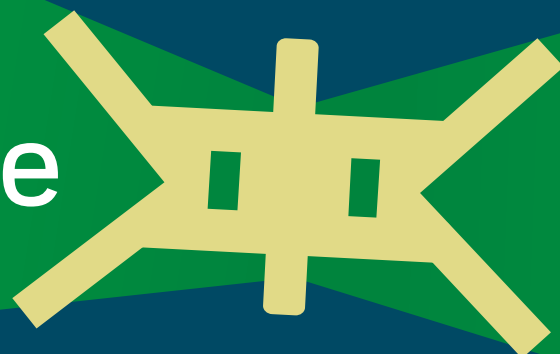


Special Unified Marking Scheme

SOP





Contents

Glossary	2
Roles and responsibilities	3
Bord Iascaigh Mhara	3
Irish Lights	3
Marine Survey Office	3
Phase 1 – Decision on area suitability	4
Phase 2 – Design and Installation	5
Phase 3 – SUMS Reporting	6
Role of the aquaculture licence holder	6
BIM's Role	6
Irish Lights' Role	6
Appendix 1 – Marking Guidelines	7
Appendix 2 – Calculating height of Poles	8
Formula	8
Worked Example	8
<i>Aim</i>	8
<i>Tide calculation</i>	8
<i>Bathymetry</i>	9
<i>Length of Pole</i>	9
Appendix 3 – Anchoring and Construction Methods	10
Navigation Buoys $\geq 70\text{kg}$	10
Navigational Buoy Type 2 Standard A4 red or yellow buoy	13
Navigational Beacon (Pole Type 1) – Firm Substrate, <6.3m height requirement	15
Navigational Beacon (Pole Type 2) – Firm Substrate, >6.3m height requirement	18
Navigational Beacon (Pole Type 3) – Soft Substrate	20
Appendix 4 – Contacts	22

Glossary

AtoN	Aids to Navigation
BIM	Bord Iascaigh Mhara
CLAMS	Coordinated Local Aquaculture Management Systems
DAFM	Department of Agriculture Food and Marine
GNSS	Global Navigation Satellite System
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IG	Irish Grid
IL	Commissioners of Irish Lights
LLA	Local Lighthouse Authority
MED	Marine Engineering Division of DAFM
MHWS	Mean High Water Springs
MSO	Marine Survey Office (Department of Transport, Tourism and Sport)
SUMS	Special Unified Marking Scheme
STS	Seafood Technical Services Division of BIM

Roles and responsibilities

Bord Iascaigh Mhara

BIM helps develop the Irish Seafood Industry by providing technical expertise, business support, funding, training and promoting responsible environmental practice.

The Co-ordinated Local Aquaculture Management Systems (CLAMS) is an environmental initiative that helps aquaculture businesses to work in harmony with their environment and local community. As part of this process BIM's regionally based Development Officers co-ordinate and manage a range of projects including the installation and maintenance of Special Unified Marking Schemes (SUMS).

SUMS provide improved navigation and safety for all users of the marine environment in areas where aquaculture coexist with other users. The SUMS marking schemes uses fewer, higher quality marks with a long lifespan, achieving efficiencies for the producers. BIM and IL ensure that marks are included in the UK Hydrographic Office's Admiralty Charts which informs visiting vessels of the perimeter of the production areas.

Irish Lights

Irish Lights constitutes the General Lighthouse Authority (GLA) for the whole of the Ireland and its adjacent seas and Islands.

Irish Lights is responsible for the provision and maintenance of Lighthouses, Buoys, Beacons and Radio Aids to marine navigation to assist the safe and expeditious passage of all classes of mariners in general navigation and has a duty of superintendence and management for all local aids to Navigation.

In the Republic of Ireland the Merchant Shipping Act 1894 provide that no lighthouse, buoy or beacon can be installed, removed, have the character changed or the mode of exhibition varied without the consent of the Commissioners of Irish Lights. Irish Lights are therefore responsible for the approval of statutory Sanction of the Aids to Navigation (AtoN) on Aquaculture sites.

Marine Survey Office

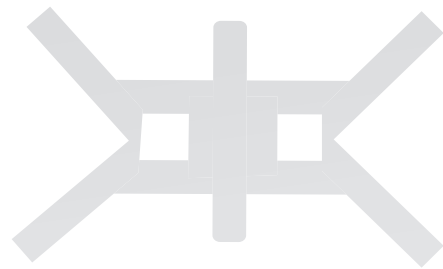
The Marine Survey Office administers and regulates maritime safety, security, pollution prevention and living and working conditions in relation to Irish ships, foreign ships in Ireland and for Irish seafarers. It also carries out surveys and inspections of vessels to ensure that they meet accepted safety standards in order to prevent, as far as possible, loss of life at sea and pollution of the marine environment, maritime security and living and working conditions and regulates the security of Irish ports. It co-operates with other countries in the EU, Paris MOU, IMO, IHO, ITU and other international bodies. Discharges obligations as a member of the International Hydrographic Organisation and maintains an external panel of surveyors of small fishing vessels and a general register of shipping and seafarers.

Of relevance to the Aquaculture Sector it supports the safety of navigation by the provision of advice on foreshore licences, aquaculture licences, Buoyage, Offshore Activities and providing advice to the oil industry.

Phase 1

Decision on area suitability

1. Possible SUMS area identified. As guidance, areas with greater than one site in close proximity may be regarded as potentially suitable. However, priority will be given to areas encompassing larger numbers of sites and/or greater usage by commercial or recreational users.
2. Informal discussions between Regional Resource Development Officers, Producers (Under CLAMS if in place in the area) and Section Manager.
3. Suitability of area for SUMS agreed.
4. SUMS submitted to the Seafood Technical Services work programme.



Phase 2

Design and Installation

1. Regional officers draft plan which should take account of the following factors:
 - Existing and proposed structures in the Area
 - Other uses of the Bay especially areas of anchorage and navigational channels
 - Licences and Licence applications
 - Intertidal/Subtidal
 - Number of Marks
 - Type of Marks¹
 - Placement of Marks
 - Anchoring method
 - Map and IG
 - Industry input.
2. Draft plan circulated internally in BIM for comment.
3. Draft plan agreed between BIM Regional Office and the local producers.
4. Draft 1 submitted to IL and MSO as part of statutory consultation. Consideration should also be given to consultation with the relevant Local Lighthouse Authority (LLA).
5. Following this consultation, an application is compiled.
6. This application is submitted to IL for Statutory sanction (BIM as applicant). IL will generate the AtoN Names in line with their naming convention.
7. If lights are required, the contracted light supplier calculates light requirements and configures all lights in compliance with statutory sanction (This is a free service covered under the contract).
8. SUMS installed under BIM coordination and supervision as per statutory sanction.
9. IL to confirm scheme is as required during the next scheduled inspection of the LLA area.
10. Any amendments to plan approved by IL and extra equipment installed, if required.
11. As per AtoN name in issued Statutory Sanction, ownership of marks are assigned to the relevant aquaculture licence holder.
12. BIM notify LLA of title change. BIM confirm to IL that notification has been sent.
13. IL notify BIM that assignment of marks has been completed
14. Installation of public awareness signs if requested locally.
15. Maps circulated to all producers and other local marine users.²
16. IL to add marks to the UK Hydrographic office if required.

¹ See Appendix 2 for the procedure for calculating the height of poles

² If a licence holder objects to their name being attached to a specific mark, they may withdraw from inclusion in the SUMS. However in accordance with the Merchant Shipping Act 1894, they would be required to mark their site and apply for statutory sanction.

Phase 3

SUMS Reporting

Role of the aquaculture licence holder

The reporting on Aquaculture Aids to Navigation should be submitted to BIM as part of the general maintenance on a site.

Producers must report to BIM on a quarterly basis on their assigned mark(s) by email or text. The following features of the installed AtoN must be inspected to comply with the reporting requirements:

- Topmark colour and condition.
- Position of the AtoN in relation to the hazard to be marked. This may be a visible check but must be verified annually with BIM in their maintenance check using GNSS. (In the case that additional aquaculture equipment is placed outside but adjacent to the defined SUMS area, BIM must be immediately informed).
- Structure Condition.
- Height of the AtoN. (Above MHWS for fixed structures such as a beacon, Focal Plane height for floating AtoN such as Buoys, Rafts or Finfish structures.
- For AtoN with lights:
 - Light working to character during darkness.
 - Condition of light. (Check lens for moisture/internal obstruction. Solar Panel clear from fouling.)
 - Light free from obstruction.
- For Floating AtoN:
 - Condition of the mooring system – 2-year check.
 - Position in relation to sanctioned position (Preferably using GNSS).
 - Position in relation to related hazards (Where hazards are introduced outside the marked area, inform BIM immediately for scheme reassessment).

Irish Lights acknowledges that certain checks, such as checking buoy moorings require a specific skill sets however any change in the efficacy of the AtoN position or conspicuity would require a failure report to be made to the LLA. Minor blemishes or wear may become an issue and affect how the AtoN perform, and as such, it is considered good practice to attend to these issues as soon as practical.

The safety of those tasked with performing these checks supersedes the necessity for reporting and this must be relayed to those concerned.

BIM's Role

- BIM collates information received and submits a report to IL.
- BIM report to IL to contain 2 categories – failure of a specific mark and failure to receive report from a producer.
- BIM regional staff are available to assist aquaculture licence holders with inspections.
- BIM will review individual SUMS when/if licences in or adjacent to a SUMS area are brought into, or exit production.

Irish Lights' Role

IL to liaise with LLA if reports are not submitted or if non-conformities are identified.

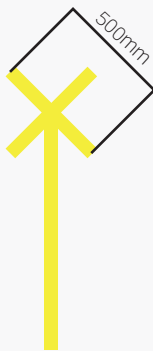
Appendix 1

Marking Guidelines

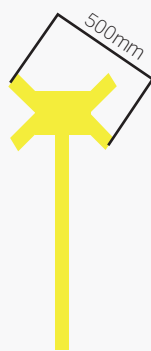
BIM Aquaculture Marking Guidelines 2019 in accordance with IALA international standards

In addition to foreshore/aquaculture licensing, all Aids to Navigation (AtoN) require statutory Sanction for Irish lights prior to their establishment, alteration or disestablishment. These guidelines are for general information only and alternative marking specifications may be required for specific sites or groups of sites. Provision and maintenance of AtoN Markings are the responsibility of the licensee. Further advice is available from the eNavigation and Maritime Services Department. Tel: +353 1 271 5400. Email: info@irishlights.ie, website: www.irishlights.ie

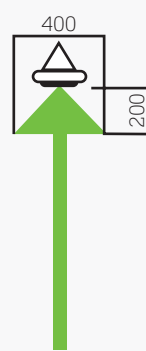
Manufactured Daymark Without Radar Reflector



Manufactured Daymark With Radar Reflector



Manufactured Daymark Lateral Starboard

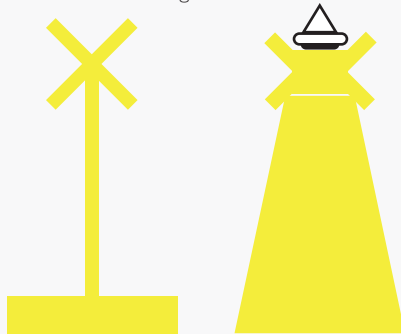


Manufactured Daymark Lateral Port



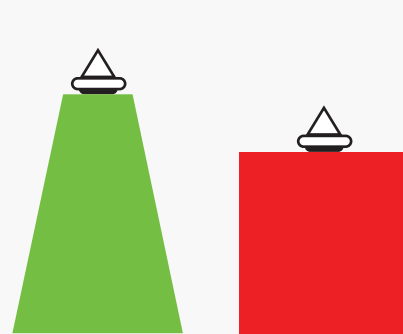
Topmark:

Yellow X Topmark within a square with length of side about 33% buoy diameter. Welded metal or moulded plastic visible as X from all directions. Width of arms about 15% of arm length.



Topmark:

Where Lateral Buoys are used, the topmark can be defined by the shape of the Buoy Body. Colours should reflect the required Lateral Type.

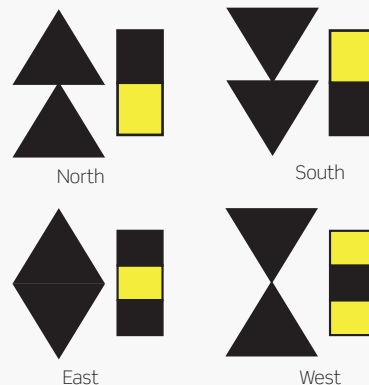
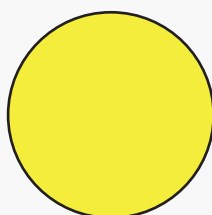


BuoyBody:

Minimum diameter 1.2 metres except for very minor Inshore markings. Size commensurate with depth of water and traffic analysis. Sufficient buoyancy to allow for growth on moorings and body Ballasted for vertical stability. Pillar/spar buoy permissible in some locations Moored securely to seabed. Where possible, site number shown on body.

Inflatable Spherical Buoys:

In some Inshore areas inflatable spherical buoys may be used to warn of Infrastructure where there is non marine traffic such as horse traffic and land sailing.



Cardinal Mark colours as per IALA specification. Sizes are relative to the Buoy Dimensions.

Appendix 2

Calculating height of navigational beacons

Formula

Using the local tide table calculate the maximum range of spring tides in bay in meters X.

Look at bathymetry of the site and establish the bathymetry relevant to chart datum Y (Y can be plus or minus. Below chart datum will be minus, above chart datum will be plus).

Navigational beacons must be 2m in height above water at spring high tide.

Calculate height as follows $X - (Y) + 2 = \text{height of beacon}$.

Worked Example

Aim

Placing 3 navigational beacons in Tarbert.

Tide calculation

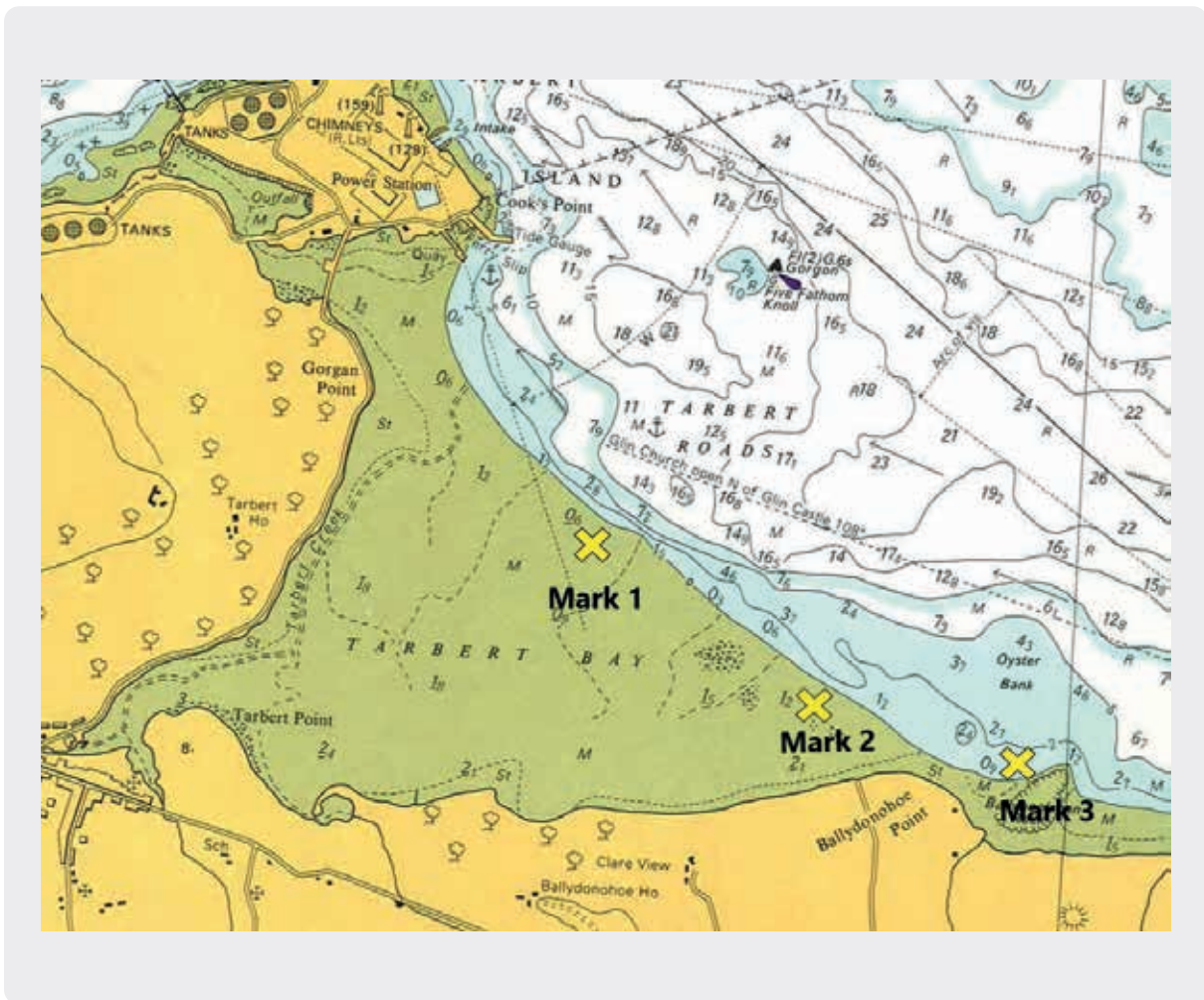
Review the full year of tables to ensure you are getting the maximum range.

DATE / DAY		MORNING	NOON	AFTERNOON	NIGHT	MORNING	NOON	AFTERNOON	NIGHT
1	F	01:46	3.9	14:41	4.0	07:56	1.8	20:34	1.8
2	SA	02:56	4.1	15:48	4.2	09:07	1.8	21:30	1.8
3	SU	03:49	4.4	16:25	4.4	09:58	1.3	22:15	1.3
4	M	04:32	4.8	17:03	4.5	10:40	1.0	22:53	1.1
5	TU	05:08	4.7	17:36	4.7	11:17	0.9	23:28	1.0
6	W	05:41	4.9	18:06	4.8	11:59	0.7	23:59	0.9
7	TH	06:13	5.0	18:36	4.8			12:21	0.7
8	F	06:43	5.0	19:05	4.8	00:29	0.8	12:59	0.7
9	SA	07:13	5.0	19:36	4.8	00:58	0.9	13:18	0.8
10	SU	07:44	4.9	20:07	4.7	01:27	0.9	13:47	0.9
11	M	08:16	4.8	20:41	4.8	01:58	1.0	14:20	1.1
12	TU	08:54	4.6	21:20	4.4	02:34	1.2	14:58	1.3
13	W	09:40	4.3	22:10	4.2	03:16	1.4	15:44	1.5
14	TH	10:45	4.1	23:20	4.0	04:10	1.6	16:47	1.8
15	F			12:11	3.9	05:24	1.7	18:12	1.9
16	SA	09:46	4.0	13:40	4.0	07:00	1.7	19:45	1.7
17	SU	02:05	4.2	14:56	4.3	08:32	1.3	21:00	1.3
18	M	03:13	4.5	15:55	4.7	09:37	0.8	21:57	0.9
19	TU	04:10	4.9	16:45	5.0	10:28	0.4	22:46	0.5
20	W	04:59	5.2	17:31	5.2	11:14	0.1	23:30	0.2
21	TH	05:44	5.4	18:13	5.4	11:57	-0.1		
22	F	06:26	5.4	18:54	5.4	00:11	0.1	12:38	-0.1
23	S	07:07	5.4	19:33	5.3	00:51	0.1	13:16	-0.1
24	SU	07:48	5.2	20:12	5.0	01:29	0.3	13:55	0.4
25	M	08:28	4.9	20:51	4.8	02:06	0.5	14:33	0.8
26	TU	09:12	4.6	21:34	4.4	02:46	0.9	15:15	1.2
27	W	10:02	4.2	22:25	4.1	03:30	1.3	16:04	1.6
28	TH	11:11	3.8	23:35	3.8	04:25	1.8	17:13	2.0
29	F			12:47	3.7	05:44	1.9	18:47	2.1
30	SA	01:03	3.8	14:12	3.8	07:21	1.9	20:09	1.9
31	SU	03:20	3.9	16:13	4.0	09:37	1.6	22:06	1.6

DATE / DAY		MORNING	NOON	AFTERNOON	NIGHT	MORNING	NOON	AFTERNOON	NIGHT
1	M	04:17	4.2	16:57	4.2	10:29	1.3	22:49	1.4
2	TU	05:00	4.4	17:33	4.4	11:10	1.1	23:26	1.1
3	W	05:37	4.8	18:06	4.6	11:46	0.9		
4	TH	06:11	4.8	18:36	4.7	00:00	0.9	12:19	0.7
5	F	06:43	4.9	19:06	4.8	00:32	0.6	12:51	0.6
6	SA	07:13	5.0	19:36	4.9	01:03	0.7	13:21	0.6
7	SU	07:45	5.0	20:07	4.9	01:33	0.7	13:51	0.7
8	M	08:17	4.9	20:40	4.8	02:04	0.7	14:21	0.8
9	TU	08:53	4.8	21:15	4.7	02:36	0.8	14:55	0.9
10	W	09:33	4.6	21:58	4.5	03:12	0.9	15:33	1.2
11	TH	10:22	4.3	22:46	4.2	03:55	1.1	16:21	1.4
12	F	11:26	4.0	23:53	4.0	04:50	1.4	17:25	1.7
13	SA			12:01	3.9	08:05	1.5	18:56	1.8
14	SU	01:18	3.9	14:26	4.0	07:42	1.5	20:31	1.6
15	M	02:45	4.1	15:42	4.3	09:11	1.1	21:44	1.2
16	TU	03:56	4.4	16:38	4.6	10:14	0.7	22:39	0.8
17	W	04:51	4.8	17:26	5.0	11:05	0.3	23:20	0.4
18	TH	05:46	5.0	18:10	5.2	11:51	0.1		
19	F	06:24	5.2	18:52	5.3	00:10	0.2	12:33	0.0
20	SA	07:06	5.3	19:31	5.3	00:50	0.1	13:13	0.0
21	SU	07:47	5.2	20:09	5.2	01:29	0.1	13:52	0.2
22	M	08:26	5.0	20:47	5.0	02:06	0.3	14:29	0.5
23	TU	09:06	4.8	21:24	4.7	02:43	0.5	15:05	0.9
24	W	09:48	4.4	22:06	4.4	03:20	0.9	15:44	1.2
25	TH	10:34	4.1	22:51	4.1	04:02	1.2	16:29	1.6
26	F	11:54	3.8	23:50	3.8	04:50	1.5	17:27	1.9
27	SA			13:01	3.6	05:56	1.7	18:55	2.0
28	SU	01:11	3.7	14:23	3.6	07:26	1.8	20:22	1.9
29	M	02:29	3.8	15:27	3.8	08:44	1.8	21:23	1.7
30	TU	03:29	3.9	16:15	4.1	09:41	1.4	22:09	1.4

On the 22nd of March High Tide is 5.4m and low water drops to -0.1, therefore tidal range (X) is $(5.4) - (-0.1) = 5.5\text{m}$

Bathymetry



Mark 1 is in area marked as $\underline{0.6}$. Underlined figure indicates this is 0.6m above chart datum ($Y = 0.6$)

Mark 2 is in area marked as $\underline{1.2}$. Underlined figure indicates this is 1.2m above chart datum ($Y = 1.2$)

Mark 3 is in area marked as 0.9 . No Underline indicates this is 0.9m below chart datum ($Y = -0.9$)

Height of beacon

Mark 1: $5.5 - (0.6) + 2 = 6.9\text{m}$

Mark 2: $5.5 - (1.2) + 2 = 6.3\text{m}$

Mark 3: $5.5 - (-0.9) + 2 = 8.4\text{m}$

Appendix 3

Anchoring and Construction Methods

Navigation Buoys $\geq 70\text{kg}$

Suitable for deeper water sites that do not dry out on any given tide or only dry out once or twice per year.

For buoy installation, please consult with specialist mooring equipment providers on the specification required for the SUMS location. The following is the information that will be required by the buoy supplier for their recommendation, this is the minimum which is required:

- A copy of the document confirming the granting of Statutory Sanction
- Size/type of buoy/focal height as determined by IL
- Depth of water
- Tidal range
- Type of ground
- Swell/wave height
- Max current

In general, the length of chain needed should be 2-3 times the water depth, plus the tidal range and maximum swell/wave height. At greater depths, confirm that the buoy can support that length of chain.

Where possible site number should be shown on the body of the Buoy.

Figure 1: Mooring equipment being brought to site.



Figure 2: Detail of attachment of chain to buoy noting securing pin and arrangements.

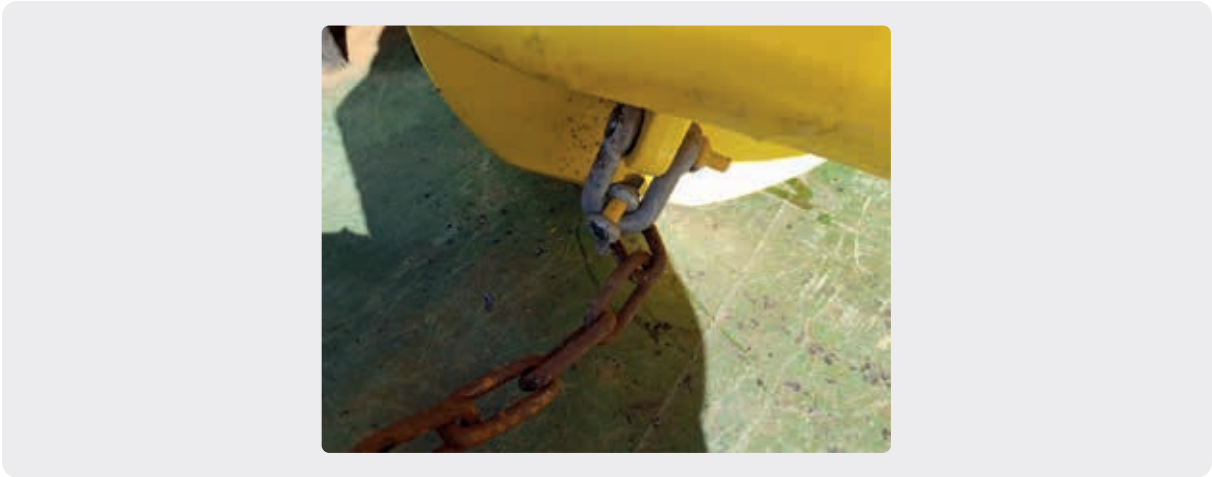


Figure 3: Preparing to deploy.



Figure 4: Deploying mooring block and buoy.

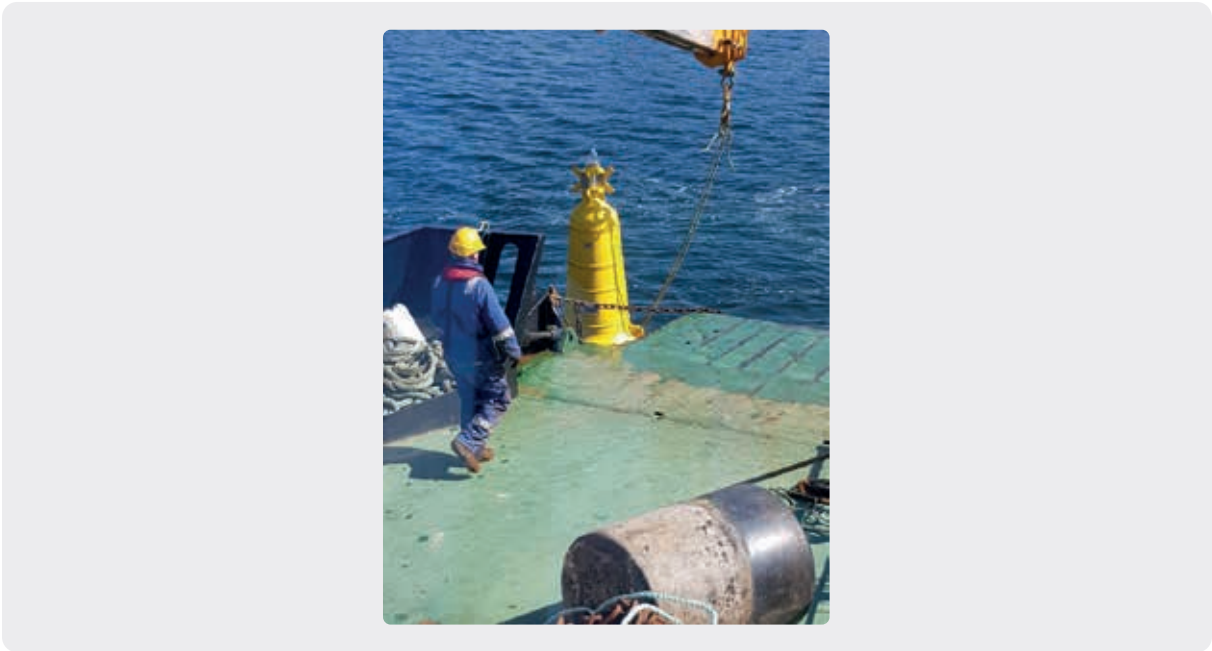
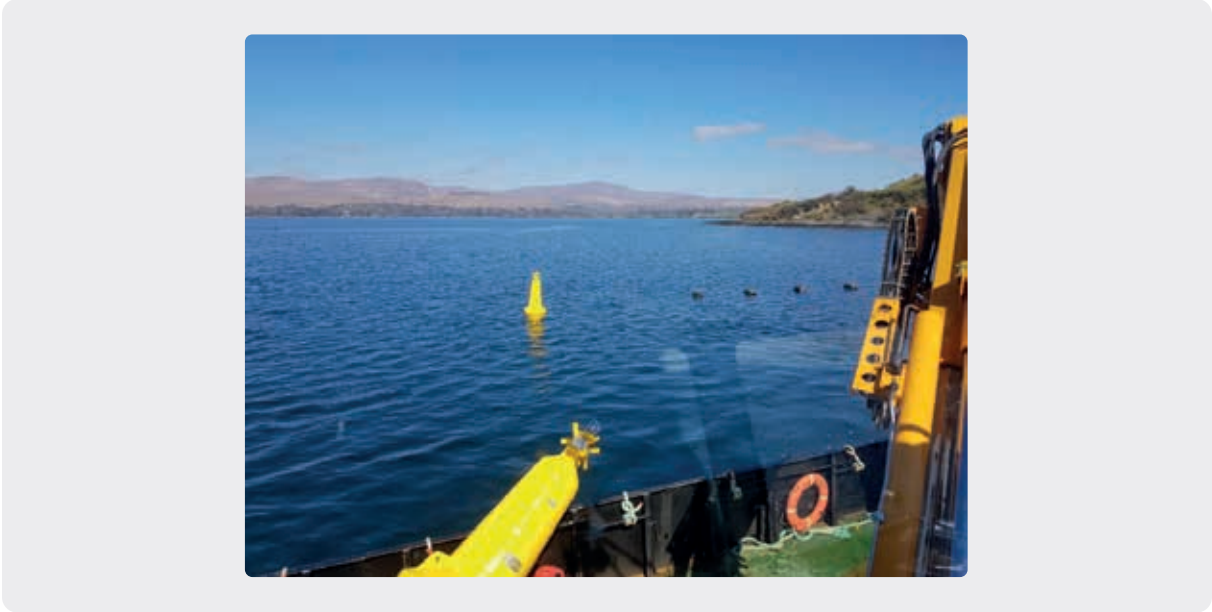


Figure 5: Safely deployed AtoN.



Buoy Type 2 – Standard A4 red or yellow buoy

Suitable for inner edges of SUMS as a compliment to poles or larger buoys marking the outer margin.

Front tyre of a tractor or a mid-sized car tyre (70cm diameter and 21 cm height) filled with concrete and a 2-inch hole cut through centre when set.

Galvanised chain (8mm x 53mm) 1.5m in length is inserted through the central hole and tied into a knot on the underside of tyre to prevent being pulled through. Tyre is then set in ground with the chain knot under the tyre. Rope (sicor steel 18mm) of required length (Use formula in Appendix 2 to calculated this) is attached to other end of chain by a stainless-steel shackle (12mm). Strong cable ties can secure the rope into a loop around the shackle after weaving loose end of rope to main rope in loop. A plastic pot spinner (suitable for 18mm rope) is attached to top of rope and then a short section of rope attaches the buoy to the pot spinner. Buoy should be inflated to at least 50cm diameter. Site number should be shown on the body of the buoy.

Figure 3: Buoy 1 detail.

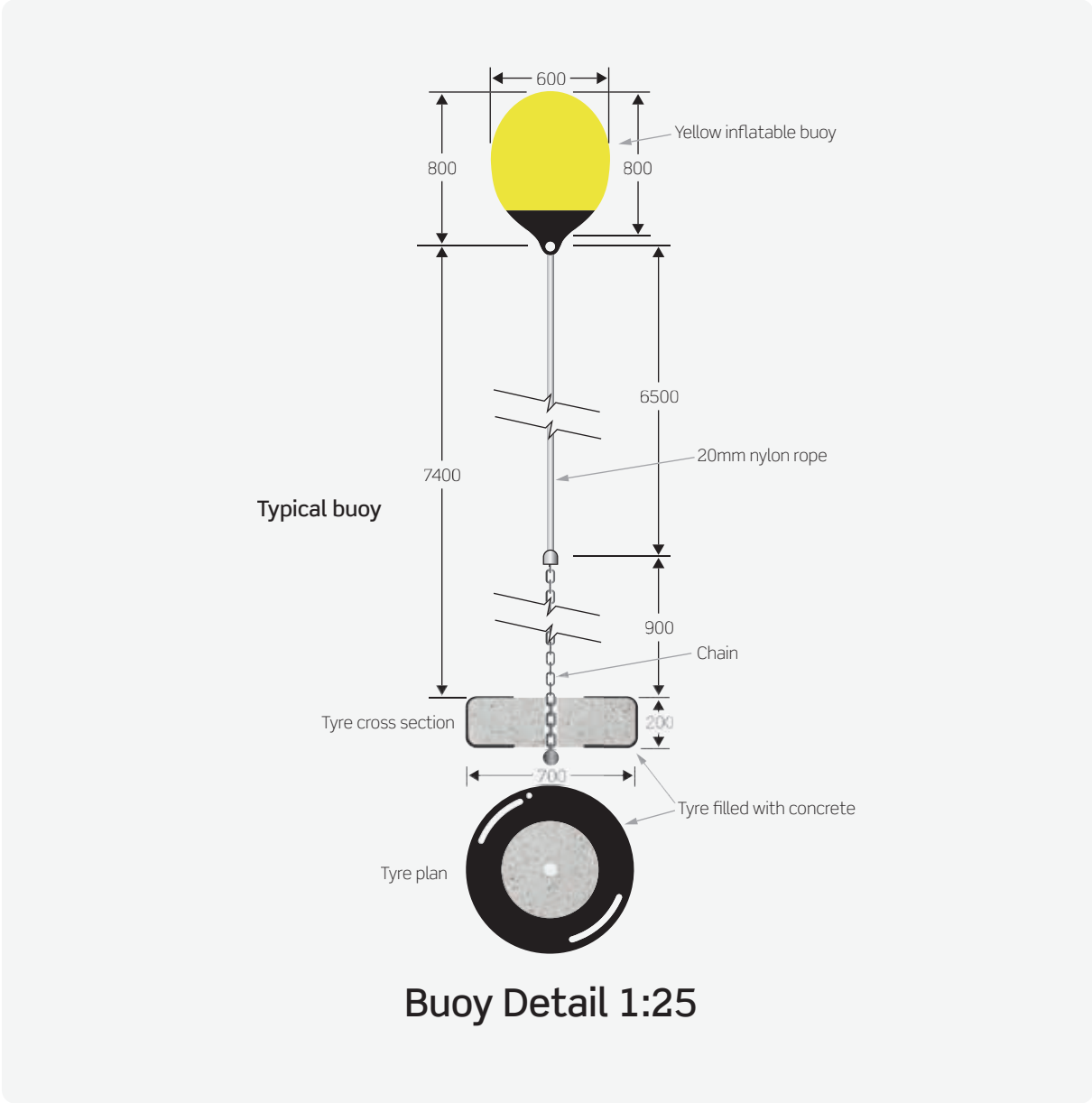
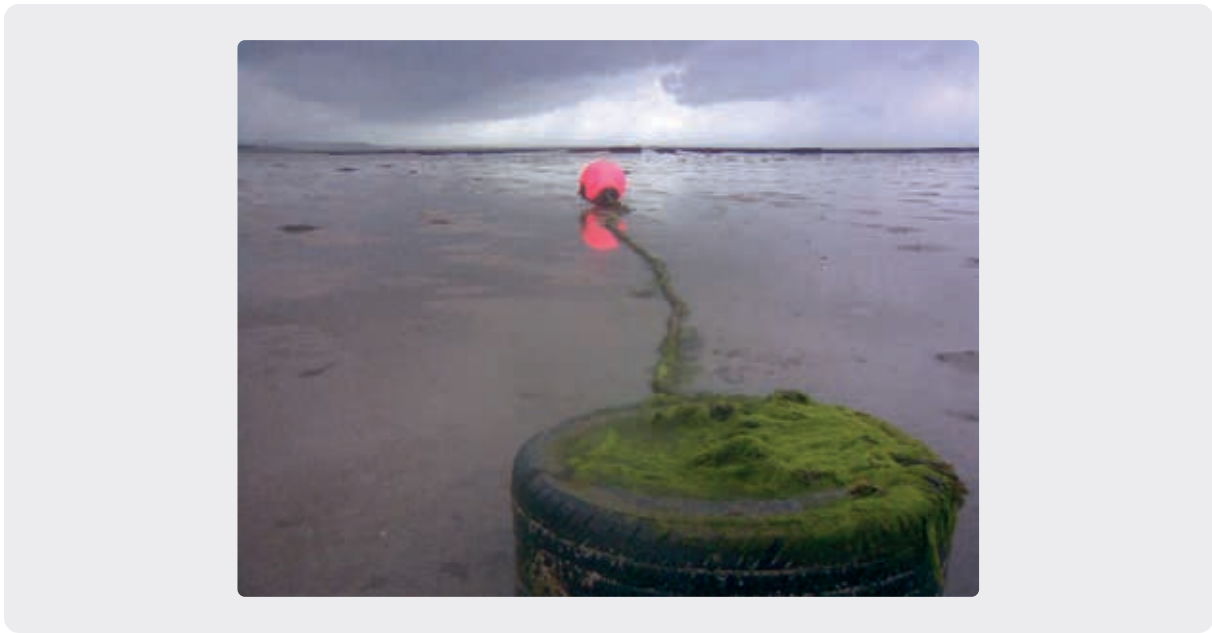
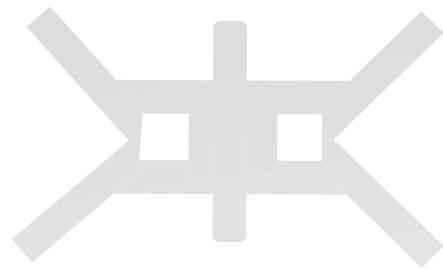


Figure 4: Intertidal buoy in Dungarvan Harbour SUMS.



Please note: Recycled tyres are used in this buoy type and in the construction of navigational beacons described below. At end of life, all mooring equipment (Including tyres) must be retrieved from the marine environment.



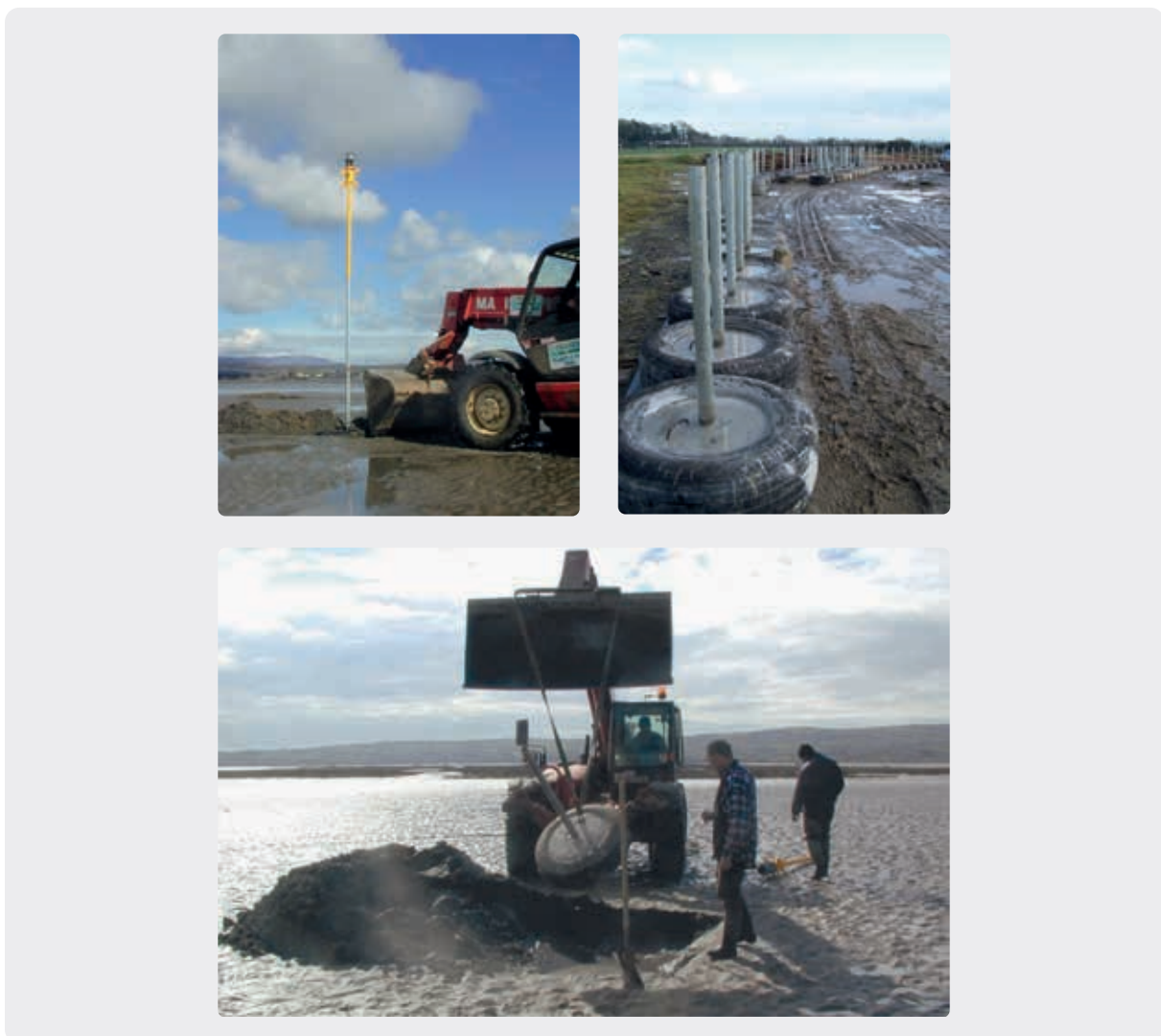
Navigational Beacon (Pole Type 1) – Firm Substrate, <6.3m height requirement

Suitable for firm substrate that allows tractor access with a beacon height requirement of <6.3m.

This type of Navigational Beacon is composed of a 1.5m outer pole (76.1mm outer diameter, 3.5mm-4.5mm wall thickness) with metal spokes (welded to pole) radiating out from the base and set in a concrete-filled lorry or tractor tyre for strength. A steel oyster bar bent into a handle shape is also welded onto the metal spokes prior to pouring the concrete. There should be of sufficient height to protrude above the concrete to allow for lifting with a tractor fork etc.

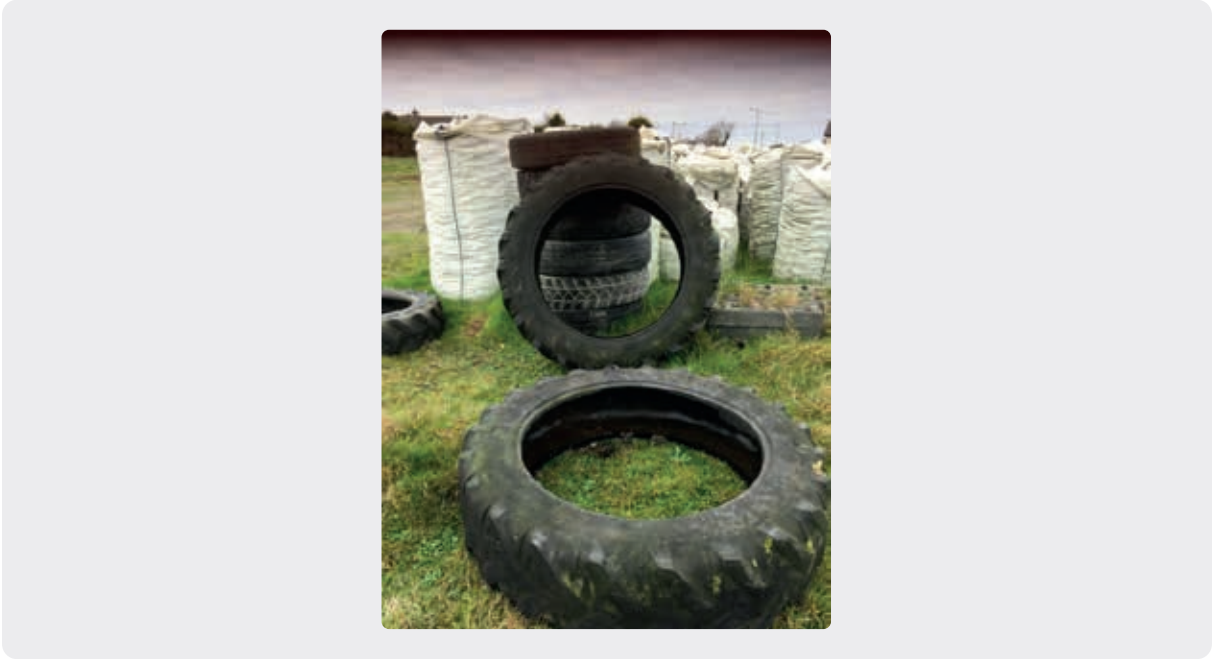
Where possible the tyre base should be buried to leave only the handle protruding above seabed, this ensures the beacon remains upright over time and increases the anchoring due to the suction of the base within the sediment. If not buried, currents can erode the sediments unevenly around the base causing it to tilt and lose anchoring power.

Figure 5: Illustrations of makeup and installation.



For very exposed conditions a larger rear tractor tyre can be used with a 1.5 to 2.0m section of outer pole (76.1mm external diameter, 4.5mm wall thickness). The same metal spokes are required but in this case two steel oyster bars bent into a handle shapes are welded onto opposite sides of the pole for lifting. Again these should be of sufficient height to protrude above the concrete to allow for lifting with a tractor fork and bases buried where possible.

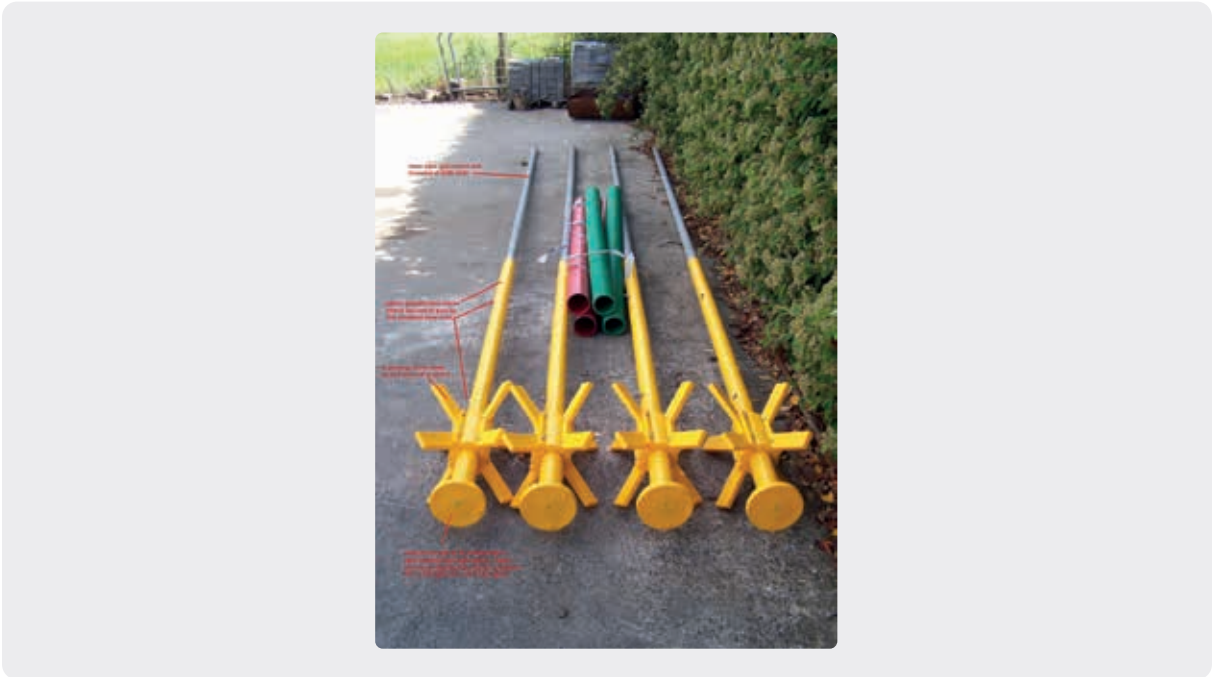
Figure 6: Wider diameter rear tractor tyres can be used when constructing bases for rougher conditions or where more than 6.3m height is required for the pole.



A yellow outer sleeve with an attached day-mark consisting of a 3D St Andrews Cross and a light or radar reflector (if required by IL) is attached to an inner pole (6m long 60.3mm external diameter, 4.5mm wall thickness). This sleeve should be secured to the inner pole at two points by 18-20mm stainless steel lock nuts. This is then slotted into the outer pole of the buried base.

2-3 UV-stable plastic shims (slices of 2inch red underground electric ducting pipe) should then be hammered into the gap between inner and outer poles to reduce movement and friction, thus increasing the lifespan of the AtoN.

Figure 7: Inner poles with yellow sleeves secured by two stainless steel bolts and 3D St Andrews Crosses attached.

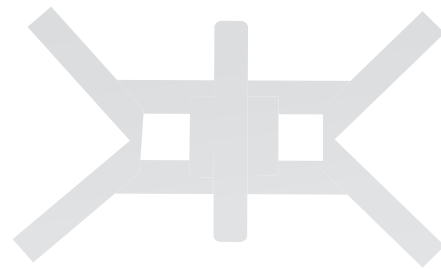


It is possible to extend the height of this pole by using a wider base coupled with 2m of outer pole (with thicker wall described earlier) to receive an extended inner pipe (6m plus an extension of a meter welded together with a solid bar inside the join). The join in the inner extended pipe should be located 1m above the base, inside the 2m outer pole.

Additional height can be achieved for any pole type by leaving a gap of 30-40cm between the top of the inner pole and the top of the covering yellow sleeve.

This type of Navigational Beacon is not suited to a pole height requirement of >6.3m.

It is important not to compromise structural strength when striving for height.



Navigational Beacon (Pole Type 2) – Firm Substrate, >6.3m height requirement.

Suitable for firm substrates that allow tractor access with a height requirement of >6.3m however can also be used in exposed locations at heights of less than 6.3m

This Navigational Beacon is not modular, the lower half is made from box iron (100mm X 100mm, 10mm wall thickness) and the inner pole is welded to the box iron (Figures 8-9). The top pole should be galvanised (60.3mm external diameter, 4.5mm wall thickness) and can be cut to the height required. The top pole is welded into the box iron cavity at two locations of not more than 1m from the top of the box iron. The lower 1m of the box iron is buried beneath the seabed for anchoring.

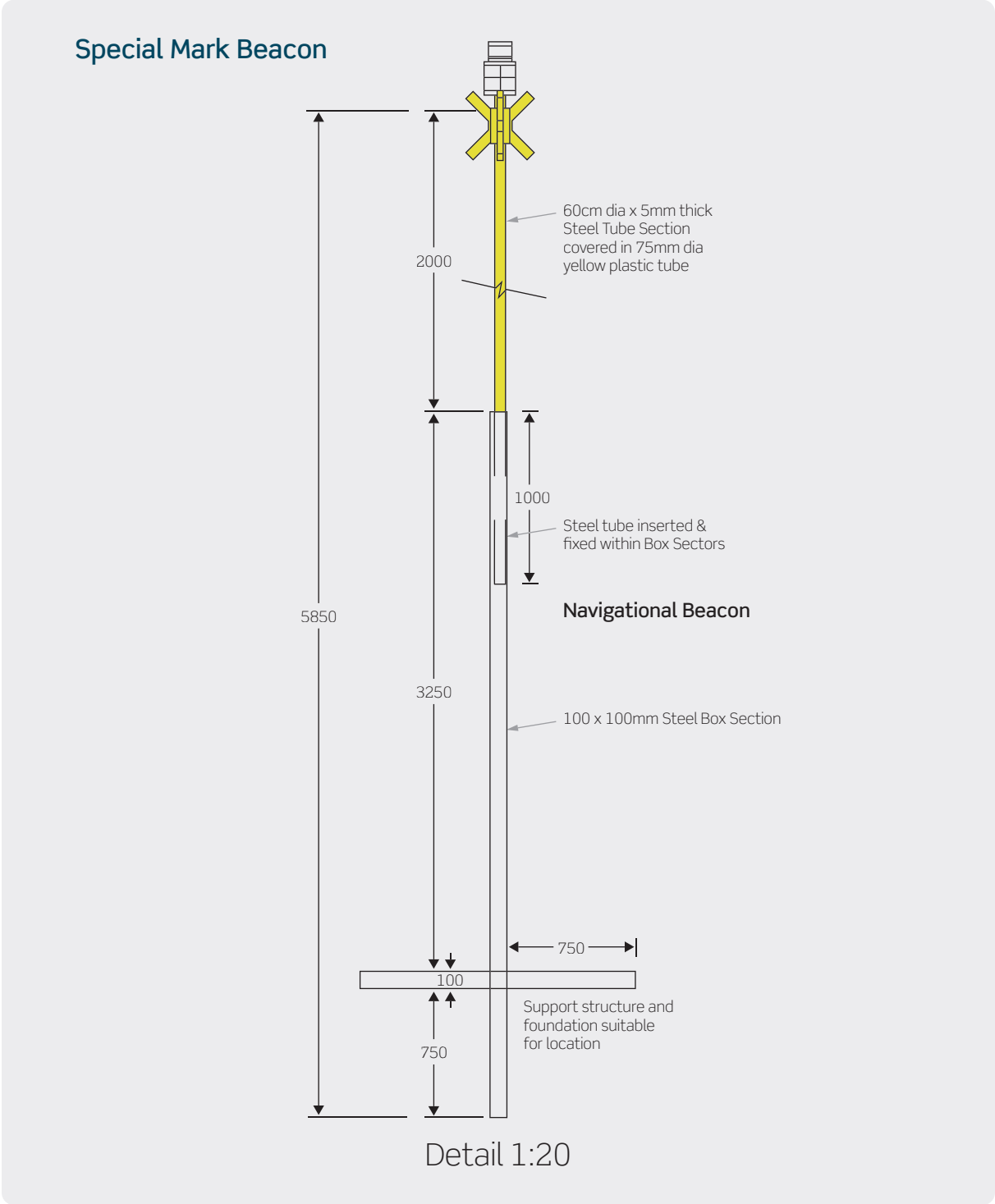
Repair of this beacon requires either complete replacement or cutting off the top 1m of box iron removing the damaged inner pole. If the option to remove the top 1m of box iron is preferred, a replacement galvanised pole (3m long 76.1mm external diameter, 3.65mm wall thickness) should then be pounded into the remaining box iron and a replacement galvanised pole (6m long 60.3mm external diameter, 4.5mm thick wall) with required attachments should be inserted into the outer pole and shimmed with UV-stable plastic to avoid movement and friction, thus extending the lifespan of the AtoN.

For additional height a stainless-steel bolt can be inserted across the 76.1mm pipe so that when the inner pole is inserted it will be elevated above the seabed at the required height.

Figure 8: Installation of Navigational beacon (Pole type 2) in Dungarvan. Bottom 1m of pole (just above the cross) is buried in a hole for anchorage.



Figure 9: Measurements for a standard Type 2 navigational beacon at a point with only 3.2m rise on the maximum spring high water (2m of mark always above water on an average spring tide).



To obtain extra height a 6m inner pole can be welded at a depth of 2-1m inside the box iron leaving 4-5m protruding, giving a total height above seabed of 7.1-8.1m. Additional height can again be achieved by leaving a gap of 30-40cm between the top of the inner pole and the top of the covering yellow sleeve.

It is important not to compromise structural strength when striving for height.

Navigational Beacon (Pole Type 3) – Soft Substrate

Suitable for soft substrate with no tractor access

A 2-3m section of outer pole (76.1mm external diameter and a minimum of 3.5mm wall) is pounded into the ground with a hand-held stake driver until only 70-100cm remains above the seabed. The 3m section is suitable for very soft ground while the 2m section is suitable for soft ground or an area where there is always some water at low water spring e.g. a channel edge.

Small concrete filled tyres (1-3 in number) with a hole in the middle can then be slid over the outer pole to assist with anchoring. Gravel is washed into the space between the concrete tyres and the outer pole to reduce movement.

The damaged top edge of the pounded outer pole should then be trimmed using a consaw or rotating disc metal cutter to get a clean edge and to avoid friction between inner and outer metal poles which would shorten deployment lifespan.

2 to 3 UV-stable plastic shims (slices of 2inch red underground electric ducting pipe) should then be hammered into the gap between inner and outer poles to reduce movement and friction, thus increasing the lifespan of the AtoN. Figures 10-11 below show deployment of this type of navigational beacon.

Figure 10: Small tyres filled with concrete and a circle cut out in middle to accommodate a 76.1mm pole. Approximate weight of 30-40kg.



Figure 11: Top of a 3-tyre stack placed over an outer pipe and with an inner pole shimmed in afterwards. Gravel washed down into spaces between pole and hole to tighten the structure. Gravel washed in to hole at each tyre level.



Appendix 4

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