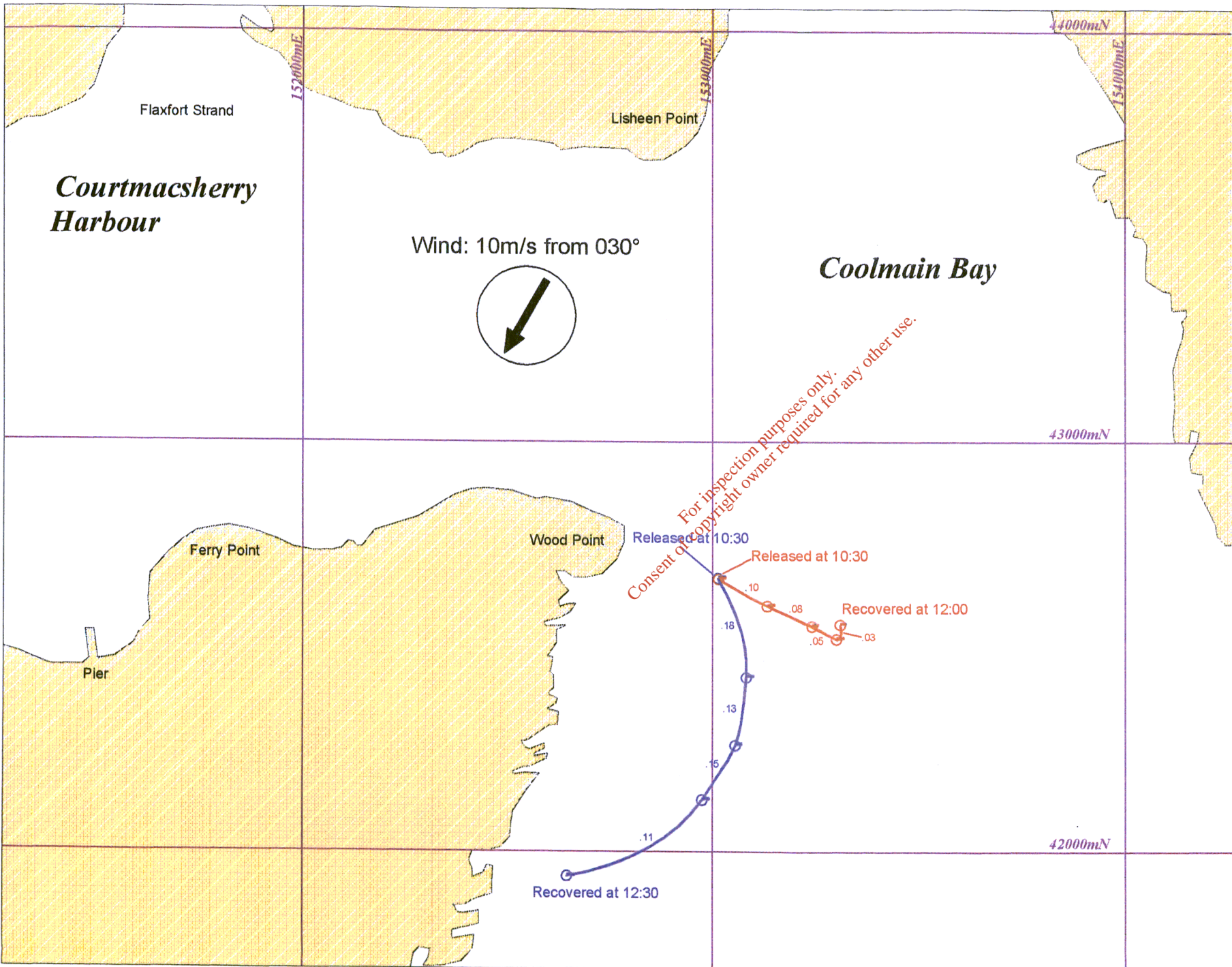
KEY

- POSITION FIXED
- .07 SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

**IRISH
HYDRODATA Ltd**
Rathmacullig West
Ballygavan Co. Cork
info@hydrodata.ie

FIGURE



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

Droge Tracking
on August 18th 2004
Spring Tide

Released at HW+3

Courtmacsherry Tide
on August 18th 2004

BST	CD (m)
01:34	0.5
07:21	3.5
13:48	0.4
19:38	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

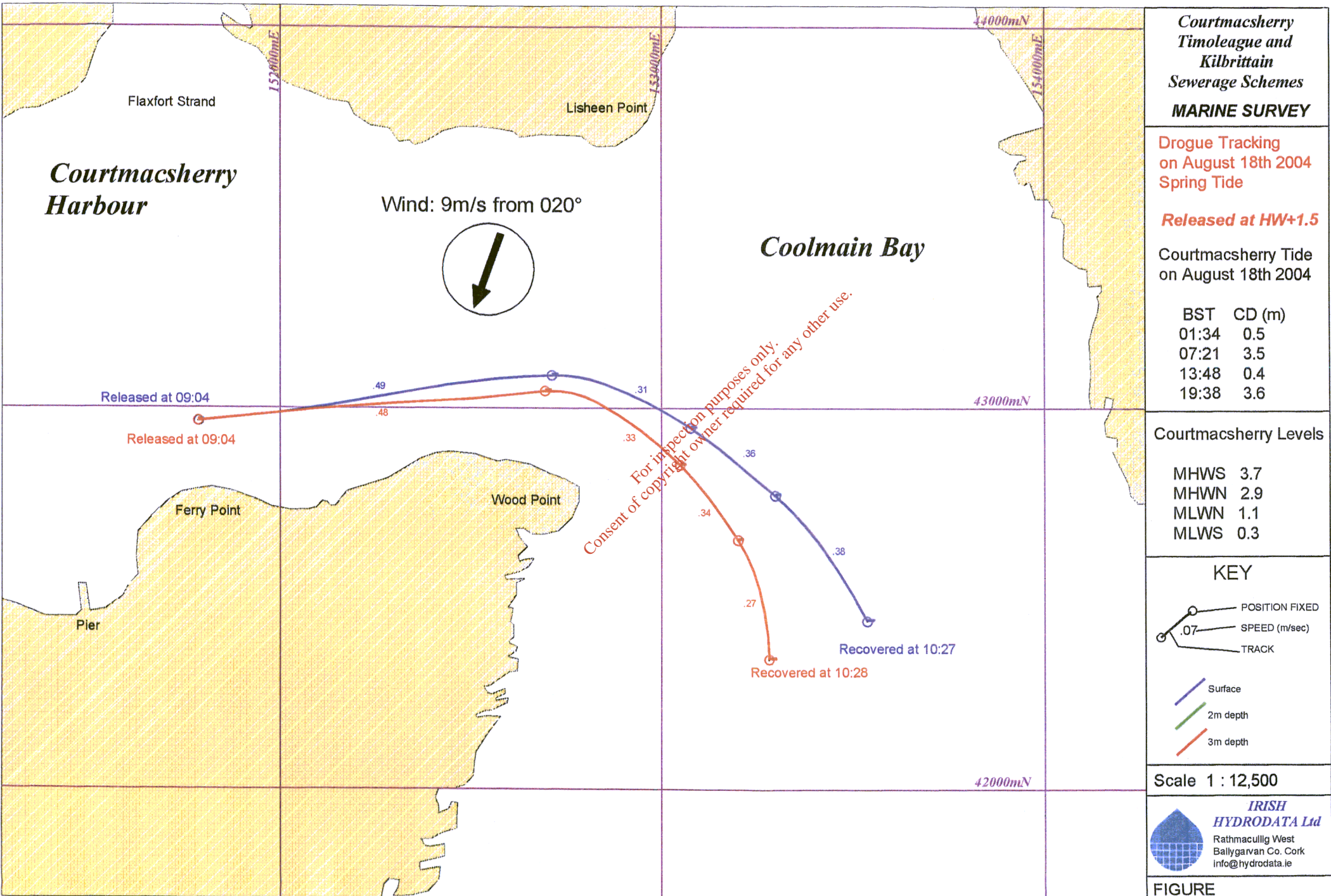
- POSITION FIXED
- .07 SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

**IRISH
HYDRODATA Ltd**
Rathmacullig West
Ballygarvan Co. Cork
info@hydrodata.ie

FIGURE

For inspection purposes only.
Consent of copyright owner required for any other use.



**Courtmacsherry
Timoleague and
Kilbrittain
Sewerage Schemes
MARINE SURVEY**

**Drogue Tracking
on August 18th 2004
Spring Tide**

Released at HW+1.5

Courtmacsherry Tide
on August 18th 2004

BST	CD (m)
01:34	0.5
07:21	3.5
13:48	0.4
19:38	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

- POSITION FIXED
- .07 SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

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FIGURE

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Courtmacsherry Harbour

Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes MARINE SURVEY

Drogue Tracking on August 18th 2004 Spring Tide

Released at HW+1.5

Courtmacsherry Tide on August 18th 2004

BST	CD (m)
01:34	0.5
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KEY

- POSITION FIXED
- SPEED (m/sec)
- TRACK
- Surface
- 2m depth
- 3m depth

Scale 1 : 12,500

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 Rathmacullig West
 Ballygarvan Co. Cork
 info@hydrodata.ie

FIGURE

Wind: 9m/s from 020°

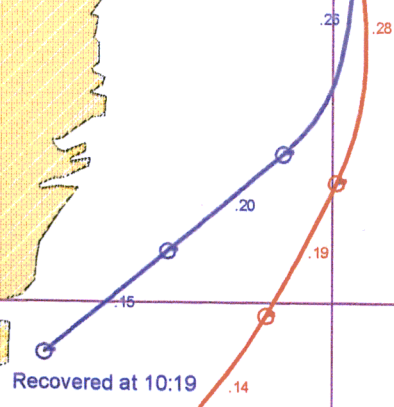


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Released at 09:00
 Released at 09:00

Recovered at 10:19

Recovered at 10:23



Flaxfort Strand

Lisheen Point

Coolmain Bay

Ferry Point

Wood Point

Pier

44000mN

153800mE

153900mE

154000mE

43000mN

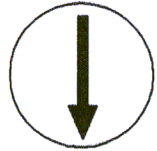
42000mN

Courtmacsherry Harbour

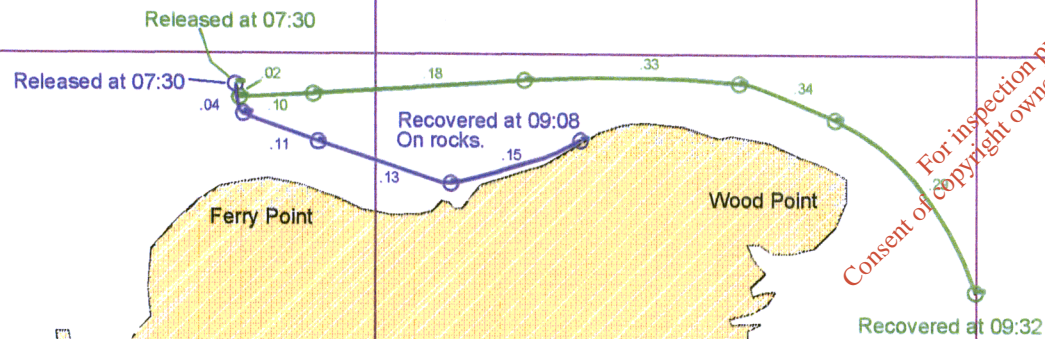
Flaxfort Strand

Lisheen Point

Wind: 10m/s from 360°



Coolmain Bay



Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes MARINE SURVEY

Drogue Tracking
on August 18th 2004
Spring Tide

Released at HW

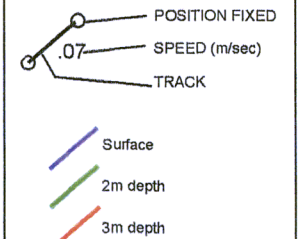
Courtmacsherry Tide
on August 18th 2004

BST	CD (m)
01:34	0.5
07:21	3.5
13:48	0.4
19:38	3.6

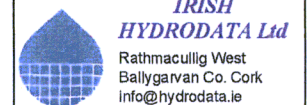
Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY



Scale 1 : 12,500



FIGURE

Courtmacsherry Harbour

Courtmacsherry Timoleague and Kilbrittain Sewerage Schemes MARINE SURVEY

Drogue Tracking on August 18th 2004 Spring Tide

Released at HW







Courtmacsherry Tide on August 18th 2004

BST	CD (m)
01:34	0.5
07:21	3.5
13:48	0.4
19:38	3.6

Courtmacsherry Levels

MHWS	3.7
MHWN	2.9
MLWN	1.1
MLWS	0.3

KEY

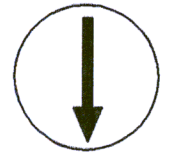
-  POSITION FIXED
-  .07 SPEED (m/sec)
-  TRACK
-  Surface
-  2m depth
-  3m depth

Scale 1 : 12,500

IRISH HYDRODATA Ltd
 Rathmacullig West
 Ballygarvan Co. Cork
 info@hydrodata.ie

FIGURE

Wind: 10m/s from 360°



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Released at 07:34

Released at 07:34

Recovered at 08:53

Recovered at 08:56

152600mE

153000mE

44000mN

43400mN

43000mN

42000mN

Flaxfort Strand

Lisheen Point

Ferry Point

Wood Point

Pier

ANNEX 7

DYE PATCH TRACKING

(Plots not yet prepared)

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Scale must be adjusted by 0.10 meters:
SOUTHWARD and 0.04 meters
EASTWARD before using on this chart.

Example:
Sailed: Dec 20 1958
WGS 84 Datum: 5120 208, 0 23 200,
10 00 000 000 0 00 0 00 0
Adjusted Position: 5120 472, 10 00 000
(convertible with other datum)

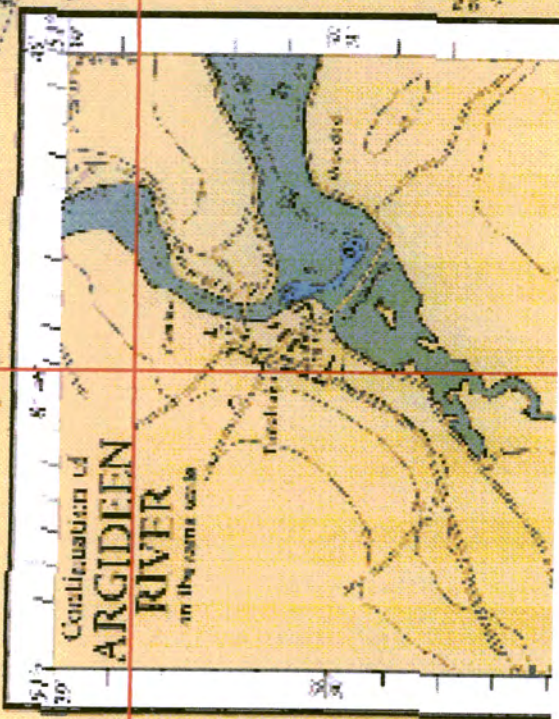
Consent of copyright owner required for any other use.

4000Y

RELEASE POINT

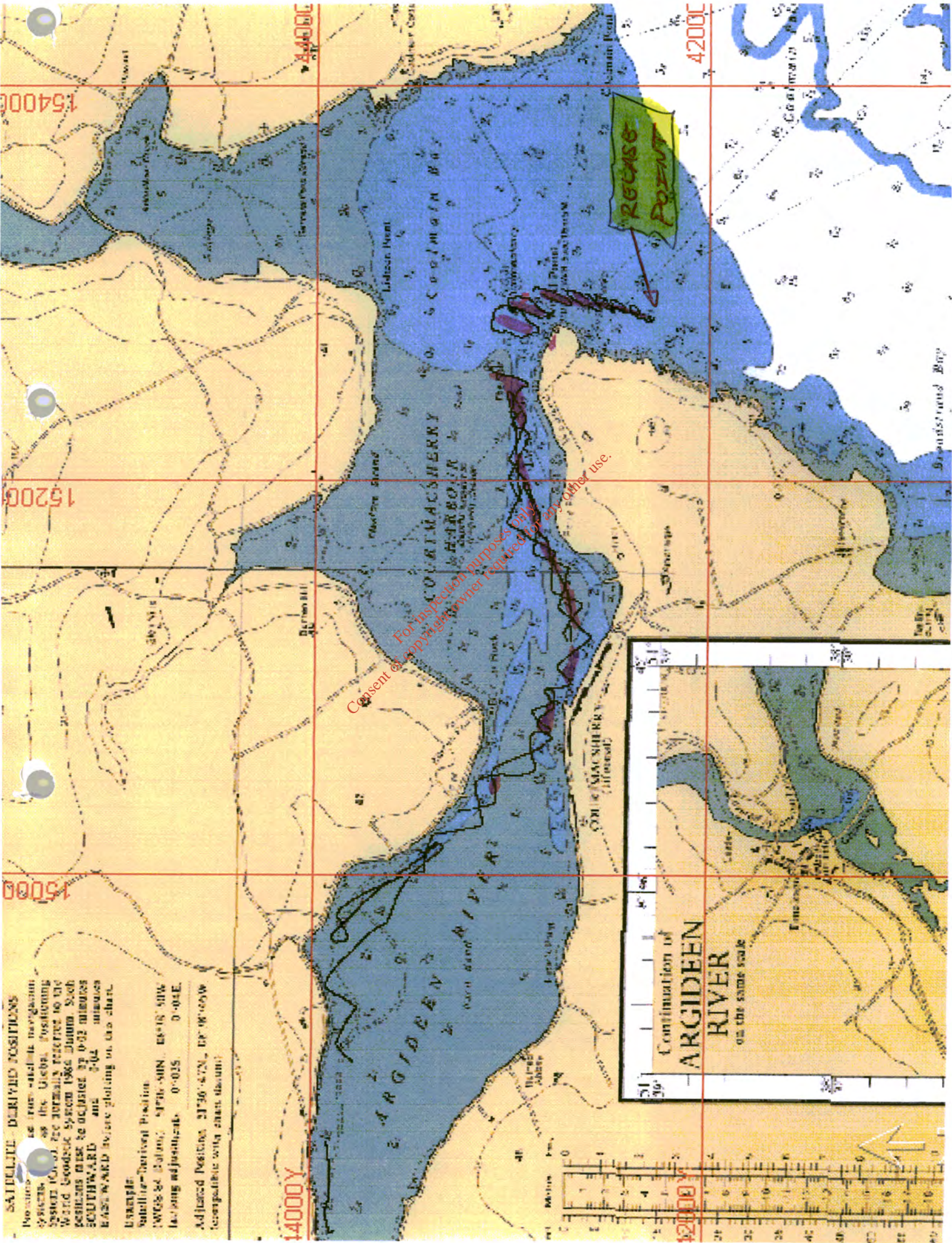
EBB
DYG
11/9/04

2000Y

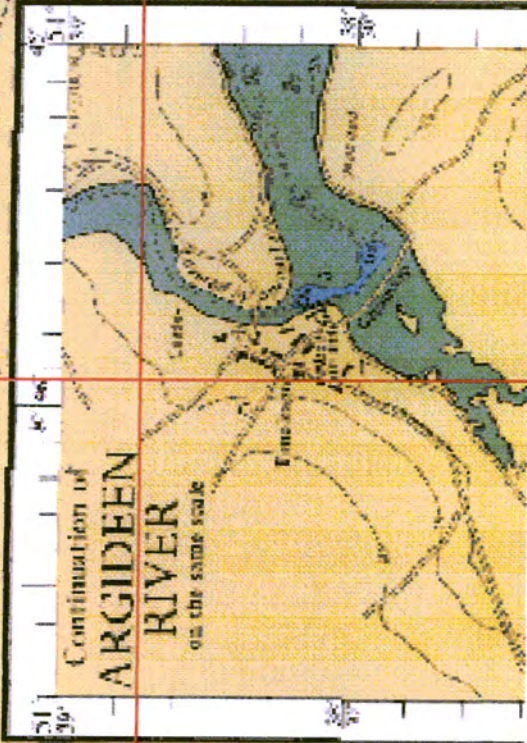


SATELLITE-DERIVED POSITIONS
 Positions are from satellite navigation systems, as the Global Positioning System (GPS), are normally referred to the World Geodetic System 1984 datum. Such positions may be adjusted by 0-02 minutes SOUTHWARD and 0-02 minutes EASTWARD before plotting on this chart.

Example:
 Satellite-Derived Position
 (WGS 84 Datum): 47°05.50N, 08°08.50W
 (Adjustment): 0'-02S, 0'-04E
 Adjusted Position: 47°03.50N, 08°06.50W
 (Compatible with chart datum)



FOOD
 DYE
 2/9/04



Courtmacsherry / Timoleague Sewerage Scheme

Hydrographic and Water Quality Model Study

Progress Report

20th April 2005

Revised.
20/4/05

1. Model Development

A very refined finite difference mesh of 15m by 15m was used to model Courtmacsherry Harbour and Approaches. The study domain extends from Barry's Point north to upstream of Timoleague. The finite difference domain size is 659 × 373 grids, which represents a total of 245,800 grid cells. This grid spacing is sufficient to allow accurate resolution of the flow patterns, shoreline, inter-tidal geometry, low tide river channel, outfall nearfield and pollutant plume dispersion. Each cell was defined as either land or sea (wet and drying cells). Irish Hydro Data Ltd. was commissioned to carry out a bathymetric survey of Courtmacsherry Harbour paying particular attention to defining the low water channel and adjoining tidal flats. This survey data was combined with the bathymetry data from the 1 : 25000 scale Admiralty Chart (ref no. 2081) and interpolated using Kriging interpolation method to produce a 15m resolution grid.

2. Model Calibration

The model boundary conditions, bathymetry, low flow channel geometry and roughness coefficients were fine tuned to produce good agreement between computed hydrodynamics and measured hydrodynamics, drogue tracks and current metering at survey sites. Further fine tuning of model bathymetry is required to produce more realistic wet and drying of the inner mud flat areas. This work is undergoing at present. A sponge layer at the open sea boundaries had to be provided to dissipate numerical noise that would otherwise be reflected at the boundary eventually making the solution unstable.

3. Preliminary Outfall Site Selection

The following four potential outfall sites were investigated as part of the Outfall site selection process:

	Easting	Northing	Reference
Outfall A	149100	43840	Midway in Estuary between Timoleague & Courtmacsherry
Outfall B	151910	43010	Courtmacsherry
Outfall C	152910	42350	Approaches west of Wood Point
Outfall D	147320	43540	Timoleague

Simulations were carried out modelling 3DWF (32 l/s) faecal coliform loads at secondary treated concentration of 2.2×10^5 Counts/100ml. A conservative T_{90} of 24hours was specified. Simulations were carried out over repeating spring and neap tidal cycles.

The provisional results indicate that Outfall Site B adjacent to Courtmacsherry is the preferred option. The analysis also shows that taking the outfall west of Wood Point into the approaches to the harbour (Site C) is of no additional benefit over Site B. The model simulations clearly show that discharging near Timoleague (site D) will result in a considerable build-up of pollutant which will have ramifications for nitrate loads to the estuary and consequently this site would not be recommended even if tidal balancing was provided.