Galway Harbour Company

Galway Harbour Extension

Proposed Compensatory Measures (Version 2.3B) in relation to the proposed Galway Harbour Extension,

An Bórd Pleanála (Ref: 61.PA 0033)

August 2017

TOBIN Consulting Engineers

AQUAFACT

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1 INTRODUCTION

1.1 BACKGROUND

By letter dated 29th September 2015 An Bord Pleanála advised as follows:-

> *"The Board has completed an appropriate assessment of the proposed Galway Harbour Extension in accordance with Article 6(3) of the Habitats Directive and has concluded that approval of the proposed development could not be considered under Article 6(3) of the Habitats Directive, given that a significant adverse impact on the integrity of the Galway Bay SAC would occur.*
>
> *The impacts on the integrity of the European Site are as follows:*
>
> - *The direct and permanent loss of fucoid-dominated reef habitat [1170] and mud and sand flat habitat [1140] in Galway Bay Complex cSAC will result in the conservation objective for these features not being met. The direct and permanent loss of a habitat, which is part of the conservation objective of the site, is in general a significant adverse effect on the integrity of the site.*
> - *The loss of perennial vegetation of stony banks [1220] due to the sheltering effect of the harbour extension will also have a significant adverse effect on the integrity of the cSAC".*

The Board went on to state:-

> *"…it is necessary for you to submit proposals for compensatory measures to address the impacts on the integrity of the Galway Bay Complex SAC identified above".*

1.2 DEVELOPMENT OF COMPENSATORY MEASURES

The development of the proposed compensatory measures has proceeded as follows:-

1.2.1 Version No. 1 November 2015

In response to the timeline as set out by the Board, initial proposals [Version No. 1] were forwarded to the Board in November 2015.

These were based on proposals to be developed in the immediate vicinity of Renmore adjacent to the proposed Harbour Extension and on the coastline to the West of Silverstrand on the North shore of Galway Bay. These proposals were reviewed by NPWS and considered in discussions between the Board and NPWS.

1.2.2 Version No. 2.0 October 2016

A further submission to the Board in October 2016 addressed some issues raised by NPWS at their meeting with the Board and also addressed *"Legacy Issues"* related to the earlier development of Galway Harbour Enterprise Park in the early 1990's when areas of intertidal habitat, stony bank and salt marsh were lost.

The following Table No. 1 shows the total of the areas of the three separate habitats for which compensatory measures are now to be identified, as a result of the historical development of the Enterprise Park and of the proposed development of the Galway Harbour Extension.

Table 1 – Summary of Areas of Habitat Affected

Habitat Type	Areas of Habitat affected by Development of		Total Area
	Galway Harbour Extension	Galway Harbour Enterprise Park	
Intertidal Fucoid Dominated Reef [1170] and Mud & Sand Flat [1140] Complex	5.93 ha	8.58 ha	14.51 ha
Stony Bank [1220]	0.35 ha	0.28 ha	0.63 ha
Atlantic Salt Marsh [1330] and Mediterranean Salt Marsh [1410] Complex	---	7.39 ha	7.39 ha

Note the Galway Harbour Enterprise Park losses are added to fully address legacy issues.

Following discussions with NPWS the focus on identifying suitable compensatory measures shifted from the Northern shore West of Silverstrand to the Eastern shore of Galway Bay towards Renville and Tawin.

1.2.3 Version No. 2.1 December 2016

This report was initially based on a desk study of existing literature (McCorry 2007, McCorry and Ryle 2009, NPWS 2013) on the distribution of the three habitat types required for compensation in the Galway Bay area including the North shore of County Clare. The results of this desk study showed that the Eastern part of Galway Bay contains the largest areas of distribution of these habitats.

Field survey work to record stony bank and areas of saltmarsh were conducted along the coastline commencing at Oranmore and extending southwards through Renville and terminating at the South Eastern corner of Tawin.

Based on the findings of these initial field surveys which showed that extensive areas of saltmarsh, stony bank and intertidal reef / mudflat / sandflat were present in Tawin, the Tawin area was selected for further study.

In addition, an initial suite of measures to control the management of areas of these habitats into the future were developed.

1.2.4 Version 2.2 February 2017

The Version 2.1 report was discussed at a tripartite meeting in December 2016 following which a further update Version 2.2 was prepared in February 2017. That report proposed that initial more detailed surveys of the Tawin area be carried out to qualitatively assess the Tawin area in terms of the site suitability for the habitats in question.

This would then allow for the selection of the most suitable specific areas for quantative survey work to be carried out at a suitable time of year to document the plant and animal species present in each habitat.

1.2.5 Version 2.3B August 2017

V2.3 [Draft A] was discussed with NPWS on 28.03.2017 with a view to help direct the preliminary survey work required to choose the site to be offered as the Compensatory site and work in the interim has progressed on that basis.

Having carried out the qualitative survey work in April 2017 this present report identifies Mweeloon Lagoon as the preferred location for establishing the compensatory measures subject to detailed quantitative surveys to be undertaken during the coming weeks.

On 27.07.17 a Tripartite Meeting with An Bord Pleanála, Dr Bastreri and NPWS discussed the merits of the previous Reports V2.1 and V2.2, and progress since 28.03.17, such that this document V2.3B has now been finalised accordingly to allow it to be lodged as the proposed last element of Phase 1 of this compensatory proposals process.

2 IROPI PRECEDENTS

As part of the process in formulating a compensation package for the Galway Harbour Extension project, a review of previously successful compensatory plans throughout the EU was undertaken. To date, 20 such compensation plans in the EU (excluding examples from the U.K.) have been agreed and an example from Eastern France in relation to the construction of a section of railway track and another from the port of Rotterdam in relation to infilling of the sea are of relevance.

2.1 NIED TGV COMPENSATION, 2004 EU COMMISSION OPINION C (2004) 3460 (9/9/2004). SALT MEADOW RESERVE PRECEDENT

Regarding the French example, proposed compensatory measures for the loss of *ca* 3.75 ha of salt meadow and subhalophytic meadow (which is listed as a PRIORITY habitats in the EU Habitats Directive) in the Nied Valley in Eastern France arose as a result of the construction of a new section of high speed rail (TGV) connecting France to Germany (EU, 2004) (see Appendix 1).

Three different measures for compensatory measures have been planned by the Contracting Authority and validated by the appropriate Department of the Ministry of the Environment: i.e.-

1. Preservation of remaining 31 ha of salt meadows near the line by means of a management agreement between the contracting authority and a nature protection body. The latter was to draw up individual agreements with each of the farmers concerned.

2. Restoration of the site and re-establishment of salt meadows. A restoration trial had been carried out in 2003 on 20 ha of land and involved preparation of the site, sowing of local seeds and implementation of scientific monitoring over 5 years focussing on salinity and vegetation. It was planned to fill in drainage ditches so as to better preserve the special character of these areas.

3. Preservation of Nied Valley salt meadows not adjacent to the TGV line but included in the Natura site. Mapping of the natural habitats in the area proposed for the Natura 2000 network in the Nied Valley carried out by the University of Metz and financed by the contracting authority (RFF) identified 6 halophytic sites in the valley. A site at Aubécourt, which was the most remarkable, had been selected for RFF to purchase 3.5 ha of land for heritage management via an agreement concluded with the specialised body already approached to manage and preserve the 31 ha.

The *"Commission Opinion"* records that:-*"The Commission considers that the proposed compensatory measures, as described in the notification and the documents mentioned in Annex 2, are sufficient to make up for the project's effects on Natura 2000 provided that they are executed in a timely manner corresponding to the phasing of the project and that the proposed management plans assure their long term effectiveness".*

2.2 PROJECT MAINPORT ROTTERDAM, 2003.EU COMMISSION OPINION C (2003) 1308 24/04/2003) MARINE RESERVE PRECEDENT.

Project Mainport Rotterdam is a plan to extend the port of Rotterdam consisting of a combination of

- better use of space available in the existing harbour area
- reclamation of 2,500ha from the sea (Maasvlakte 2) and
- creation of a new area of 750ha as a nature reserve and recreation areas.

This westward extension into the North Sea is expected to significantly affect a priority habitat (Grey Dunes, area lost 19.5 ha), 2 non-priority habitats (White Dunes, area lost 23 ha and Sandbanks which are not covered by seawater at low tide, area lost 3,125 ha), one plant species (the fen orchid, *Liparis loeselii*) and two bird species (Slavonian grebe, *Podiceps auritus* and Scaup, *Aythya marila*).

The compensation for these losses included

- creation of a new area of Grey Dune, 100ha in size,
- creation of 23 ha of White Dune,
- creation of an intertidal marine reserve 31,250 ha in size in the SPA Voordelta. This will not involve creation of new habitat but will entail measures that reduce disturbance of the sea bed such as restrictions on fisheries allowing the creation of better conditions for foraging birds such as Slavonian grebe and Scaup and
- creation of 10 ha of humid dune slack for colonisation by the fen orchid.

The EU Commission held the view that "*this land reclamation project could be executed for reasons of overriding public interest on the condition that all necessary compensation measures to ensure the overall protection of the coherence of Natura 2000 be taken in due time."*

It went on to add that it "*presumes that the compensatory measures will be implemented and monitored as described by the Dutch Authorities"*

and that "*the results of the accompanying monitoring programmes regarding Natura 2000 are taken into account in the sense that they may, if need be, lead to appropriate rectifications in project design or to additional compensation and mitigation measures".*

2.3 SUMMARY OF PRECEDENTS

These two examples of IROPI projects that included priority habitats and that were accepted by the Commission are of considerable relevance to developing a compensation plan for loss of non-priority habitats. In the Nied example, it primarily entailed a management plan for the remaining areas of the priority habitat "salt meadow" and this proved acceptable to the Commission.

In relation to the loss of intertidal habitat in the Rotterdam case, the designation of an area as a marine reserve was accepted by the Commission.

The proposed compensatory measures for habitat loss in the Galway Bay Complex SAC follow closely along the above lines and are based on implementing a comprehensive management plan for areas of habitat in the Tawin area whose current status is described in a report for NPWS as *"unfavourable / inadequate".* See Fig. 1 below which shows all of study area.

Figure 1 - Overall Study Area

Figure 1. Overall Study Area

3 PROPOSED COMPENSATION PLAN

3.1 TAWIN - EXISTING CONDITION

It is proposed to develop a management plan for part of the Tawin area (see map above) of Inner Galway Bay (within the boundary of the cSAC) where stony bank, salt marsh and intertidal complexes of fucoid-dominated reef, sand and mud flat habitats occur to bring about the biological improvement of substandard areas of these habitats which in places have been described as being of *"unfavourable/inadequate"* status in a report commissioned by National Parks and Wildlife (NPWS Saltmarsh Monitoring Programme Project, 2006, Tawin Island). There are several references in this report to pressures, on salt marsh and stony bank habitats arising from a variety of agriculture pressures such as:-

- gazing (p. 7, p. 8, p. 11, p. 12, p.17 and p. 19),
- poaching by cattle (p.9, p.11, p. 12, p. 19),
- grazing tracks (p.12),
- dumping (p. 13),and
- excavation of stones and gravel (p. 14).

On p.14 of this report, the overall status of this area is described as *"unfavourable/inadequate"* while on p.17 under the heading *Habitat structure and function* for saltmarsh, this is also described as *"unfavourable/inadequate"* and on p.19 under the heading *Future prospects,* this too is described as *"unfavourable/inadequate"*.

On p.21 under the heading *Management Recommendations* at the end of this report, the authors state "*In some specific areas, the grazing intensity should be reduced"* and go on to note that

"*Removing grazing as an impact from a small part of the site would also be beneficial as this would increase the sward diversity particularly in the middle and lower marsh areas, which are generally preferentially grazed and so are even affected at low stocking densities".*

Based on the initial desk studies it is considered that potential areas of *ca* 25 ha of stony bank and *ca* 136.33 ha of salt marsh may exist in the Tawin Peninsula within which appropriate areas may be found to compensate for the losses of 0.63 ha of stony bank and 7.39 ha of salt marsh respectively arising from the earlier GHEP development and the proposed Galway Harbour Extension.

In addition the complex of intertidal sands, mud and fucoid dominated reefs cover an area of *ca* 500 ha, again within which an appropriate area may be found to compensate for the historic loss

of 8.58 ha and the future loss of 5.93 ha *i.e.* a total of 14.51 ha. [Refer to Figures 2.1, 2.2 and 2.3 in Appendix 3]

3.2 COMPENSATORY MEASURES - MANAGEMENT PROPOSALS

Ecological restoration as a form of compensation is specifically described in the EU (2007) Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC ref. Sect 1.4.3 Page 14 *"biological improvement of substandard habitat within an existing designated site*".

3.2.1 Specific Management Measures – Stony Bank and Salt Marsh

In relation to the proposed management plan for the sites to be selected, this will include the following 18 components:

1. Manage the salt marsh and stony bank habitats that can be subject to possible purchase / long term agreements to manage them in accordance with organic principles.
2. Control (in saltmarsh) and curtail (in stony bank) grazing levels by horses, cattle and sheep to give the level of seasonal grazing that best suits the plant species of the habitat and in Salt Marsh to eliminate poaching.
3. Cease fertilizer and slurry spreading in areas of salt marsh and eliminate dunging in stony bank habitats by fencing off animals from these areas.
4. Cease the use of herbicides within or close to the habitat types.
5. Ensure that livestock are not allowed on the lands during the withdrawal period for medicines and anthelminths.
6. Ensure no shooting.
7. Control access by tractors to the habitats to eliminate rutting.
8. Eliminate the use of round feeders and winter feeding and supplementary feeding to curtail the related poaching and rutting of lands at feeding and gate sites,
9. Ensure no removal of cobbles (stony bank) / ensure no further construction of drainage channels (salt marsh).
10. Limit the construction of any further land protection sea defence works or dumping of materials to act as a sea defence unless approved for ecological reasons.
11. Cease repair of any sea defence works to allow for erosion / ingress by the sea, unless required for ecological reasons.
12. Arrange for regular removal of flotsam and jetsam and other refuse.
13. Carry out annual biological surveys of the habitats to document any changes in their extent and in their characterising species.
14. If extreme events such as the storm in January 2014 occur, carry out surveys immediately to document the impact.

15. In the light of the results of the annual biological surveys and surveys required as noted in Bullet 14, adjust/modify the management plan.
16. Commission annual independent audit of the progress of the management plan.
17. In the light of the results of these independent audits, adjust/modify the management plan.
18. Erect signage including drawings at chosen vantage points demonstrating what the project comprises and what species are contained within each habitat.

In relation to Bullet 11 above, the ecological reasons for allowing for sea protection measures is to ensure the status of the "lagoon" remains in favourable ecological condition.

3.2.2 Specific Management Measures – Intertidal

In relation to the proposed management plan for the sites to be selected, this will include the following 18 components:

1. Manage the intertidal areas that can be subject to possible purchase or purchase of the adjacent lands / long term agreements to manage the adjacent lands in accordance with organic principles and for the protection of the intertidal lands.
2. Control (in saltmarsh) and curtail (in stony bank) grazing levels by horses, cattle and sheep and eliminate the use of round feeders and winter feeding and supplementary feeding to curtail the related poaching and rutting of lands at feeding and gate sites.
3. Cease fertilizer and slurry spreading.
4. Cease the use of herbicides within or close to the habitat.
5. Ensure that livestock are not allowed on the foreshore during the withdrawal period for medicines and anthelminths.
6. Ensure no shooting.
7. Control access by tractors to the habitats to eliminate rutting.
8. Cease aquaculture use.
9. Ensure no further construction of land protection sea walls.
10. Limit the repair of sea defence works or dumping of materials to act as a sea defence unless approved for ecological reasons (for the same reason as noted above).
11. Arrange for regular removal of flotsam and jetsam and other refuse.
12. Ensure area preserved free from *Didemnum* – see 3.2.3 below for further detail.
13. Carry out annual biological surveys of the habitats to document any changes in their extent and in their characterising species.
14. If extreme events such as the storm in January 2014 occur, carry out surveys immediately to document the impact.
15. In the light of the results of the annual biological surveys and surveys required as noted in Bullet 14, adjust/modify the management plan.

16. Commission annual independent audit of the progress of the management plan.
17. In the light of the results of these independent audits, adjust/modify the management plan.
18. Erect signage including drawings at chosen vantage points demonstrating what the project comprises and what species are contained within each habitat.

3.2.3 Control of non-native species

An additional and separate part of the management plan relating to the complex of intertidal reef, mud flat and sand flat habitat is to develop a programme to eradicate the non-native tunicate taxon *Didemnum* in the selected location.

Dr. Tasman Crowe of the Department of Zoology in T.C.D. directed a Ph.D. project on successfully controlling *Didemnum* in oyster farms in Westport Bay (which also is a cSAC) by regularly spraying the tunicate with vinegar. Dr. Crowe will act as a consultant in this part of the proposed range of management options.

4 QUALITIATIVE SURVEYS

4.1 AREAS SURVEYED

Three areas on Tawin headland were identified for qualitative surveys:

1. Mweeloon Lagoon,
2. Glasheen Island
3. Tawin West

These are shown on Figure 3.

Figure 3. Locations of three areas selected for qualitative survey work.

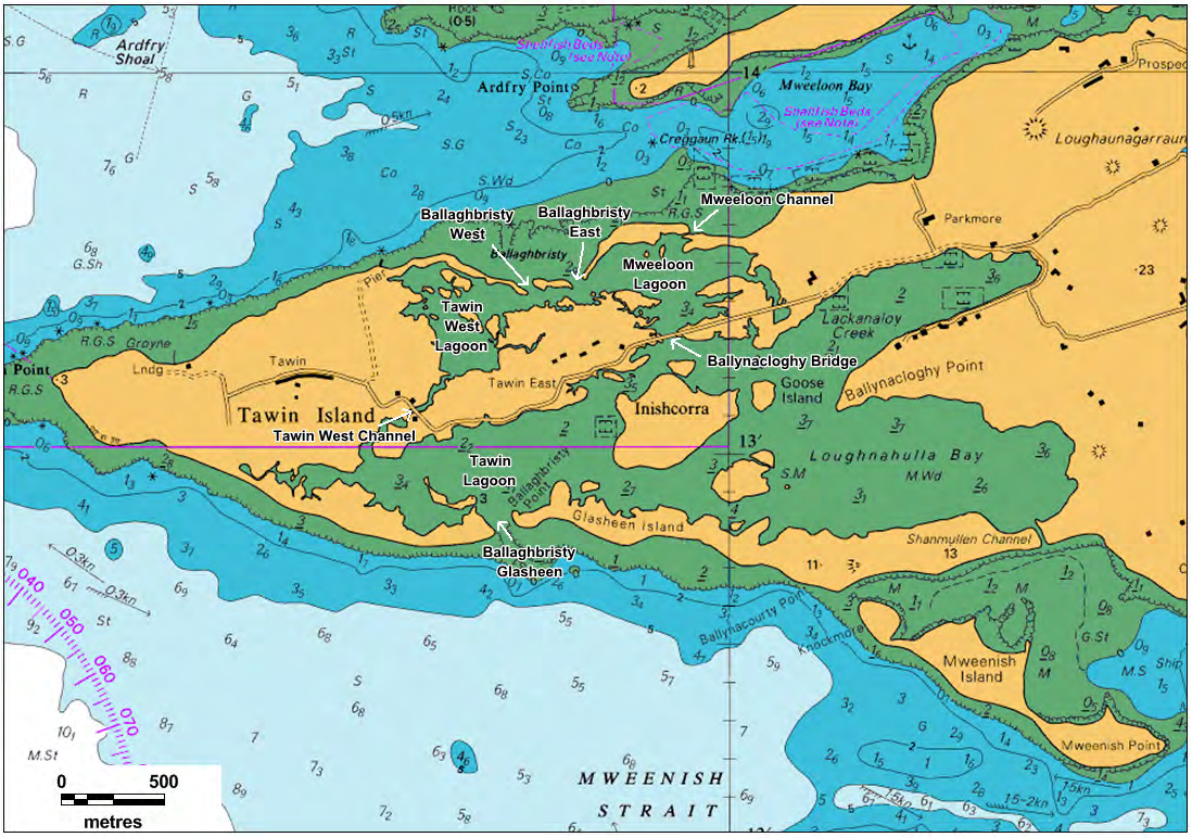

Figure 4. Site-specific place names

4.2 MATERIALS AND METHODS

The following qualitative survey techniques used were:

1. Walk over surveys using photography and qualitative sampling of stony bank, salt marsh and intertidal mud, sand and reef habitats in each area.
   The sampling methods included observations on the sediment types present *e.g.* mud, sand, shell debris, stones, bed rock, macroalgal species and % cover, obvious macrofauna, casts and estimate of REDOX depth.
2. Rocky shore transects to record macrophytes and macrofauna at HW, MW and LW. Identification was carried out in the field.
3. Aerial photographic surveys were carried out at each location. A Phantom 2 drone was used with a GoPro Hero 4 camera (see Figure 5) to work with a 2.4 Ghz Futaba T8J transmitter with a HD monitor and a 5.8Ghz video receiver for line of sight flight.

Figure 5. Drone and camera.

Survey work was carried out at Spring tides (April 26th – 28th. 2017, minimum predicted low water 0.34m) to ensure that maximum areal mapping of the intertidal habitat was achieved. Winds were light easterly and weather conditions were sunny with no rain.

4.3 RESULTS

4.3.1 Mweeloon Lagoon (see Appendix 4 for a selection of photographs).

Mweeloon Lagoon is the body of water to the north of the access road into Tawin (see Figure 4). Its main access to the open sea is via an opening in its northwest corner leading to Ballybristy East opening. This is a silled opening which creates an asymmetrical tide that ebbs for *ca* 9 hours and floods for *ca* 3 hours. There is one other small access channel to the sea, Mweeloon Channel (see Figure 4), but this only functions in *ca* the last hour before and 1 hour after High Water Spring tides. Within Mweeloon Lagoon, there is a channel under Ballynacloghy Bridge that links Mweeloon Lagoon with the greater body of lagoonal water to the south of the road. (Just to the west of the bridge, there is a small culvert under the road that that also links Mweeloon Lagoon with the body of water to the south but this only functions *ca* 1 hr before and after High Water Springs).

East of the bridge, there are two much smaller channels that connect Mweeloon Lagoon with Lackenaloy Creek. However, as noted for Mweeloon Channel above, these only function in *ca* the last hour before and one hour after High Water Spring tides. Salinity was recorded at 32 psu (practical salinity units) at Lackenaloy Creek. The underlying geology is limestone.

Stony Bank

With regard to compensatory habitats, perennial vegetation of stony bank is present all along the northern seaward boundary of Mweeloon Lagoon (see Figure 6.1, 6.2 and 6.3 in Appendix 3, Maps 3, 4 and 5). In total, the area of stony bank habitat at Mweeloon Lagoon is estimated at *ca* 2.42ha. Signs of poaching and tracking were recorded along the eastern half of where this habitat was recorded.

Salt Marsh

There are two main areas of salt marsh, one along the eastern border in the townland of Mweeloon and the other along the eastern part of Tawin East (see Figures 6.1, 6.2 and 6.3, in Appendix 3B). In total, the area of salt marsh around Mweeloon Lagoon is estimated at *ca* 8.06ha. Within the saltmarsh habitat, brackish water pools occur. There was evidence of poaching and tracking by cattle and horses in both areas. Brent Goose droppings were recorded in some sections of the salt marsh in Tawin East.

Intertidal

There are extensive tracts of intertidal habitat, which is a mosaic of mud flats and sand flats and fucoid covered reef exposed at low water, along the seaward side of the northern shore of Mweeloon Lagoon. No Oyster trestles were noted at the eastern end of this habitat. Smaller areas of intertidal habitat occur along the seashore within the lagoon proper (see Figure 6.3). Redox

depths varied from 0.5 cms to 2 cms. An area of intertidal sand/shell habitat is present at low water in the northwestern corner of the lagoon. This was not surveyed as it was not possible to access it due to water depth.

Algae recorded included *Pelvetia canaliculata, Fucus spiralis, F. vesiculosus, F. serratus, Ascophyllum nodosum, Himanthalia* sp., *Codium* sp., *Laminaria hyperborea, Ceramium* sp., *Chondrus crispus, Ectocarpus* sp., *Lomentaria sp. Ulva lactuca, U. intestinalis, Corallina officinalis* and *Palmaria palmata.*

Invertebrate species noted included *Actinia equina,* hydroids indet., *Harmothoe* sp., *Arenicola marina, Spirobranchus triqueter, Spirorbis sp. Platynereis dumerilii, Phyllodoce* sp., *Anurida maritima, Apherusa* sp. amphipods indet., *Crangon crangon, Praunus flexuosus, Carcinus maenas, Calliostoma* sp., *Littorina littorea, L. obtusata, L. saxatilis, Nucella lapillus, Mytilus edulis* and Bryozoa indet. A *Mytilus edulis*-dominated community is present at the main opening to the sea in the northwestern part of Mweeloon Lagoon. The total area of intertidal habitat is estimated at 42.87 ha.

Other Species

Bird species recorded included Brent Goose (present up to April 28th), Merganser, Mallard, Teal, Little Egret, Heron, Redshank, Greenshank, Ringed Plover, Dunlin, Curlew, Whimbrel (present from April 18th), Black headed Gull, Herring Gull, Great black backed Gull, Sandwich Tern (present from April 27th) and Common/Artic Tern (present from April 28th).

Otter spraints were noted along the stony bank habitat.

4.3.2 Glasheen Island (see Appendix 5 for a selection of photographs).

Glasheen Island is a relatively narrow (*ca* 150m) strip of land that extends westwards from Knockmore on Mweenish Island as far as Ballaghbristy Point (see Figure 4). The channel at Ballaghbristy Point is a silled opening that creates an asymmetrical tide that ebbs for *ca* 9 hours and floods for *ca* 3 hours in and out of Tawin Lagoon. There is one other small access channel to the sea, Shanmullen Channel (see Figure 4), but this only functions in *ca* the last hour before and 1 hour after High Water Spring tides. Open sea (Inner Galway Bay) is present off its southern shore and Tawin Lagoon is present to the north of it. Salinity was recorded at 33 psu (practical salinity units) at Ballaghbristy Point. The underlying geology is limestone.

Stony Bank

With regard to compensatory habitats, perennial vegetation of stony bank is present all along the southern seaward boundary of Glasheen Island (see Figure 7.1, 7.2 and 7.3, in Appendix 3C). In total, the area of stony bank habitat at Glasheen Island is estimated at *ca* 2.31ha. There were signs of poaching and tracking along the eastern half of where this habitat was recorded.

Salt Marsh

Salt marsh is limited in distribution to the northern shore of Glasheen Island (see Figure 7.3). In total, the area of salt marsh around Glasheen Island is estimated at *ca* 10.06ha. Unlike the saltmarsh habitat recorded at Mweeloon Lagoon, no brackish water pools were recorded. There was evidence of poaching and tracking in the eastern half of Glasheen Island and there was also evidence of machine tracks along its entire extent. No Brent Goose droppings were recorded.

Due to the exposed nature of the southern shore to southeasterly, southerly, southwesterly and westerly winds, no sand flat of mud flat habitat occur in that area of Glasheen Island. The shore line is composed of limestone boulders which above half tide are mostly bare of any algae. Algae recorded in this area of intertidal habitat were limited to *Fucus spiralis, F. vesiculosus, F. serratus, Ascophyllum nodosum, Laminaria hyperborea* and small patches of *Ulva lactuca,* corraline crusts and *Corallina officinalis*.

Intertidal

Invertebrate species noted along the southern shore of Glasheen Island included hydroids indet., *Harmothoe* sp., *Spirobranchus triqueter, Spirorbis sp.* amphipods indet., *Carcinus maenas, Calliostoma* sp., *Littorina littorea, L. obtusata, L. saxatilis, Nucella lapillus, Mytilus edulis* and Bryozoa indet. A *Mytilus edulis*-dominated community is present at the main opening to the sea at Ballaghbristy Point.

Within Tawin Lagoon to the north of Glasheen Island, there are areas of intertidal habitat, which are a mixture mud flats and sand flats exposed at low water (see Figure 7.3). Redox depth was measured at 1 cm. An area of intertidal sand/shell habitat is present at low water in the central part of the lagoon and to the southeast of Inishcorra. These were not surveyed as it was not possible to access them due to water depths.

Algae recorded in this area of intertidal habitat were limited to *Pelvetia canaliculata, Fucus spiralis, F. vesiculosus, Ascophyllum nodosum* and small patches of *Ulva lactuca*.
Invertebrate species noted included hydroids indet., *Harmothoe* sp., *Arenicola marina, Spirobranchus triqueter, Spirorbis sp., Platynereis dumerilii, Phyllodoce* sp., Cirripedia sp., *Apherusa* sp., amphipods indet., *Crangon crangon, Carcinus maenas, Mytilus edulis* and Bryozoa indet.

The total area of intertidal habitat is estimated at 32.06ha.

Other Species

Bird species recorded included Great Northern Diver (coming into Summer plumage on April 25th.), Cormorant, Brent Goose (present up to April 28th), Merganser, Mallard, Little Egret, Heron, Redshank, Greenshank, Ringed Plover, Dunlin, Curlew, Whimbrel (present from April 18th), Black headed Gull, Herring Gull, Great black backed Gull, Sandwich Tern (present from April 27th), Common/Artic Tern (present from April 28th), Wheatear (present from April 18th), Peregrine Falcon and Kestrel.

Otter spraints were noted along the stony bank habitat and Harbour seals were frequently seen hauled out on the northeastern tip of Ballybristy Point. The maximum number recorded was 74 on April 20th.

4.3.3 Tawin West (see Appendix 6 for a selection of photographs).

The western extent of Tawin headland is separated from the central island of Tawin East by a channel, Tawin West Channel that links Tawin Lagoon on the south to Tawin West Lagoon to the north (see Figure 4). The specific area of interest extends westwards from Ballaghbristy to Kilcolgan Point including the southern half of Tawin West Channel. Water flow direction in this channel was from south to north under Tawin West Bridge up to *ca* 1 hour before High Water and the flow then reversed to flow from north to south for the last hour of the flood tide. Salinity in this channel was recorded at 31 psu.

Stony Bank

With regard to compensatory habitats, as for Glasheen Island, perennial vegetation of stony bank is present along the southern, western and northern seaward boundaries of Tawin West (see Figure 8.1, 8.2 and 8.3, in Appendix 3D). In total, the area of stony bank habitat at Tawin West is estimated at *ca* 4.28ha. There were signs of poaching and tracking along the eastern half of where this habitat was recorded.

Salt Marsh

Salt marsh is limited in distribution to the inner western parts of Tawin West (see Figure 8.3). In total, the area of salt marsh at Tawin West is estimated at *ca* 8.99ha. No brackish water pools were recorded. There was evidence of poaching and tracking in the central parts of Tawin West and along the western part of Tawin West Channel. A drivable track is present in that same section of Tawin West Channel.

As noted for Glasheen Island, the exposed nature of the southern shore to southeasterly, southerly, southwesterly and westerly winds means that no sand flat of mud flat habitat occur in that area of Tawin West. The shore line is composed of limestone boulders which above half tide are bare of any algae because of exposure and erosion. Algae recorded in this area of intertidal habitat were limited to *Fucus spiralis, F. vesiculosus, F. serratus, Ascophyllum nodosum, Laminaria hyperborea* and small patches of *Ulva lactuca*.

Invertebrate species noted along the southern shore of Tawin West included hydroids indet., *Harmothoe* sp., *Spirobranchus triqueter, Spirorbis sp., Cirripedia sp.,* Amphipoda indet., *Carcinus maenas, Littorina littorea, L. obtusata, L. saxatilis, Nucella lapillus, Mytilus edulis* and Bryozoa indet.

Intertidal

There are areas of intertidal habitat which are a mixture mud flats and sand flats exposed at low water in the inner section of Tawin West lagoon (see Figure 8). Redox depth was measured from between 0.5 cms to 2 cms.

Algae recorded in this area of intertidal habitat were limited to *Pelvetia canaliculata, Fucus spiralis, F. vesiculosus, Ascophyllum nodosum* and small patches of *Ulva lactuca*.

Invertebrate species noted included hydroids indet., *Arenicola marina, Spirobranchus triqueter, Spirorbis sp., Platynereis dumerilii, Phyllodoce* sp., Cirripedia sp., *Apherusa* sp., amphipods indet., *Crangon crangon, Carcinus maenas and Mytilus edulis.*

The total area of intertidal habitat is estimated at 61.4ha.

The underlying geology is limestone.

Other Species

Bird species recorded included Cormorant, Brent Goose (present up to April 28th), Merganser, Mallard, Little Egret, Heron, Redshank, Greenshank, Ringed Plover, Dunlin, Curlew, Whimbrel (present from April 18th), Black headed Gull, Herring Gull, Great black backed Gull, Sandwich Tern (present from April 27th) and Common/Artic Tern (present from April 28th).

Otter spraints were noted along the stony bank habitat.

Shell Midden

A previously unrecorded shell midden was noted at the southwestern end of Tawin West (see photograph No. 17 in Appendix 6).

4.4 COLLATERAL BENEFIT

One of **the** most important findings of this survey work is that the marine waters within Tawin can be defined as “lagoon” which is a priority habitat within the EU Habitats Directive. This is because:

1. The seaward openings at Ballaghbristy Point on the south shore of Tawin and Ballaghbristy East and West on the north shore are cilled,
2. Sea water is retained in the landward areas of the water body and
3. Sections of these areas never dry out at Low Water.

The total area of lagoonal habitat at Tawin has been estimated at 267.5 ha. This habitat is mapped on Figure 9.

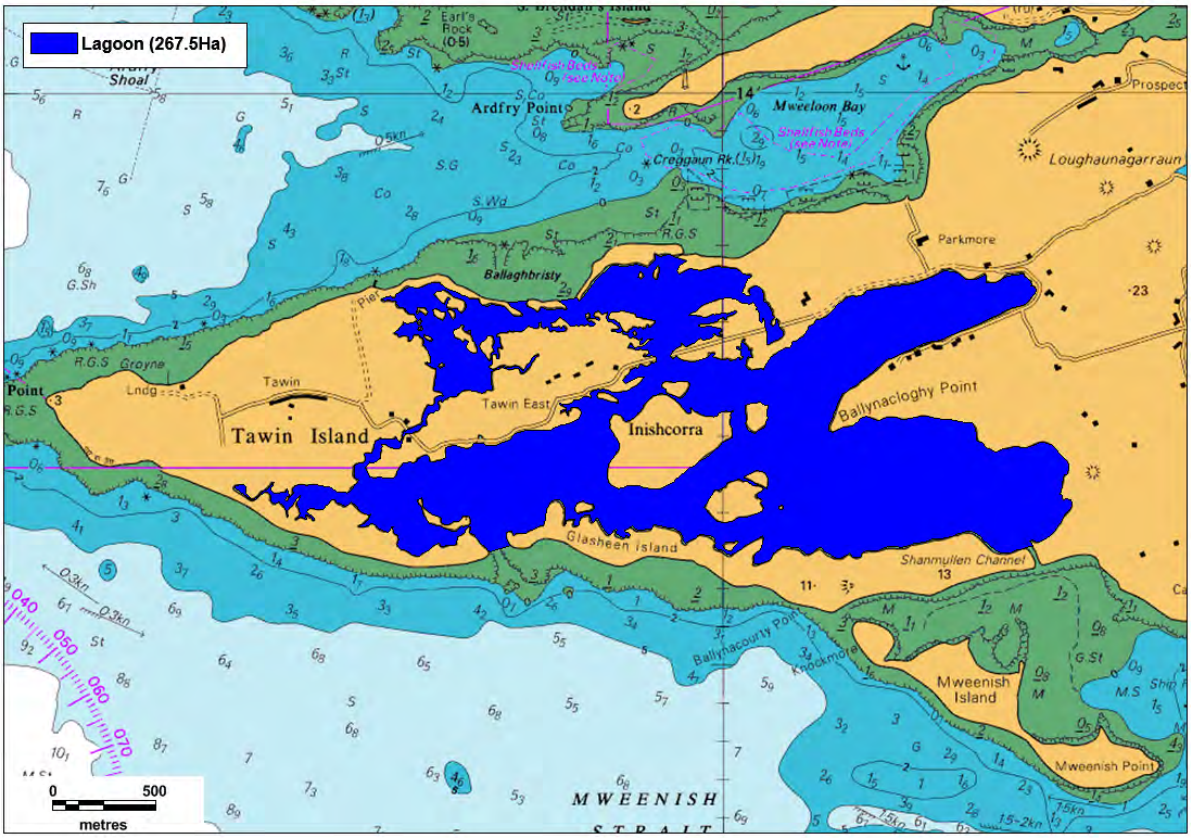

Figure 9. Extent of lagoonal habitat at Tawin (shown in blue).

Of the three sections of Tawin Headland examined, the area of Mweeloon Lagoon is regarded as being most similar to the area where the proposed expansion of the Galway Harbour Extension is proposed. This is because it is less exposed as it faces to the northwest and the fetch distance to the north shore is *ca* 5km whereas the fetch distance of Tawin West and Glasheen Island is potentially thousands of kilometres. This is reflected by the clear signs of coastal collapse observed at both these areas. Furthermore, the exposed nature of the southern shore makes it impossible for finer sediments to accrete and give rise to mud and sand flats exposed at low water. The habitat type only occurs in the inner parts of both Glasheen Island and Tawin West.

Observations also showed that although there is some erosion, the northern shoreline of Mweeloon Lagoon is experiencing a lower level of erosion in comparison to the southern shore of Glasheen Island and Tawin West. Given the lower level of exposure along the northern shoreline of Mweeloon Lagoon, sandy sediments can and do accrete there and there are extensive areas of this habitat type at that location. Sea weed is abundant on this shore whereas macroalgae only occur on the lower half of the southern shore.

The more sheltered nature of the north shore line in comparison to Glasheen Island and Tawin West also means that the stony bank habitat is less frequently disturbed in that area than the much more exposed nature of the southern shoreline.

The sheltered nature of the inner parts of Mweeloon Lagoon give rise to muddy sediments and lug worm casts were noted on the surface of these sediments.

Figure 10 below shows the lagoon habitat outlined in red which represents an area of *ca* 23.96 ha. The furthest eastern part of the lagoon is perched and only floods during Spring tides.

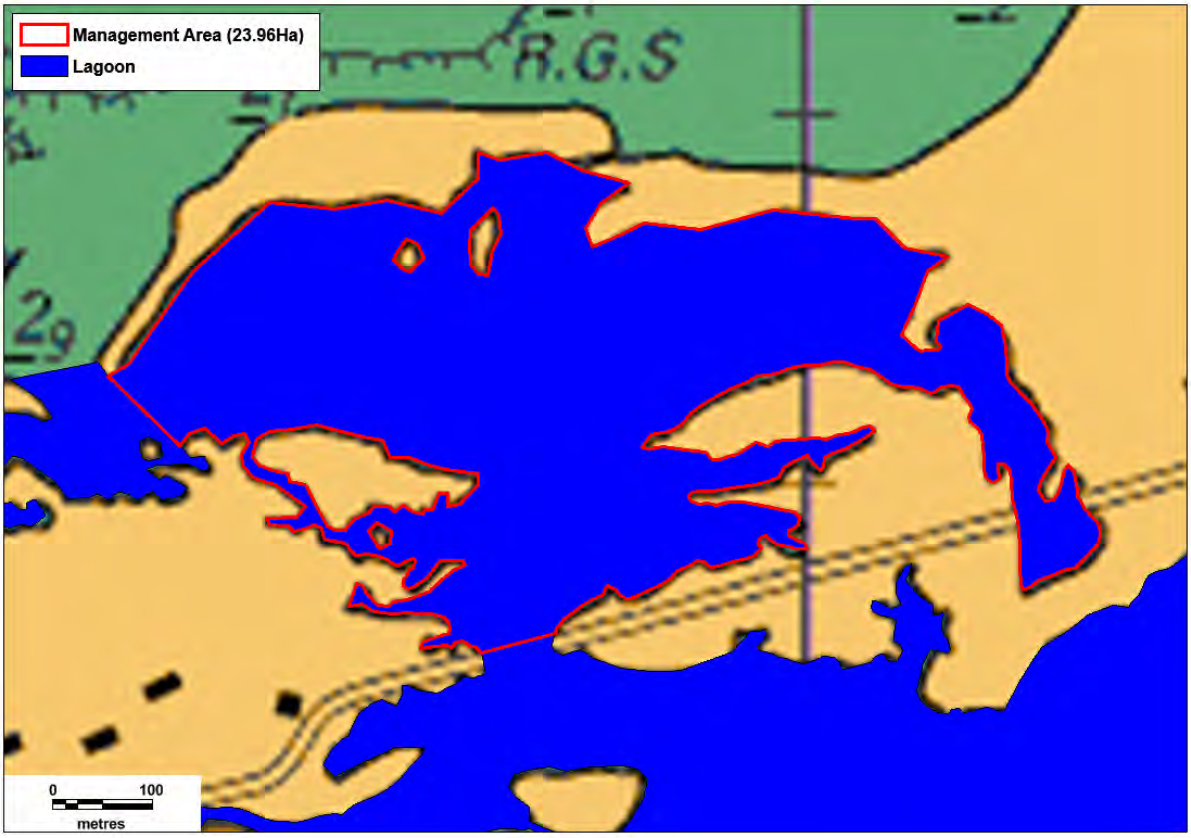

Figure 10. Extent of lagoonal habitat at Mweeloon (outlined in red).

4.5 PREFERRED LOCATION

For all of the above reasons, the area of Mweeloon Lagoon is considered to be the preferred location for carrying out the proposed management plan to compensate for habitat loss that will arise from the planned Galway Harbour Extension and that arose during the construction of the Galway Harbour Enterprise Park).

The areas proposed to be purchased for management are shown on Drawing 7476-1031D, Fig. 6.1 in Appendix 3B.

5 EXTENT OF COMPENSATION

Appendix 7 contains a generic table for each of the three habitats types for which compensation is required and lists the management proposals for each under two main headings *i.e.* Ownership and Management. The Management heading is further broken down into five sub headings namely:

1. Damaging Impacts *e.g.* grazing, slurry spreading, use of weed killers *etc*
2. Damaging works *e.g.* drainage, machinery tracking over the habitat *etc*
3. Constraining works *e.g.* no construction works on the habitats

4. Removal of litter on an on-going basis and
5. Monitoring.

Each of these headings and subheadings is assessed in terms of its effectiveness and is scored against the seven topics listed EU Article 6 IROPI Guidance document *i.e.* Targeted Compensation, Effective Compensation, Technical Feasibility, Extent of Compensation, Location of Compensatory Measures, Timing of Compensation and Long Term Implementation and these scores are then used as a basis to arrive at an equivalent compensatory area for each habitat. Subject to agreement of this assessment methodology, the detailed qualitative and quantitative study results are proposed to be presented in this format to show the extent and effectiveness of the compensation to be proposed. The Tables presented in Appendix No. 7 are generic only and are presented to illustrate how the actual results will be presented following the detailed site studies.

6 PROPOSAL

At this stage it is now proposed to proceed as follows:-

- **Preferred Location**

Based on the qualitative surveys carried out at the end of April, it is proposed to concentrate the quantitative survey for compensatory habitats at Mweeloon Lagoon and its immediate surrounds. See Figure 6.1 Appendix 3B.

- **Quantitative Surveys**

Detailed surveys will be undertaken over the next few weeks both at Renmore and in and around Mweeloon Lagoon.

The intertidal work and reporting will be carried out by AQUAFACT while the stony bank and saltmarsh survey work at both locations will be carried out by John Conaghan.

In addition, a preliminary survey and report on *Didemnum* in the vicinity of Mweeloon Lagoon will be carried out by AQUAFACT.

- **Management Plan**

Following the completion of the surveys at both locations, the generic compensatory Management Assessment Tables in Appendix No. 7 will be populated as regards the management measures.

- **Ownership / Control**

Consultation is currently underway with the various landowners to first of all get agreement to allow the various surveys to be carried out.

Discussions are also under way regarding purchase of the land proposed, as referenced above and in the Tables in Appendix 7.

- **Extent of Compensation**

The outcome of these discussions will also be entered into the assessment tables so as to allow for the *"extent of compensation"* as set out at Sect. 1.5.4 of the Guidance Document to be assessed.

- **Progress**

As we are now in the month of August 2017, it is proposed to proceed on the above basis and then proceed to a final Version 2.4 which will be the Phase 2 of the development of the proposed compensatory measures as outlined in the Board's communication of 28th September 2015. This will be submitted on completion of the proposed studies and assessment and following receipt from An Bord Pleanála of the consideration of this V2.3B submission.

7 REFERENCES

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APPENDIX 1

EU Commission Opinion (Copy) – TGV EST – Nied Valley, France 2004

COMMISSION EUROPÉENNE

SECRÉTARIAT GÉNÉRAL

Bruxelles, le 9 septembre 2004

FDE

C(2004)3460

NOTE POUR LES MEMBRES DE LA COMMISSION

E/1795/2004

NORMALE

Délai: JEUDI 16 SEPTEMBRE 2004 - 11 H

Observations éventuelles : service des procédures écrites SG-A-2
Fax : 64316 - Tél.: 52362 / 52363

Objet : Directive "Habitats"
- avis de la Commission (France)

Proposition de Mme WALLSTRÖM

Décision proposée :

- approuver le projet d'avis de la Commission, émis conformément à l'article 6, paragraphe 4, deuxième alinéa, de la directive 92/43/CEE du Conseil, du 21 mai 1992, concernant la conservation des habitats naturels ainsi que de la faune et de la flore sauvages (directive "Habitats"), en ce qui concerne la demande d'avis et d'échange d'informations adressée par la France à la Commission européenne dans le cadre de la directive "Habitats", en relation avec le projet de construction d'une Ligne Grande Vitesse (TGV Est) ;
- le texte en langue française est le seul faisant foi.

Commentaire :

Selon le service responsable, ce projet ne comporte pas d'incidences financières sur le budget communautaire.

P. Bugnot

Patricia BUGNOT
Directeur du Greffe

Destinataires : Mme DAY, MM. LAMOUREUX, MEADOWS, PETITE

E/1795/2004

NOTE DU SECRETARIAT GENERAL

PREPARATION DU DOCUMENT

Direction générale responsable

ENV Environnement

Services Associés

pour accord

SG	Secrétariat général	: Accord
TREN	Energie et Transports	: Accord
REGIO	Politique régionale	: Accord

pour avis

SJ	Service juridique	: Avis favorable

Langue originale : FR

En cas de demande de corrigendum/suspension de cette procédure, **les cabinets et/ou le Service juridique** sont invités à envoyer leurs observations à la boîte fonctionnelle "**SG A-2 ACCORDS CABINETS**".

Dossier traité par Ulrike TRAUTENBERGER - BREY 13/17 - 67372

Info-point PROCEDURE : **SG/A/2 (52362- 52363)**
Info-point NOTIFICATION : Valérie GALLOO (tél. 69522)
Info-point PUBLICATION : Colette Jansen (tél. 60432)

MEMORANDUM TO THE COMMISSION

1. SUBJECT: OPINION ACCORDING TO ART. 6 (4) OF COUNCIL DIRECTIVE 92/43/EEC OF 21 MAY 1992 ON THE CONSERVATION OF THE NATURAL HABITATS AS WELL AS THE WILD ANIMALS AND PLANTS[1], DELIVERED UPON REQUEST OF THE REPUBLIC OF FRANCE

Natura 2000 is a Community-wide network of nature protection areas established under the 1992 Directive 92/43/EEC on the conservation of the natural habitats as well as the wild animals and plants (the 'Habitats directive). It aims to promote the maintenance of biodiversity by assuring the long-term survival of Europe's most valuable and threatened species and habitats. The network is composed by sites that have been classified by Member States as Special Protection Areas (SPAs) according to the Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds[2] (the 'Birds directive') or proposed as Sites of Community Importance according to the Habitats Directive.

Natura 2000 sites are subject to the protection regime laid down in article 6 (3) and (4) of the Habitats directive: Any plan or a project having a significant negative effect on a site may only be authorised, if there is no alternative solution and if it is justified for imperative reasons of overriding public interest, including those of a social or economic nature. In this case the Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. If the site hosts a priority natural habitat type and/or a priority species, and if considerations relating to human health, public safety or beneficial consequences of primary importance for the environment cannot be invoked, **the project must be justified by other imperative reasons of overriding public interest, further to an opinion from the Commission.**

The subject of this decision is to adopt an opinion relating to a French project, according to article 6 of the Habitats directive. Corresponding request was submitted to the Commission by the Republic of France. In the following, a short summary of the opinion is given.

The Commission is hereby invited to adopt the above mentioned opinion and approve the notification to the Republic of France.

COMMISSION OPINION

delivered pursuant to the second subparagraph of Article 6(4) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive), concerning the request from France for advice and exchange of information with the European Commission within the framework of the Habitats Directive in relation to the project to build a high-speed line (TGV East)

1. Legal background

Article 6(3) of Directive 92/43/EEC[1] stipulates that any plan or project not directly connected with or necessary to the management of a Natura 2000 site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, must be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of its implications for the site and subject to the provisions of paragraph 4, the competent national authorities may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

Article 6(4) of Directive 92/43/EEC stipulates that a plan or a project may be carried out in spite of a negative assessment of the implications for a Natura 2000 site, in the absence of alternative solutions, if it is justified for imperative reasons of overriding public interest, including those of a social or economic nature. In this case, Member States must take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected and must inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species, and if considerations relating to human health, public safety or beneficial consequences of primary importance for the environment cannot be invoked, the project can be justified, further to an opinion from the Commission, by other imperative reasons of overriding public interest.

2. France's request

On 12 March 2004 the Permanent Representation of France to the European Union sent DG Environment an official notification, in accordance with Article 6(4) of the Habitats Directive, concerning the project to build a high-speed line (Section F – TGV East), together with a request for advice addressed by France to the European Commission in the framework of the Habitats Directive (hereinafter "the notification").

Accompanying the notification, the French Government sent the documentation required by DG Environment, namely the impact document relating to Section F of the TGV East.

An account of the exchanges with the French administration and other stakeholders that led to the drafting of the present text is given in **Annex 1**.

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[1] JO N° L 206 dated 22.07.1992, p.7

The documentation received from the French Government is listed and numbered in **Annex 2**. Reference will be made to these numbers in the remainder of this document.

3. The project

The TGV East project was declared to be of public utility on 14 May 1996. It involved the construction of a new 406 km railway line between Vaires-sur-Marne (Paris region) and Vendenheim (near Strasbourg) to enable high-speed trains to connect Paris with the cities of eastern France and with neighbouring countries and to connect the eastern regions of France with the country's western, south-western and northern regions without having to go via Paris.

In January 1999 France decided to implement the project in phases, starting with the construction of the new 300 km line between Vaires-sur-Marne and Baudrecourt.

This phased approach requires the construction of an additional 4.6 km of track to link the high-speed line to the existing Metz–Réding line so that the TGV can run to Strasbourg. The new link branches off from the original Herny link (allowing trains to run to Saarbrücken) and crosses the municipalities of Baudrecourt, St Epvre and Vatimont in the Moselle department. This is where the TGV East line cuts across the Natura 2000 site at two points: the link to the Metz–Strasbourg line cuts through the salt meadows of Baudrecourt, while the original link to Saarbrücken (contained in the 1996 declaration of public utility) cuts through the mesophilic and hygrophilous meadows at St Epvre and Vatimont.

The Baudrecourt link was declared to be of public utility on 29 April 2002.

4. The Natura 2000 sites directly involved

There is no doubt that the project will significantly affect, within the meaning of Article 6(3) of Directive 92/43/EEC, the integrity of several sites of Community interest proposed for the Natura 2000 network and the habitats and species occurring in them, as well as areas of major ornithological interest which should have been proposed as Special Protection Areas under Directive 79/409/EEC. In these circumstances, the project may be carried out only if it complies with the requirements of Article 6(4) of Directive 92/43/EEC and the provisions of Directive 79/409/EEC.

Judging by the notification, the project to build the high-speed line (Section F) will significantly affect a priority habitat listed in Annex I to Directive 92/43/EEC – Habitat 1340 "Inland salt meadows" as it crosses a site of Community interest – FR 4100231 "Secteurs halophiles et prairies humides de la vallée de la Nied" – proposed by France under Directive 92/43/EEC.

5. Assessment of the project's effects on Natura 2000 sites

5.1. The direct effects forecast for the project

With the construction of the additional link under the phased approach, the European TGV East line will, in crossing the Natura 2000 area, destroy 3.75 hectares of salt meadow and subhalophytic meadow. This represents 0.55% of France's mainland halophytic areas and 18.6% of the halophytic areas included in the French Nied Valley area proposed for the Natura 2000 network. In terms of mesophilic meadow, the project will affect 0.02% of the mesophilic meadow area included in the Nied Valley Natura 2000 area.

The Commission believes these assessments can be considered appropriate within the meaning of Article 6(3) of Directive 92/43/EEC.

The Commission believes that the expected implications for these habitats may affect the overall coherence of Natura 2000 and that, subject to compliance with other requirements of Article 6(4) of the Habitats Directive, adequate compensatory measures therefore need to be taken. Such measures must be seen as a precondition for the project to go ahead.

6. Alternatives – other options for the project

The advantage of France's decision to phase construction of the high-speed line in Baudrecourt was the proximity to lines already in operation and the fact that work on the Saarbrücken link planned in the initial project was already under way in this area. Having the additional link branch off from the Saarbrücken link, which crosses the Metz-Réding line, would greatly reduce the length of new infrastructure required (4.6 km) and thus have the least impact on the natural environment. Alternative routes for the new link further south would not have avoided the Natura 2000 area.

7. Imperative reasons of overriding public interest

In its notification, the French Government refers in particular to the abovementioned lack of options for linking the existing lines in support of its declaration that the project has to be implemented for an imperative reason of overriding public interest other than those related to human health, public safety or beneficial consequences of primary importance for the environment.

In addition, the European TGV East project was viewed favourably in the Council of Ministers of the European Community on 14 and 15 December 1990 and was chosen as a priority project by the European Council in 1994, having benefited from Union decisions regarding the priority of infrastructure projects to be implemented.

8. Proposed mitigation and compensatory measures

To offset the project's likely effects on Natura 2000 as described in the notification, the French authorities propose a series of mitigation and compensatory measures planned as follows:

Mitigation measures:

- *Adaptation of the longitudinal section*: to minimise the project's impact on the area concerned, the route has been optimised so as to reduce the longitudinal section and thus limit the surface area occupied by the embankments; the construction of a 300 m viaduct where the existing railway track is crossed also serves to reduce the surface area needed for the project.
- In the work phase, precautionary steps are to be taken to protect the site from any additional harm: for example, ground marking to prevent site machinery moving off the site proper.

Compensatory measures and timetable:

In addition to the effort to reduce the project's impact through the project design, compensatory measures have been planned by the contracting authority and validated by

DIREN Lorraine (decentralised department of the Ministry of the Environment). Designed to perpetuate the salt environment, they operate on three fronts:

- preservation of the remaining salt meadows near the line over a surface area of around 31 hectares by means of a management agreement between the contracting authority and a nature protection body. The latter will draw up individual agreements with each of the farmers concerned. Moves are already under way with the farmers, who have given their agreement in principle. The agreements should be finalised during 2004.

- restoration of the site and re-establishment of salt meadows. A restoration trial was carried out in 2003 on 20 ares of land (preparation of site, sowing of local seeds and implementation of scientific monitoring over 5 years focusing on salinity and vegetation (still under way)). Drainage ditches will be filled in as part of the work associated with the land consolidation in 2005 so as better to preserve the special character of these areas.

- preservation of the Nied Valley salt meadows not adjacent to the TGV line but included in the Natura site. Mapping of the natural habitats in the area proposed for the Natura 2000 network in the Nied Valley, carried out by the University of Metz and financed by the contracting authority (RFF), identified 6 halophytic sites in the valley. The Aubécourt site, which is the most remarkable, has been selected for RFF to purchase 3.5 hectares of land for heritage management via an agreement concluded with the specialised body already approached to manage and preserve the 31 hectares. Purchase of these areas of land should be completed during 2004.

All the compensatory measures and the grounds justifying them are described in detail in the impact document for Section F of the TGV East.

The Commission considers that the proposed compensatory measures, as described in the notification and the documents mentioned in Annex 2, are sufficient to make up for the project's effects on Natura 2000 provided that they are executed in a timely manner corresponding to the phasing of the project and that the proposed management plans assure their long term effectiveness.

9. Opinion of the Commission

Taking into account the arguments set out above, the Commission takes the view that the TGV East high-speed line project, as described in the notification and in the documentation mentioned in Annex 2 to this text, especially the impact document for Section F of the TGV East line, can be executed for reasons of overriding public interest on condition that all necessary compensatory measures to ensure the overall coherence of Natura 2000 are taken in good time.

With regard to the opinion expressed in this document the Commission notes the following:

- this opinion is valid for this particular project, as described in the abovementioned additional documents submitted to the Commission by the French authorities, and cannot be considered applicable to possible effects of the TGV construction project on other Natura 2000 sites;

- this opinion presumes that the compensatory measures will be implemented and monitored as described in the abovementioned documents submitted to the Commission by the French authorities;

- this opinion presumes that the results of the accompanying monitoring programmes regarding Natura 2000 will be taken into account in the sense that they may, if need be, lead to appropriate rectifications in project design or to additional compensatory and mitigation measures.

ANNEX

Annex 1: Sequence of exchanges between the Environment DG of the Commission and the French authorities

At the beginning of November 2003, DG Environment was consulted by DG Transport in relation to an application for Community funding for the TGV East project. DG Environment requested additional information and concluded that the project might have implications for several sites of Community interest and for important bird areas, and decided to open an own-initiative case in order to address the French authorities regarding this matter.

The Commission has analysed the impact studies of the sites in question. The proposed mitigation measures reduce the impact for most of the sites of Community interest. However, in the case of the Nied Valley site, which was proposed by France for the Natura 2000 network, the project will lead to the destruction of a priority habitat and, where it crosses the Meuse Valley, may have an impact on bird species in an area which, although not yet proposed by France as a Special Protection Area, deserves to be listed as such.

On 13 January 2004, at a technical meeting of representatives of the Commission and the Ministries of Infrastructure and Ecology, the French authorities were advised to notify the Commission of the project in accordance with Article 6 of the Habitats Directive. To avoid presenting the Commission with a *fait accompli*, the authorities were also advised to request its opinion as a pre-condition for the decision to go ahead with the project.

The Commission also reminded the authorities that, although the Meuse Valley has not been designated as an SPA, Article 4 of Directive 79/409/EEC nevertheless applies. The area must therefore be strictly protected and the construction of infrastructures that may have an impact on protected species is not permitted.

On 12 March 2004, an official notification was sent in accordance with Article 6(4) of the Habitats Directive, together with an impact study for section F of the TGV East. France requested the Commission's opinion on the compensatory measures for the priority habitat affected and informed it of the measures to mitigate the effects on non-priority species and habitats.

Annex 2: documents sent by the French authorities to DG Environment:

- Impact study for section F of the TGV East (sent on 12 March 2004)
- Request for opinion in accordance with Article 6 of Directive 92/43/EEC (sent on 12 March 2004)
- The Commission has also received all the impact studies carried out in the framework of the TGV East project (a copy was sent by the project owner but has not yet been officially forwarded by the French Ministry of Infrastructure).

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[11] In the different language versions of Article 6(4) of Habitats Directive, the following terms are used for the English "opinion": "advies" in Dutch, "avis" in French, "Stellungnahme" in German, "consulta" in Spanish and "parere" in Italian. The term "opinion" will be used throughout this document.

APPENDIX 2

EU Commission Opinion (Copy) – Project Mainport Rotterdam, The Netherlands, 2003.

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 24/04/2003

OPINION OF THE COMMISSION

delivered pursuant to Article 6.4 § 2 of Council Directive 92/43/EEC of 21 May 1992 on the conservation of the natural habitats and of wild fauna and flora (Habitats Directive), concerning the "Request by the Netherlands for advice and exchange of information with the European Commission within the framework of the Birds and Habitats Directives ", in relation to the "Project Mainport Rotterdam" Development Plan

I. The legal framework

Article 6(3) of directive 92/43/EEC prescribes that any plan or project not directly connected with or necessary to the management of a Natura 2000 site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of its implications for the site and subject to the provisions of paragraph 4, the competent national authorities may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

According to article 6(4) of directive 92/43/EEC, a plan or a project may be carried out in spite of a negative assessment of the implications for a Natura 2000 site, in the absence of alternative solutions, if it is justified for imperative reasons of overriding public interest, including those of a social or economic nature. In this case the Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected and it shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and/or a priority species, and if considerations relating to human health , public safety or beneficial consequences of primary importance for the environment cannot be invoked, the project can be justified, further to an opinion[1] from the Commission, by other imperative reasons of overriding public interest.

II. The Dutch request

On 12.03.2002, the Permanent Representation of the Netherlands to the EC sent to DG Environment a formal notification according to article 6(4) of the Habitats Directive regarding

[1]Different language versions of art. 6.4 of the Habitats Directive use different terms for "opinion" : the Dutch text mentions "advies", the French one "avis", the German one "Stellungnahme", the Spanish one "consulta" and the Italian one "parere". The term "opinion" will be maintained throughout this document.

the plan "Project Mainport Rotterdam" (PMR), titled " PMR Birds and Habitats Directives - Request by the Netherlands for advice and exchange of information with the European Commission within the framework of the Birds and Habitats Directives" (further: "the notification").

On 17.05.02, DG Environment requested the Dutch Government to submit for clarification a series of documents and studies mentioned in the text of the notification.

On 03.07.2002 and 08.07.2002, the Dutch government sent the requested documentation to DG Environment.

A detailed account of the exchanges with the Dutch administration and other stakeholders that led to the drafting of the present text is given in annexes 1 and 2.

The documentation received from the Dutch governement is listed and numbered in annex 3 . It will be referred to by these numbers in the subsequent part of this text.

III. The Project

The Dutch Government has decided to launch a planning exercise regarding the future of the harbour of Rotterdam. It has justified this measure by reference to predictions that in the case of continuing economic growth trends, a shortage of space for petrochemical industry, container handling and the distribution sector would develop in the Rotterdam harbour and its surrounding industrial areas.

Project Mainport Rotterdam (PMR – further "the plan") is an extension plan for the port of Rotterdam consisting of a combination of better use of space still available in the existing harbour area, the "Maasvlakte 2" land reclamation from the sea covering 2500 ha (further "the land reclamation project") and 750 ha new nature and recreation areas on shore.

Under Dutch planning procedures, the project has passed a public consultation and is now at the stage of a cabinet decision which has to be followed by an approval vote in parliament.

There is no doubt that the project will significantly affect in the sense of article 6 (3) of directive 92/43/EEC the integrity of several Natura 2000 sites and habitats and species occurring in them. In this situation, the project can only be carried out if it complies with the requirements of article 6(4) of directive 92/43/EEC.

IV. The Natura 2000 sites that are directly involved

According to the notification the land reclamation project that will result in westward extension into the North Sea of the existing Maasvlakte is expected to significantly affect a priority habitat as well as two other habitats listed in Annex I of directive 92/43/EEC, one plant species of annex II of the Habitats Directive and two bird species listed in annex I of directive 79/409/EEC in a Special Protection Area (SPA - according to directive 79/409/EEC) and in proposed Sites of Community Importance (pSCIs - according to directive 92/43/EEC) in the coastal and estuary zones South of Hoek van Holland.

The affected SPA is : "Voordelta" (NL 4000017)

The affected pSCI's are : "Voorne's Duin" (NL 9803077), "Kwade Hoek" (NL 2000006) "Kop van Goeree" (NL 9801079) and "Voordelta" (NL 4000017)

The affected habitats are : 2130* ("Grey Dunes") , 2120 ("White Dunes"), 1110 ("Sandbanks which are slightly covered by seawater all the time")

The affected plant species is : the fen orchid *Liparis loeselii*

The affected bird species are : the Slavonian grebe (*Podiceps auritus)* and the Scaup (*Anthya marila)*

V. Assessment of the effects of the land reclamation project of PMR on Natura 2000 sites

1. The expected direct effects of the land reclamation project on surrounding Natura 2000 sites have been reported in detail in part B of document IX, which is the annex concerning nature and recreation to the Environmental Impact Assessment covering the whole PMR plan . This EIA was carried out from 1998-2000 and was audited by the Dutch Commission for EIA (Commissie voor MER – doc. III) an independent body in charge of overseeing the application of EIA legislation in the Netherlands. The audit approved the completeness and the validity of the information provided and corroborated the public consultation procedures involving a wide range of private and public stakeholders. The findings from document IX have been taken into account in document VIIIa and document VIIIb, which are important elements in the Dutch decision making procedure.

The Commission holds the view that these assessments can be considered appropriate in the sense of article 6 (3) of directive 92/43/EEC.

According the above mentioned assessment, the following priority habitats, habitats and species listed in annexes of the habitats Directive will be significantly affected by the land reclamation project:

- 2130* ("Grey Dunes") in an order of magnitude of approx. 19.5 ha (priority habitat) located in the pSCI's Voorne's Duin (NL 9803077) and Kop van Goeree (NL 9801079).
- 2120 ("White Dunes"), in an order of magnitude of 23 ha (non priority habitat) located in the pSCI's Voorne's Duin (NL 9803077), Kwade Hoek (NL 2000006) and Kop van Goeree (NL 9801079).
- 1110 ("Sandbanks which are slightly covered by seawater all the time"), in an order of magnitude of 3125 ha (non priority habitat) located in the pSCI Voordelta (NL 4000017).

The expected effects on terrestrial habitats are believed to be caused by a decrease in salt spray which is due to the sheltering from marine influence by land reclamation.

The expected effects on the marine habitat will be caused by direct covering of the underwater shore and expected morphological changes in the Haringvliet estuary.

- The occurrence of the fen orchid *Liparis loeselii* (non priority species) is being significantly affected at one fifth of the sites where it occurs in the pSCI Voorne's Duin (NL 9803077).

This expected effect is thought to be caused by rising of the groundwater table.

According to the above mentioned assessment, the following bird species listed in annex I of the Birds Directive 79/409/EEC are expected to be significantly affected by the land reclamation project, through reduction of the area of habitat 1110:

- The occurrence of the Slavonian grebe (*Podiceps auritus)* is expected to decline by 0.1 to 5 % in the SPA "Voordelta" (NL 4000017).

- The occurrence of the Scaup (*Anthya marila)* is expected to decline by 8 to 16 % in the SPA "Voordelta" (NL 4000017).

The Commission holds the view that the expected changes in habitat structure and species occurrence may affect the overall coherence of Natura 2000 and, subject to meeting other requirements of art. 6.4 of the Habitats Directive, should therefore be adequately compensated. Such compensation has to be seen as a pre-condition for the land reclamation project to go ahead.

2. Effects of sand extraction

The audit of the comprehensive EIA of the PMR plan by the Dutch Commission for EIA (doc. III) contains certain observations about lacking information about the effects on coastal sea habitats of sand extraction from the seabed for land reclamation. These remarks were included in the planning documents VIIIa and VIIIb. The relevant maps in these documents show that the proposed sand extraction perimeter is located right next to the reclamation area, which means that it also borders the SPA "Voordelta". Although a buffer strip was added on map 3.2 in annex 2 of document VIIIb, it may seem appropriate to investigate the potential for a significant effect on the Natura 2000 site "Voordelta" of sand extraction in this area.

For the reasons explained above, the Commission holds the view that the effects on the Natura 2000 site "Voordelta" of sand extraction in the perimeter indicated in docs. VIIIa and VIIIb are to be considered as a separate project occurring in combination with the land reclamation project and may therefore have to be the subject of separate assessments in the sense of article 6(3) of the Habitats Directive. The Commission notes the explicit mention that is made in document VIIIb to the necessity of halting any sand extraction that may prove to have negative effects on Natura 2000 sites.

3. Effects on the Wadden Sea.

The Wadden Sea is a Natura 2000 site of paramount international importance, designated both as an SPA and as a pSCI and also as a Ramsar Convention Area. The conservation of the natural environment in this area depends largely on the stability of a process of alternating sedimentation and erosion that is fed by sediment transport from the the S. part of the North Sea along the Dutch coast. A study by Delft Hydraulics (doc. IV) about the effects of different PMR land reclamation scenarios on sediment transport comes to the conclusion that the largest effects are to be expected S. of the land reclamation area and that effects on the sediment balance in the Wadden Sea are rather small. However, the same study also points out that the error margin of its findings is still considerable and that therefore no firm conclusions about effects on the Wadden Sea can be established, altough it appears to be certain that sediment transport towards the N. would decrease as a result of the PMR land reclamation project.

The Commission notes that the assessment of possible effects of the proposed land reclamation on the sediment balance in the Wadden Sea have been investigated as much as current scientific knowledge and assessment techniques allow, but that the margin of error in the results of this assessment remains considerable.

Bearing in mind the precautionary principle, the Commission holds the view that the remaining risk for negative effects of the proposed land reclamation on the sediment balance in the Wadden Sea should be adressed by careful monitoring as an integral part of the execution process of the land reclamation project, with a possibility to take corrective measures if negative significant effects on the state of conservation of the Wadden Sea should occur or would become highly likely.

VI Alternative solutions and mitigation measures – alternative designs

Weighing of alternatives for the PMR plan has been carried out on two levels :

1. Different project approaches

Three different approaches to expand the Rotterdam harbour and to improve living conditions with minimal damage to the environment were studied :

- better use of existing space in the actual Rotterdam port area;
- increased use of existing port sites in the SW Netherlands;
- expansion of the existing Maasvlakte artificial peninsula by the land reclamation project.

Detailed accounts of these studies are given in docs. V, VIIIb and X. According to these planning documents, the SW Netherlands option was abandoned because of large investments in hinterland connections and lack of space for the kind of developments to be expected in Rotterdam, while the landside expansion of the existing Rotterdam port areas was not considered because of a too large potential for conflict with environmental, social and safety requirements.

2. Different land reclamation designs

Three main variants and several reference designs for shaping the new facilities to be established on reclaimed land are presented and studied in docs IV, V, VIIIa and IX. The options presented on p. 29 of the notification are two reference designs that belong to the variant C " Nature elsewhere / Land within boundaries". One reference design would make use of the existing harbour entrance, the other proposes a new entry channel farther out to sea. This second option appears to be more suitable to future extension of the land reclamation and is expected to offer better nautical security. But as it makes use of fixed structures that go farther from the coastline, it may have a larger effect on sediment transportation towards the North. In document VIIIb, the Dutch Government states that a phased project execution, including intermediate evaluations of the effects on the natural environment, will be its strategy to deal with uncertain effects and market demand for harbour space.

The Commission holds the view that the selection between alternative project approaches and between different land reclamation designs has been carried out in an appropriate manner, but notes the the second option for the land reclamation reference design would require more attentive monitoring of sediment transport with regard to the conservation status of the

Wadden Sea. The Commission also notes that a phased execution of the land reclamation project is essential for maintaining the possibility of taking corrective measures in the case of unexpected effects on Natura 2000 sites.

The construction of an underwater shoreline that mimics the natural situation of a "soft seawall" along the edge of the land reclamation area is identified as an important mitigation measure in relation to the effects on the SPA and pSCI "Voordelta" because it allows for partial recreation of habitat type 1110.

VII. Imperative reasons of overriding public interest

In the notification, the Dutch Government has advanced several elements on which it has based its declaration that the land reclamation project has to be executed for an imperative reason of overriding public interest other than those related to human health, public safety or beneficial consequences of primary importance for the environment.

These elements are:

- the fact that the portuary and industrial activity in the Rotterdam area is one of the main pillars of the Dutch economy, which is illustrated in docs. I and VII;

- the fact that the expected growth in global container handling and chemical industrial activity will lead to increased demand for space which will have to be met if the competitive position of the Rotterdam harbour in the Hamburg – Le Havre range has to be maintained;

- the fact that the harbour of Rotterdam is an essential multimodal crossroads in the TEN-T Network as established by "Decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport" network and is therefore of Community importance;

- the fact that the PMR project has to be considered as a project of common interest according to the provisions of art. 1 (5b) of "Decision No 1346/2001/EC of the European Parliament and of the Council of 22 May 2001 amending Decision No 1692/96/EC as regards seaports, inland ports and intermodal terminals as well as project No 8 in Annex III";

- the fact that the project approach that was chosen, which combines better use of available space, improvement of living conditions and development of new space by land reclamation, appears to find the best balance between the human and the natural environment in the Rotterdam urban and portuary area.

VIII. Proposed Compensations

To offset for the expected effects of the land reclamation project on Natura 2000 as described in the notification, Dutch authorities have proposed a compensation package consisting of new dunes and beach habitats and a marine reserve in the coastal sea area which is planned as follows:

1. Compensation for the effects on priority habitat 2130*

- It is proposed to create a new dune area of 100 ha off the Dutch coast between Hoek van Holland and Ter Heijde, inside which a sizable area of habitat 2130* will be allowed to develop over a period of 20 years.

2. Compensation for the effects on other habitats and species

- The loss of area for habitat 1110 will be compensated by a marine reserve of 31250 ha in the SPA "Voordelta". This will not involve new habitat creation but will entail measures that reduce disturbance of the seabed, such as certain restrictions on fisheries, allowing the creation of better conditions for foraging birds, such as the affected species *Podiceps auritus* and *Anthya marila*.

- The decrease in occurrence of *Liparis loeselii* will be compensated by the creation of 10 ha of habitat 2190 (Humid dune slack) in the above mentioned new dune area.

- The loss of area for habitat 2120 will be compensated by the creation of an equivalent area along the seaside of the Brouwersdam.

The complete set of compensation measures and the reasoning behind them are described in detail in the documents "Advies over natuurcompensatie bij een tweede Maasvlakte", IX and VIIIb, with maps in annex 2 of document VIIIb detailing their precise locations.

These compensation measures have been widely commented by stakeholders during the public consultation procedure mentioned in document III.

These compensation measures have been discussed in depth between Commission technical units, PMR planners and Dutch nature conservation NGO's.

The fishery sector has voiced opposition to the expected restriction on its activities, but the Commission has made it known that it considers this kind of measures as a purely national matter, insofar they are compatible with the Common Fisheries Policy and only affect Dutch operators.

The compensation proposal has been included in considerable detail in the document VIIIb and is also part of the practical arrangements mentioned in document XI. It can as such be considered to be ready for adoption as integral and essential part of the land reclamation project by the pending final and binding cabinet decision to execute the entire PMR plan.

Considering the expected effects of the land reclamation project on the priority habitat type 2130 and the expected results from the planned compensatory measures mentioned above, the Commission holds the view that in the long term the overall coherence of Natura 2000 will not be significantly affected.*

The Commission considers that the proposed compensations, as described in the notification and the documents mentioned in annex 3 are adequate to make up for the effects of the land reclamation project of PMR on Natura 2000, if they are executed in a timely manner that corresponds with the phasing of the land reclamation and if they are subject to management plans that assure their long term effectiveness.

The Commission advises the Government of the Netherlands to send reports on the implementation of the PMR plan project as a whole to its Directorate General for Environment on a periodic basis.

IX. Opinion of the Commission

Taking into account the arguments mentioned above, the Commission holds the view that the land reclamation project, as described in the notification and further illustrated in the documentation listed in annex 3 of this text, particularly so in document VIIIb, can be executed for reasons of overriding public interest on the condition that all necessary compensation measures to ensure the overall protection of the coherence of Natura 2000 be taken in due time.

With regard to the opinion expressed in this document the Commission notes the following:

- This opinion is valid for this particular project, as described in the above mentioned additional documents submitted to the Commission by the Dutch authorities and cannot be considered as applicable to possible effects of the PMR land reclamation project on other Natura 2000 areas.

- This opinion presumes that the compensatory measures will be implemented and monitored as described in the above-mentioned documents submitted to the Commission by the Dutch authorities.

- This opinion presumes that the results of accompanying monitoring programmes regarding Natura 2000 are taken into account in the sense that they may, if need be, lead to appropriate rectifications in project design or to additional compensation and mitigation measures.

Annex 1 : Sequence of exchanges between the Environment DG of the Commission and the Dutch administration

In **July 2000** the Dutch administration requested consultations with DG Environment about the application of art. 6 (3) & (4) of the Habitats Directive to an extension project for the Rotterdam Harbour. Several informal meetings between Dutch and EC officials took place during 2000-2001. DG Environment advised the Dutch representatives to notify the complete project to the Commission and to request an opinion from the Commission before taking any operational decisions.

05.11.2001 : Transmission of a draft concept for a notification according to article 6 (4) of the Habitats Directive, accompanied by an advisory study about the possibilities for compensating loss of natural values in affected Natura 2000 areas ("Advies over natuurcompensatie bij een tweede Maasvlakte", PMR 2001).

27.11.2001 : Meeting between Dutch officials and technical and legal units of DG ENV, following a request by the Netherlands.

- The Commission took note of the description of the project by the Dutch delegation.

- The Commission made the following statements regarding procedural steps:

"The Dutch authorities are advised to formulate the notification of the project according to art. 6 HD and the request for an opinion of the Commission as conditioning their decision to execute it , so as not to put the Commission before accomplished facts."

"The Commission will study in detail the advisory document on proposed compensation measures it received from PMR and compare it with the documentation on potential compensations that is has received from various Dutch NGO's and academic sources."

"The proposed concept for a notification of the PMR project according to article 6 (4) of directive 92/43/EEC does not elaborate on the land reclamation project's potential effects on the sediment balance in the Dutch coastal sea and the Wadden Sea. As the Wadden Sea is a Natura 2000 site of paramount international importance, the Commission expects that any final decision concerning PMR will contain appropriate monitoring elements and provisions to rectify developments affecting its conservation status."

"An opinion from the Commission in the sense of article 6 (4) of directive 92/43/EEC on the PMR project will have to take into account inputs from other Directorates General involved in harbour development, such as DG Regional Affairs, DG Transport and Energy and DG Economic and Financial Affairs."

12.03.2002 : The Netherlands sent to DG Environment a formal notification titled "PMR Birds and Habitats Directives - Request by the Netherlands for advice and exchange of information with the European Commission within the framework of the Birds and Habitats Directives" . This notification states that the Netherlands seek the opinion of the Commission concerning compensatory measures for the affected priority habitat and wish to inform the Commission concerning compensatory measures for the effects on non-priority species and habitats, prior to the final Cabinet decision ("PKB-plus , deel 4") to execute the project.

25.03.2002 : DG Environment reply to the notification about consulting other EC services about the project.

17.05.2002 : DG Environment request to the Dutch Government for submission of documents and studies mentioned in the text of the notification.

03.07.2002 and **08.07.2002** : Transmission by the Dutch government of the requested documentation.

Annex 2: Decription of exchanges about PMR between DG Environment and other Dutch stakeholders

During **2000-2001**, DG Environment received delegations from several Dutch nature conservation organisations who presented their views about the PMR project and submitted studies and other technical and legal documentation.

During **2000-2001**, DG Environment exchanged views with the Dutch National Fisheries Association ("Produktschap Vis") about the effects of land reclamation and nature compensation measures on fishing activities in the coastal sea.

In **2002**, DG Environment exhanged views with the European Dredging Association about the impact of the Habitats Directive on dredging operations related to the PMR project.

Annex 3 : Documentation received by the Environment DG of the Commission from the Dutch administration and mentioned in the text.

– Transmitted on 03.07.2002 :

(I.) Overview of economic data about the port of Rotterdam (Min. V &W)

(II.) Overview map with different components of PMR (Min V&W)

(III) "Toetsingsadvies over het MER mainportontwikkeling Rotterdam" (Commissie voor MER , 2001)

(IV) "Effecten van Landaanwinning Maasvlakte 2 op het slibtransport langs de Nederlandse kust" (Delft Hydraulics, 2001)

(V) PMR Interim Report "On Course" (PMR, 1999)

(VI) Clarification note about different studies mentioned in the notification (Min V&W)

(VII) Notitie "Het economisch belang van de Mainport Rotterdam" (Min V&W, 2000)

(VIIIa) "Ontwerp PKB-plus , deel 1" (PMR, 2001)

(VIIIb) "PKB-plus , deel 3 : Kabinetsstandpunt" (PMR , 2001)

(IX) "Bijlage Natuur en Recreatie Landaanwinning" (Rijkswaterstaat, 2nd version of May 2000)

(X) "Vervolgstappen bestaand Rotterdams gebied" (Gemeente Rotterdam, 2000)

- Transmitted on 08.07.2002 :

(XI) "Memorandum of understanding for the constituent projects of Rotterdam Mainport Development Project (PMR)"

APPENDIX 3

Mapping of areas and habitats

Appendix 3A **Overall Study Area – Tawin, Glasheen, Mweenish**

Fig. 2.1 Land Type Assessment
Fig. 2.2 Ownership Map
Fig. 2.3 Aerial Drone Survey Photographs

Appendix 3B **Mweeloon**

Fig. 6.1 Ownership
Fig. 6.2 Aerial
Fig. 6.3 Habitats

Appendix 3C **Glasheen / Tawin East**

Fig. 7.1 Ownership
Fig. 7.2 Aerial
Fig. 7.3 Habitats

Appendix 3D **Tawin West**

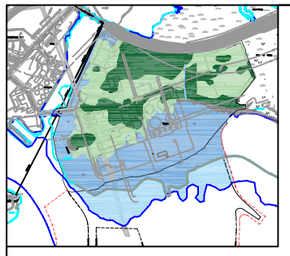
Fig. 8.1 Ownership
Fig. 8.2 Aerial
Fig. 8.3 Habitats

APPENDIX 3A

Mapping of areas and habitats

Appendix 3A **Overall Study Area – Tawin, Glasheen, Mweenish**

Fig. 2.1 Land Type Assessment
Fig. 2.2 Ownership Map
Fig. 2.3 Aerial Drone Survey Photographs



Proposed Harbour
1/20,000

Compensatory Proposals
V 2.3 - Study Area

1) Mweeloon, 2) Glasheen and 3) Tawin West

		Gain		Loss	
Agricultural Land				5.55 ha	
Freshwater Lagoon		0.97 ha			
Stony Bank/Beach		25.33 ha		0.63 ha	
Salt Marsh/Grassland Mosaic		136.33 ha		7.39 ha	
Intertidal Mud Flat		1.27 ha	510.9 ha		
Beach/Mud		18.11 ha			
Intertidal □S		212.29 ha		10.70 ha	14.51 ha
Intertidal Admiralty		279.23 ha		3.81 ha	

SCALE: 1/20,000

(1) Mweeloon

(3) Tawin West

(2) Glasheen/Tawin East

Rev	Date	Description	By	Chkd.
A	23/06/17	First Issue	MK	JPK

Client:
GALWAY HARBOUR COMPANY

Project:
GALWAY HARBOUR EXTENSION

Title:
Compensatory Lands
Mweeloon, Glasheen & Tawin West
Preliminary
Land Type Assessment

Scale @ A1: 1:10,000 @A3: 1:20,000

Prepared by:	Checked:	Date:
MK	JPK	JUNE 2017

Project Director: J.P. KELLY

Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Fig. 2.1

Drawing No.: 7476-1034

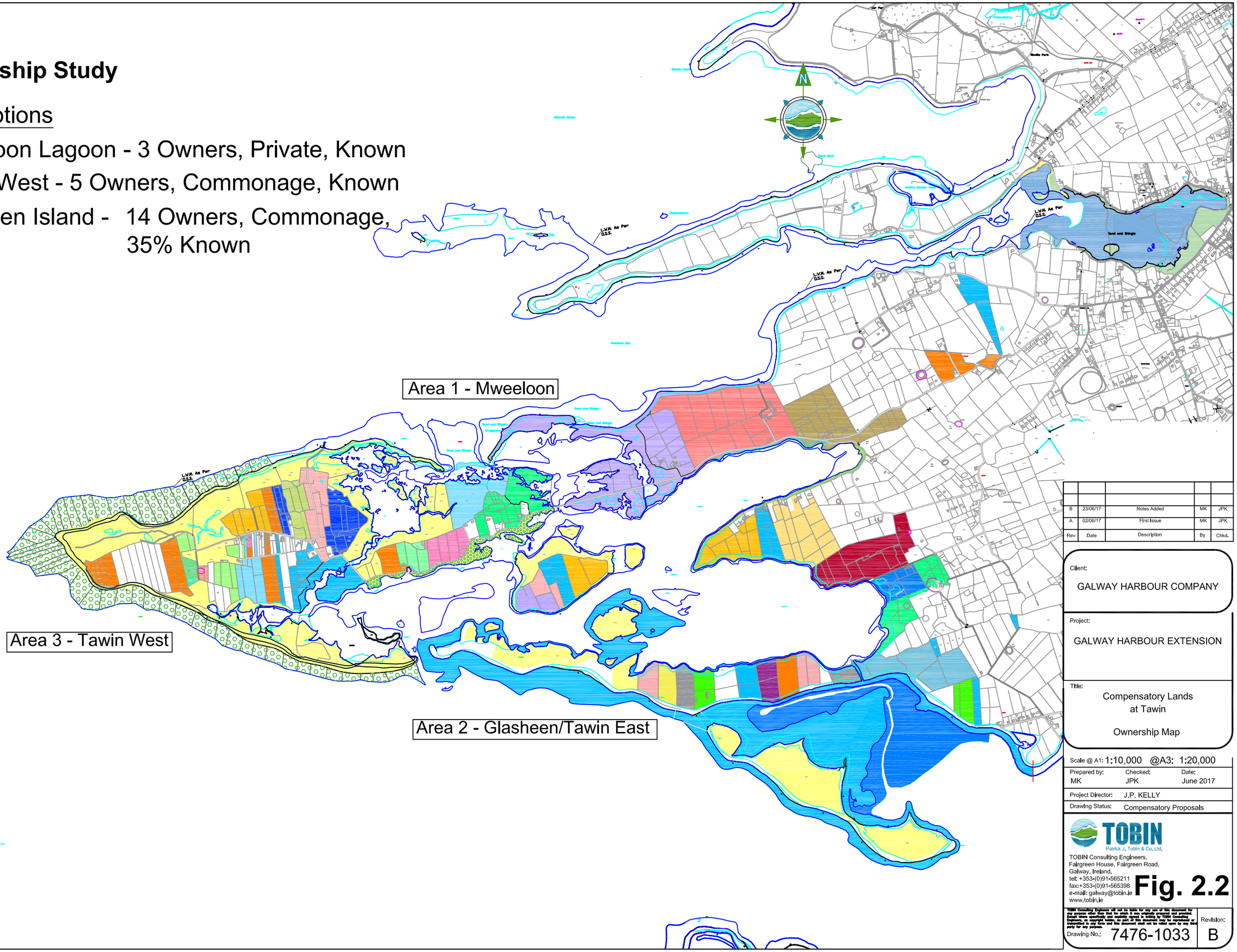
Revision: A

V. 2.3

Ownership Study

Site Options

1. Mweeloon Lagoon - 3 Owners, Private, Known
2. Tawin West - 5 Owners, Commonage, Known
3. Glasheen Island - 14 Owners, Commonage, 35% Known



Rev	Date	Description	By	Chkd.
B	23/06/17	Notes Added	MK	JPK
A	02/06/17	First Issue	MK	JPK

Client: GALWAY HARBOUR COMPANY

Project: GALWAY HARBOUR EXTENSION

Title: Compensatory Lands at Tawin

Ownership Map

Scale @ A1: 1:10,000 @A3: 1:20,000

Prepared by:	Checked:	Date:
MK	JPK	June 2017

Project Director: J.P. KELLY

Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Fig. 2.2

Drawing No.: 7476-1033

Revision: B

Area 3

Area 1

Area 2

Figure 2.3
Drone Aerial Photo of 3 Study Areas

APPENDIX 3B

Mapping of areas and habitats

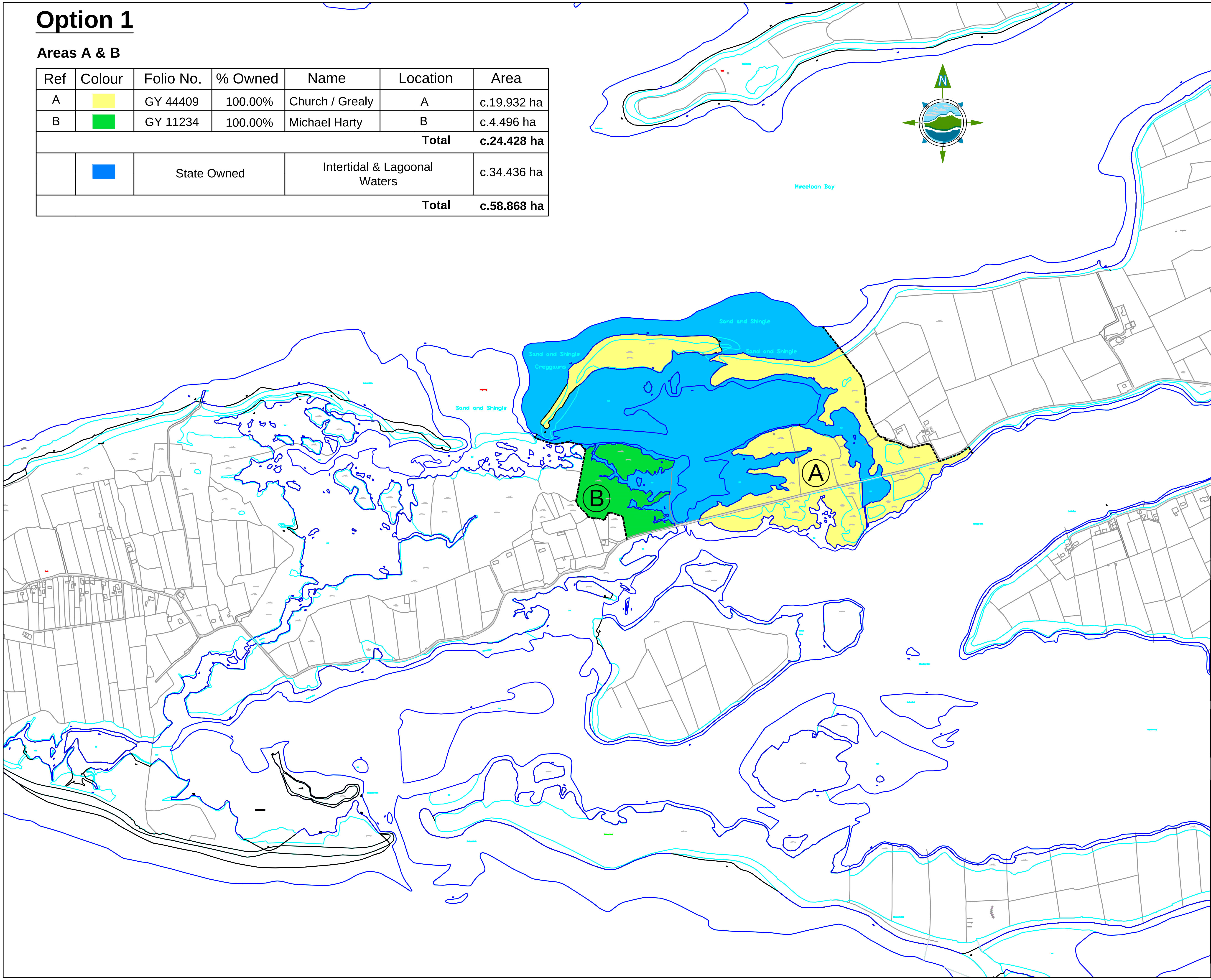
Appendix 3B **Mweeloon**

Fig. 6.1 Ownership
Fig. 6.2 Aerial
Fig. 6.3 Habitats

Option 1

Areas A & B

Ref	Colour	Folio No.	% Owned	Name	Location	Area
A	(yellow)	GY 44409	100.00%	Church / Grealy	A	c.19.932 ha
B	(green)	GY 11234	100.00%	Michael Harty	B	c.4.496 ha
					Total	**c.24.428 ha**
	(blue)	State Owned		Intertidal & Lagoonal Waters		c.34.436 ha
					Total	**c.58.868 ha**



Rev	Date	Description	By	Chkd.
D	03.08.17	Boundary Revised	MB	JPK
C	04.07.17	Areas Revised	MK	JPK
	02/06/17	Notes Revised	MK	BR
A	23/03/17	Draft Issue	AA	BR

Client:
GALWAY HARBOUR COMPANY

Project:
GALWAY HARBOUR EXTENSION

Title:
Compensatory Lands
Mweeloon

Ownership Map

Scale @ A1: 1:10,000 @A3: 1:20,000

Prepared by: MK
Checked: BR
Date: MAR 2016

Project Director: J.P. KELLY
Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.

TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Fig. 6.1

Drawing No.: 7476-1031
Revision: D

Rev	Date	Description	By	Chkd.
A	02/06/17	First Issue	MK	JPK

Client:

GALWAY HARBOUR COMPANY

Project:

GALWAY HARBOUR EXTENSION

Title:

Compensatory Lands
Mweeloon Lagoon

Aerial Map Relating to 7476-1031-B

Scale @ A1: NTS

Prepared by:	Checked:	Date:
MK	JPK	JUNE 2017

Project Director: J.P. KELLY

Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Drawing No.: Fig. 6.2

Revision: A

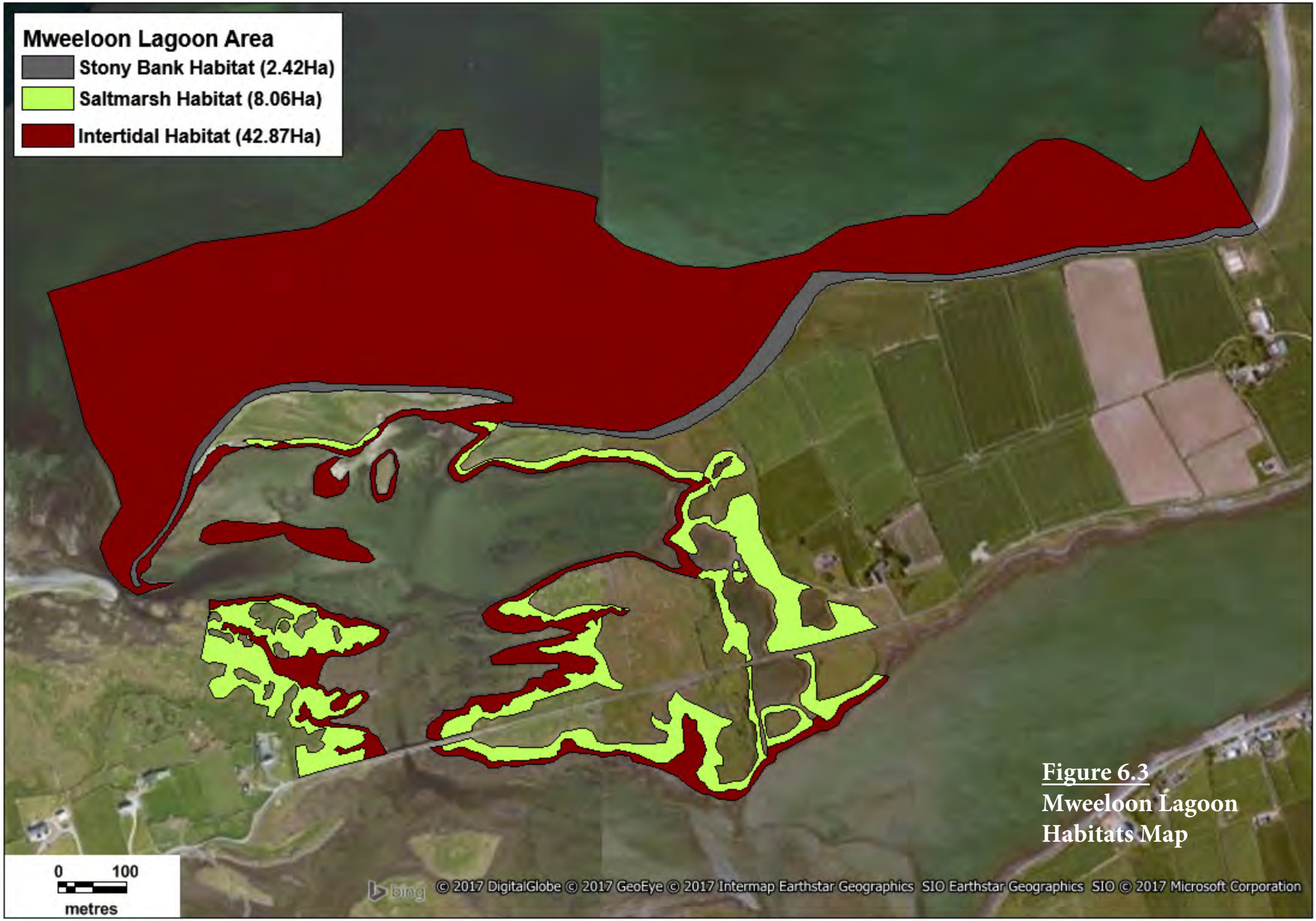


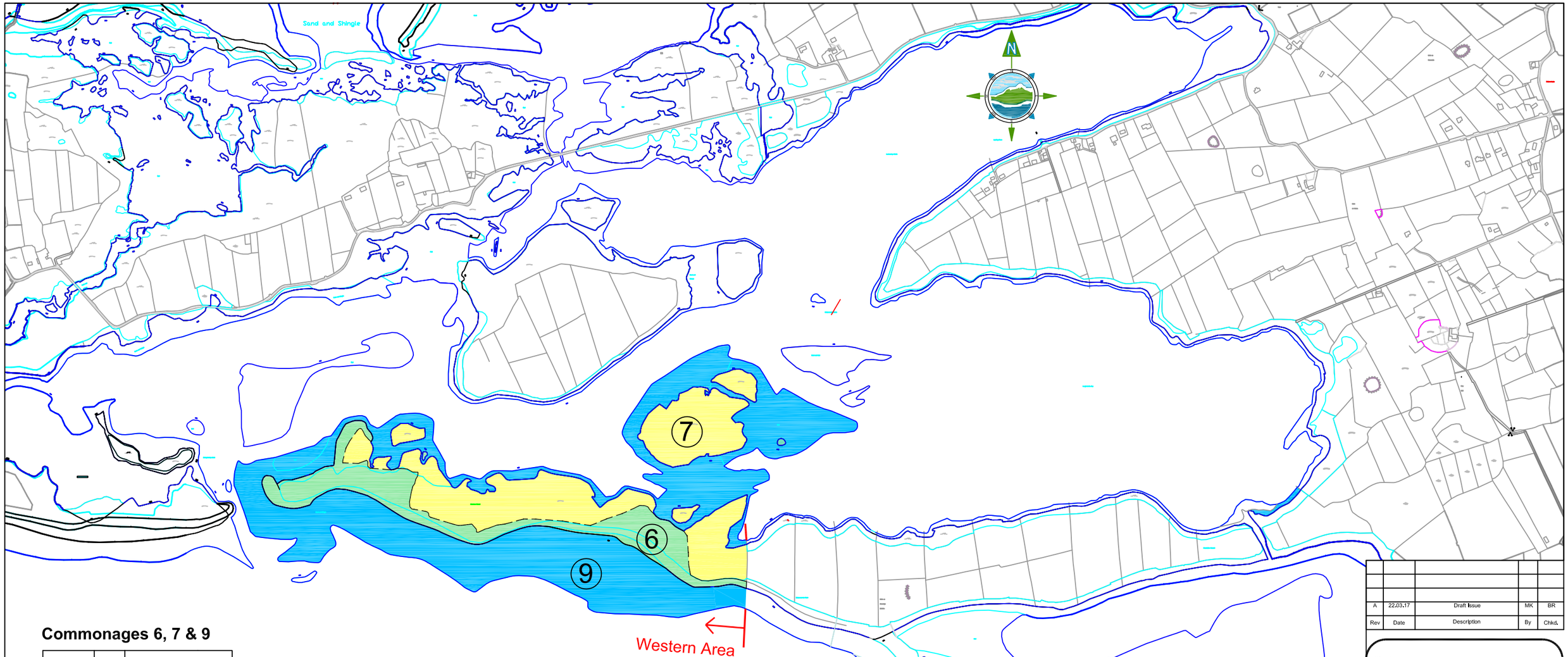
Figure 6.3
Mweeloon Lagoon Habitats Map

APPENDIX 3C

Mapping of areas and habitats

Appendix 3C **Glasheen / Tawin East**

Fig. 7.1 Ownership
Fig. 7.2 Aerial
Fig. 7.3 Habitats



Commonages 6, 7 & 9

Ref	Col	Area
6		c.7.476 ha
7		c.14.433 ha
9		c.29.583 ha
Total		**c.51.492 ha**

------- Boundary Between Area 6 & 7

Commonage 6 **Area: 7.476 ha**

Folio No.	% Owned	Name
GY 116160F	10.71%	Martin Hubert Costello
GY 40021F	10.71%	Francis Hanniffy
GY 40020F	10.71%	Patrick Holland
GY 116152F	10.71%	Martin Hubert Costello
GY 114276F	2.38%	William Joe Burke
Total % Registered:	45.22%	

Commonage 7 **Area: 14.433 ha**

Folio No.	% Owned	Name
GY 40021F	10.71%	Francis Hanniffy
GY 116160F	10.71%	Martin Hubert Costello
GY 26479F	12.50%	Kevin Keane
GY 116152F	10.71%	Martin Hubert Costello
GY 40020F	10.71%	Patrick Holland
GY 114276F	2.38%	William Joe Burke
Total % Registered:	57.72%	

Commonage 9 **Area: 29.583 ha**

Folio No.	% Owned	Name
GY 40021F	7.14%	Francis Hanniffy
GY 116160F	7.14%	Martin Hubert Costello
GY 114276F	7.14%	William Joe Burke
GY 116152F	7.14%	Martin Hubert Costello
GY 40020F	7.14%	Patrick Holland
GY 116158F	7.14%	John Kelly
Total % Registered:	42.84%	

Option 2

Rev	Date	Description	By	Chkd.
A	22.03.17	Draft Issue	MK	BR

Client: GALWAY HARBOUR COMPANY

Project: GALWAY HARBOUR EXTENSION

Title: Compensatory Lands at Glasheen

Ownership Map

Scale @ A1: 1:10,000 @A3: 1:20,000

Prepared by:	Checked:	Date:
MK	BR	MAR 2016

Project Director: J.P. KELLY

Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Fig. 7.1

Drawing No.: 7476-1029

Revision: A

Rev	Date	Description	By	Chkd.
A	02/06/17	First Issue	MK	JPK

Client:

GALWAY HARBOUR COMPANY

Project:

GALWAY HARBOUR EXTENSION

Title:

Compensatory Lands
Glasheen

Aerial Map Relating to 7476-1029-A

Scale @ A1:	NTS		
Prepared by: MK	Checked: JPK	Date: JUNE 2017	
Project Director:	J.P. KELLY		
Drawing Status:	Compensatory Proposals		

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Drawing No.: Fig. 7.2

Revision: A

Figure 7.3
Glasheen Island Habitats Map

APPENDIX 3D

Mapping of areas and habitats

Appendix 3D **Tawin West**

Fig. 8.1 Ownership
Fig. 8.2 Aerial
Fig. 8.3 Habitats

Stony Bank & Salt Marsh Mosaic

1. Plot 15A

Option 3

Commonage

Area = 35.208 ha

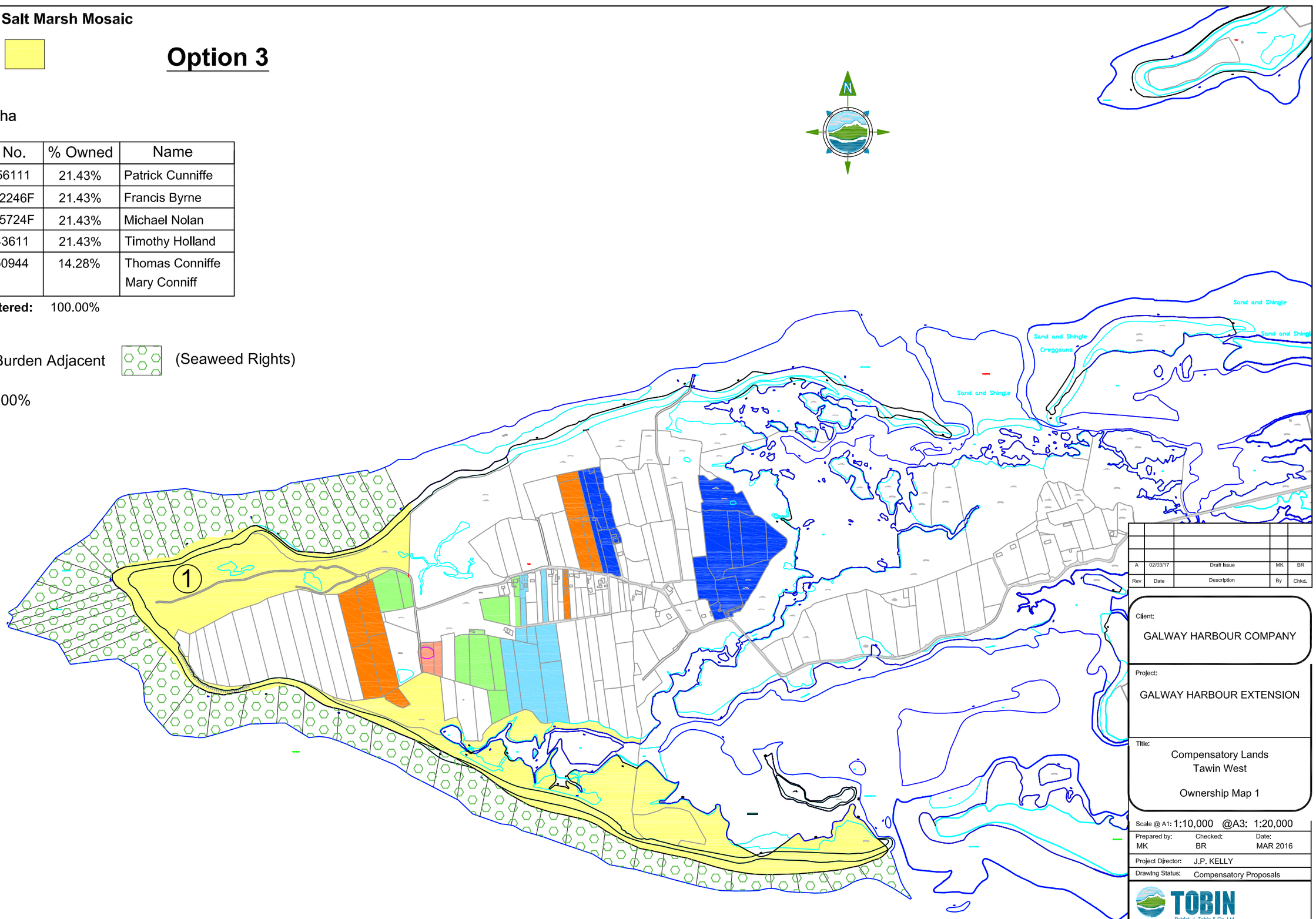
Colour	Folio No.	% Owned	Name
	GY 56111	21.43%	Patrick Cunniffe
	GY 92246F	21.43%	Francis Byrne
	GY 65724F	21.43%	Michael Nolan
	GY 43611	21.43%	Timothy Holland
	GY 50944	14.28%	Thomas Conniffe Mary Conniff

Total % Registered: 100.00%

Notes:

1) Registered Burden Adjacent (Seaweed Rights)

2) 5 owners - 100%



Rev	Date	Description	By	Chkd.
A	02/03/17	Draft Issue	MK	BR

Client:
GALWAY HARBOUR COMPANY

Project:
GALWAY HARBOUR EXTENSION

Title:
Compensatory Lands
Tawin West

Ownership Map 1

Scale @ A1: 1:10,000 @A3: 1:20,000

Prepared by:	Checked:	Date:
MK	BR	MAR 2016

Project Director: J.P. KELLY

Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

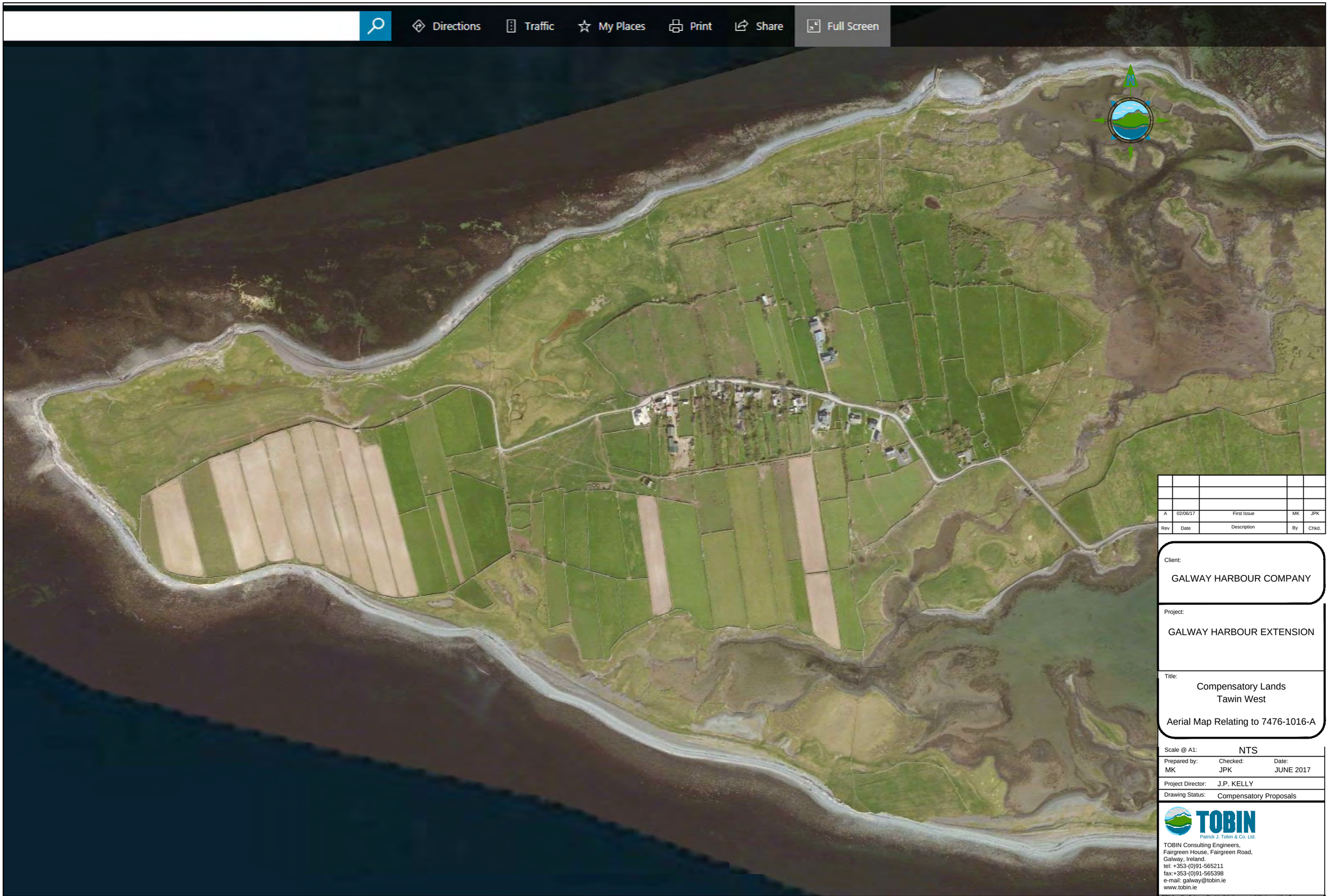
Fig. 8.1

Drawing No.: 7476-1016

Revision: A

Option 3

Directions | Traffic | My Places | Print | Share | Full Screen



Option 3

Rev	Date	Description	By	Chkd.
A	02/06/17	First Issue	MK	JPK

Client:

GALWAY HARBOUR COMPANY

Project:

GALWAY HARBOUR EXTENSION

Title:

Compensatory Lands
Tawin West

Aerial Map Relating to 7476-1016-A

Scale @ A1: NTS

Prepared by:	Checked:	Date:
MK	JPK	JUNE 2017

Project Director: J.P. KELLY

Drawing Status: Compensatory Proposals

TOBIN
Patrick J. Tobin & Co. Ltd.
TOBIN Consulting Engineers,
Fairgreen House, Fairgreen Road,
Galway, Ireland.
tel: +353-(0)91-565211
fax:+353-(0)91-565398
e-mail: galway@tobin.ie
www.tobin.ie

Drawing No.: Fig. 8.2

Revision: A

Figure 8.3
Tawin West Habitats Map

APPENDIX 4

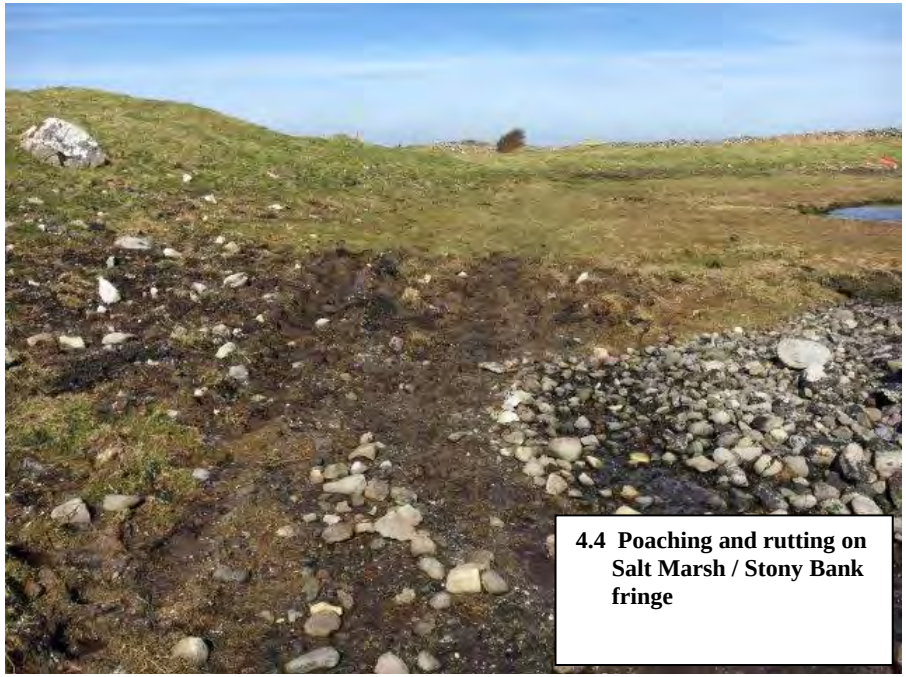
Mweeloon Lagoon Photographs

4.1 Brent geese grazing
4.2 Aquaculture redundant equipment
4.3 Stony Bank (grazed)
4.4 Poaching and rutting on Salt Marsh / Stony Bank fringe
4.5 Poaching on Salt Marsh Stony Bank fringe
4.6 Walls not maintained allowing extensive rather than controlled grazing
4.7 Poor wall maintenance
4.8 Poor wall maintenance
4.9 Grazing animal one field
4.10 Animals extensively grazing and poaching outer lands
4.11 Poor wall maintenance
4.12 Poaching tracks
4.13 Tracked Salt Marsh
4.14 Tracked grazing
4.15 Neglected fencing which would protect Stony Bank in distance
4.16 Tracking on Stony Bank to East
4.17 Grazing Stony Bank to West
4.18 Sea defence ‘rip rap’ on Eastern ridge line at Ballagh Bristy East
4.19 Rip Rap sea defence wall sagging
4.20 Dry channel at low tide
4.21 Fucoid reef
4.22 Fucoid Reef / dry channel at low tide

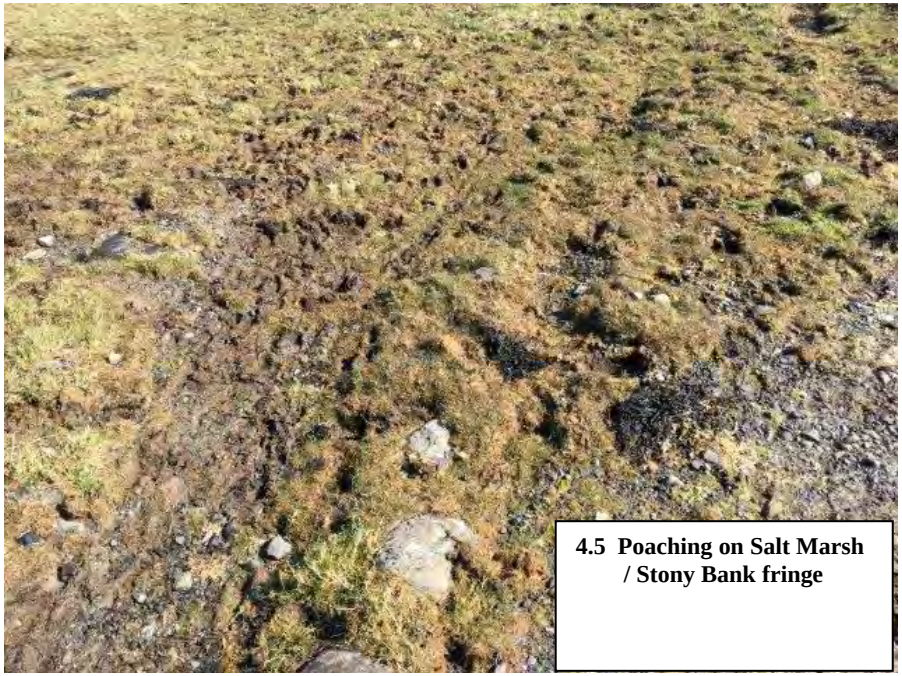
4.1 Brent geese grazing

4.2 Aquaculture redundant equipment

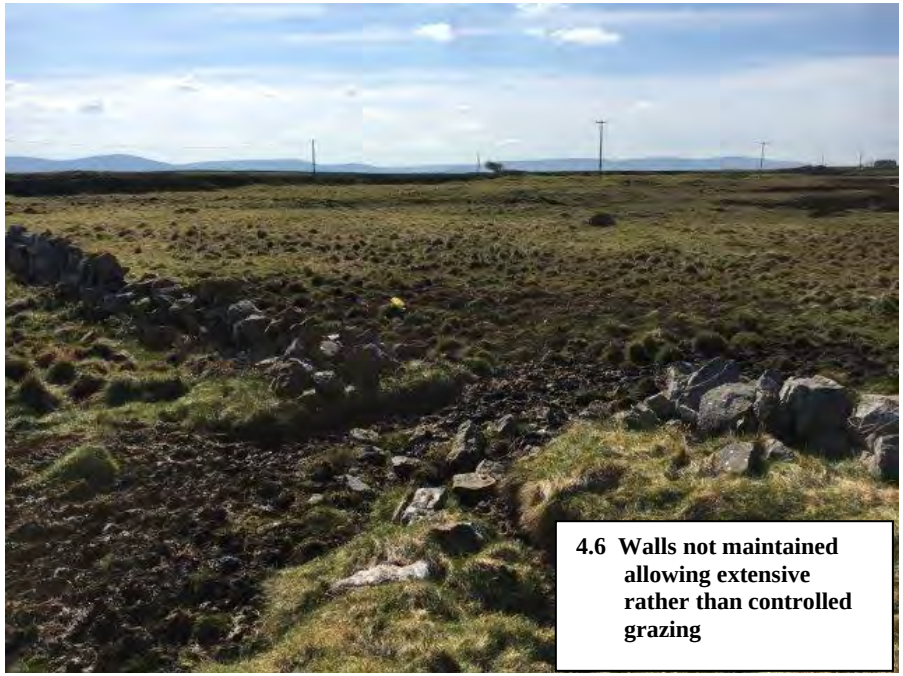
4.3 Stony Bank (grazed)



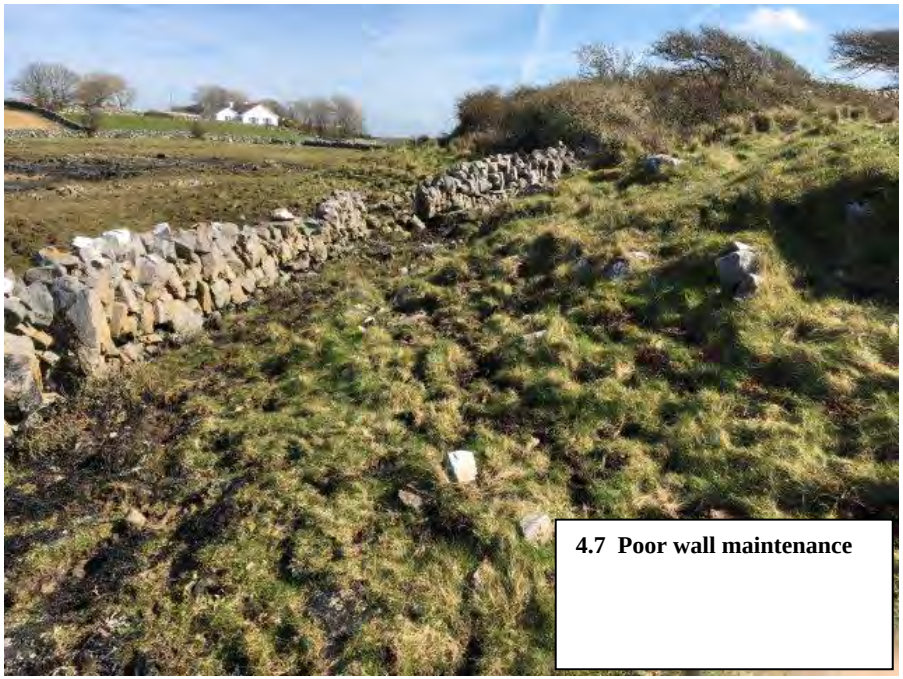
4.4 Poaching and rutting on Salt Marsh / Stony Bank fringe



4.5 Poaching on Salt Marsh / Stony Bank fringe



4.6 Walls not maintained allowing extensive rather than controlled grazing

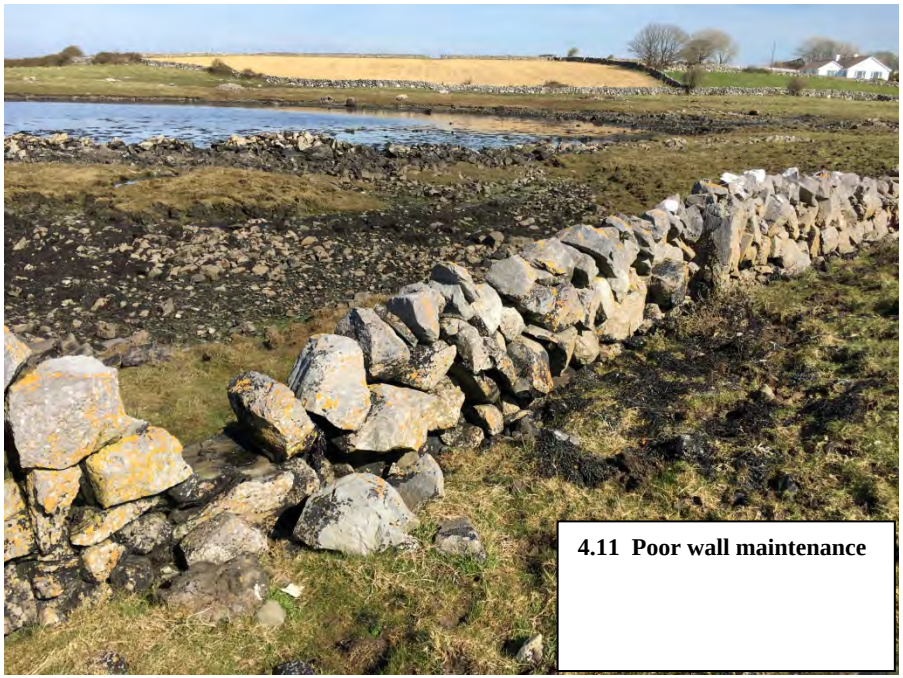


4.7 Poor wall maintenance

4.8 Poor wall maintenance

4.9 Grazing animal one field

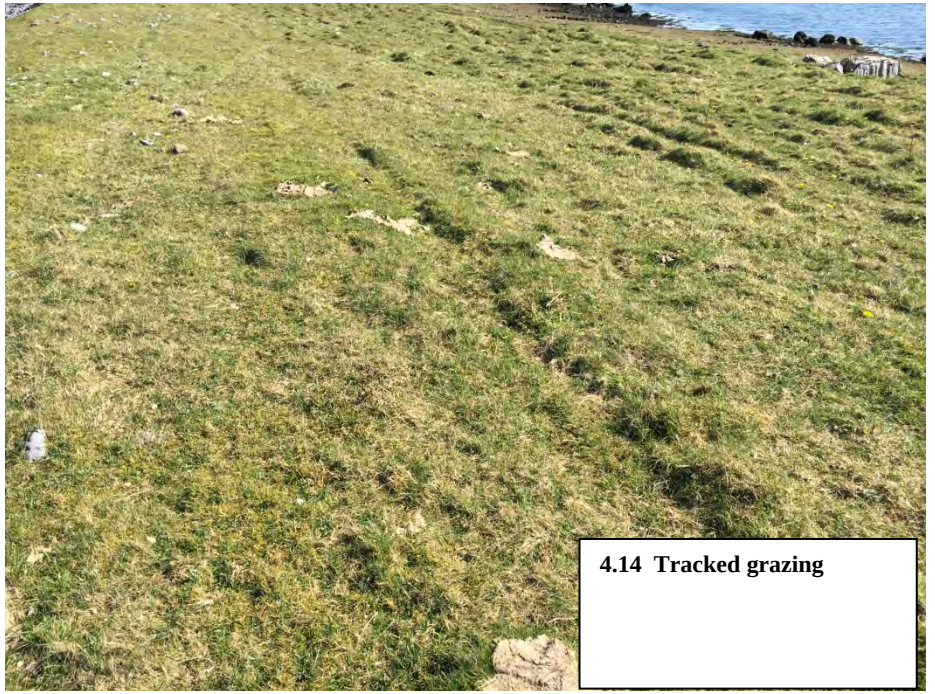
4.10 Animals extensively grazing and poaching outer lands



4.11 Poor wall maintenance

4.12 Poaching tracks

4.13 Tracked Salt Marsh



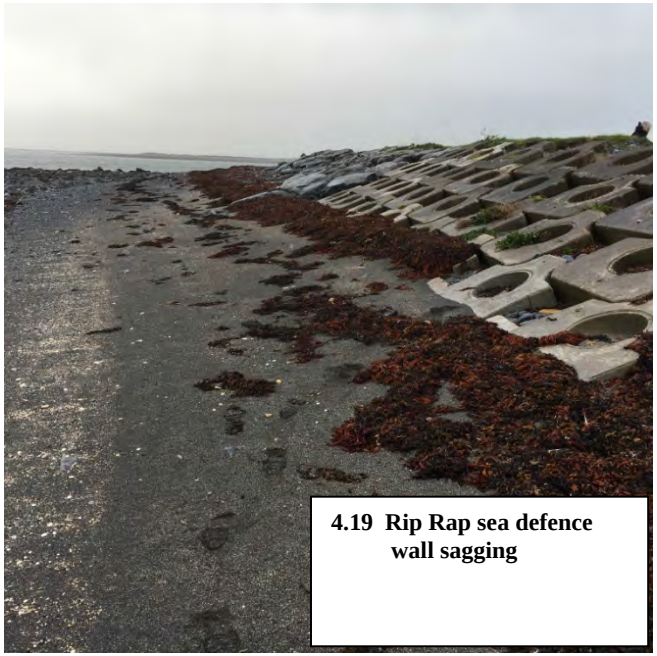
4.14 Tracked grazing

4.15 Neglected fencing which would protect Stony Bank in distance

4.16 Tracking on Stony Bank to East

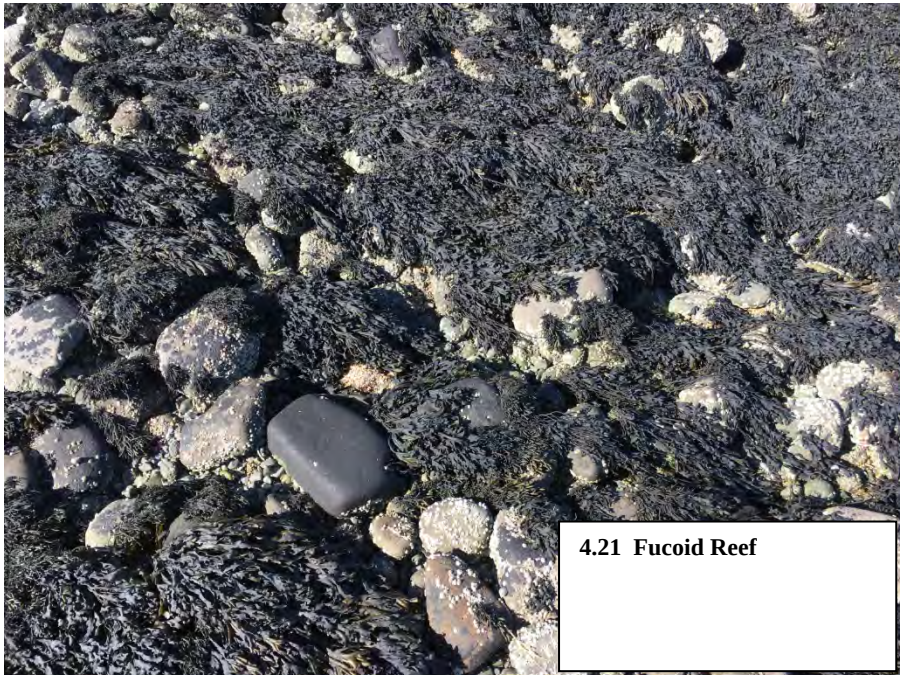
4.17 Grazing Stony Bank to West

4.18 Sea defence 'Rip Rap' on Eastern ridge line at Ballagh Bristy East



4.19 Rip Rap sea defence wall sagging

4.20 Dry channel at low tide



4.21 Fucoid Reef

4.22 Fucoid Reef / dry channel at low tide

APPENDIX 5

Glasheen Photographs

5.1 Dry Shrahmullen channel
5.2 Severe erosion of access to Glasheen West
5.3 Salt Marsh in Lough na Hulla Bay
5.4 Wire fence at entrance to Stony Bank / Salt Marsh area
5.5 Cliff eroding, fresh eroded beach, lower fucoid reef
5.6 Significant erosion collapse corresponding with 5.2 above
5.7 Undermining erosion of boulder clay cliff
5.8 Tractor tracks on un-grazed Stony Bank
5.9 Tractor rutting of Salt Marsh
5.10 Scrambler / motorbike tracking of Salt Marsh
5.11 Salt Marsh
5.12 Scrambler / motorbike rutting of Salt Marsh
5.13 Flotsam on cobble beach / Stony Bank
5.14 Broken glass flotsam on Stony Bank
5.15 Stony Bank / flotsam
5.16 Unbroken anthelminth flotsam bottle

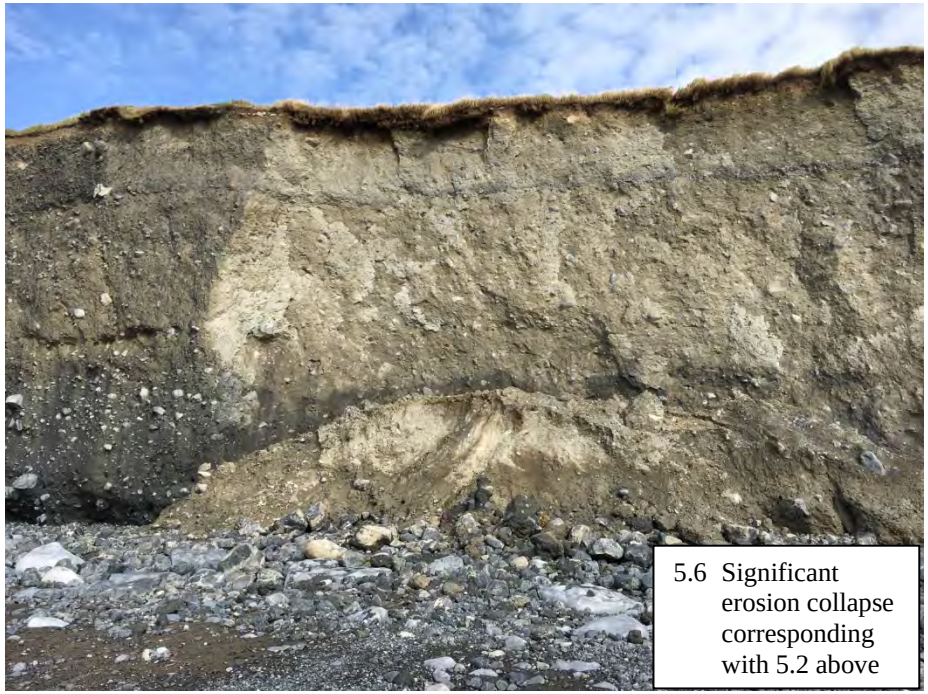
5.1 Dry Shrahmullen channel

5.2 Severe erosion of access to Glasheen West

5.3 Salt Marsh in Lough na Hulla Bay

5.4 Wire fence at entrance to Stony Bank / Salt Marsh area

5.5 Cliff eroding, fresh eroded beach, lower fucoid reef



5.6 Significant erosion collapse corresponding with 5.2 above

5.7 Undermining erosion of boulder clay cliff

5.8 Tractor tracks on un-grazed Stony Bank

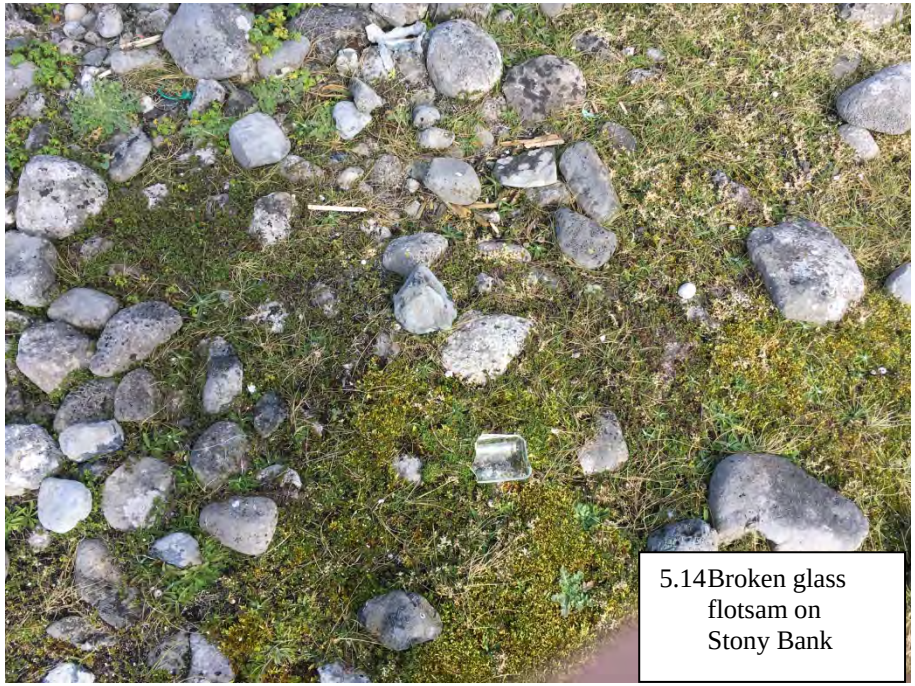
5.9 Tractor rutting of Salt Marsh

5.10 Scrambler / motor bike tracking of Salt Marsh

5.11 Salt Marsh

5.12 Scrambler / motor bike rutting of Salt Marsh

5.13 Flotsam on cobble beach / Stony Bank



5.14 Broken glass flotsam on Stony Bank

5.15 Stony Bank / flotsam

5.16 Unbroken anthelminth flotsam bottle

APPENDIX 6

Tawin West Photographs

6.1 Stony Bank / Salt Marsh
6.2 Neglected fencing on eroding land
6.3 Eroding Stony Bank
6.4 Eroding land and neglected fencing
6.5 Fresh slippage of topsoil from eroding land
6.6 Eroding Stony Bank
6.7 Salt Marsh in lee of Stony Bank
6.8 Stony Bank with considerable flotsam
6.9 Eroding boulder clay
6.10 Regenerating Stony Bank
6.11 Recent cast up of sand and cobble on Stony Bank
6.12 Dental flotsam
6.13 Eco morph
6.14 Ballagh Bristy Glasheen in flow, seal haul out in distance
6.15 Soil layers in erosion face at Tawin West
6.16 Shell Midden in upper layer of eroding fence near Tawin Point
6.17 Close up of Shell Midden

6.1 Stony Bank / Salt Marsh

6.2 Neglected fencing on eroded land

6.3 Eroding Stony Bank

6.4 Eroding land and neglected fencing

6.5 Fresh slippage of topsoil from eroding land

6.6 Eroding Stony Bank

6.7 Salt Marsh in lee of Stony Bank

6.8 Stony Bank with considerable flotsam

6.9 Eroding boulder clay

6.10 Regenerating Stony Bank

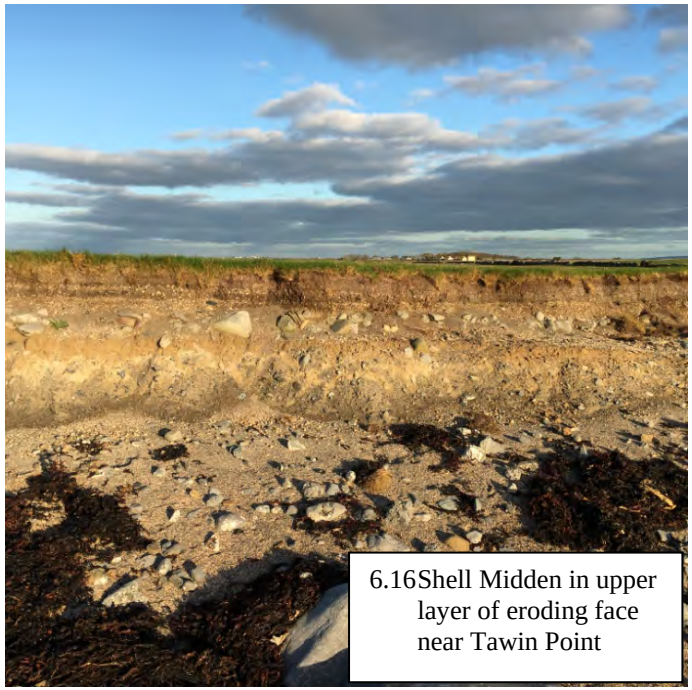
6.11 Recent cast up of sand and cobble on Stony Bank

6.12 Dental flotsam

6.13Eco morph

6.14Ballagh Bristy Glasheen in flow, seal haul out in distance

6.15Soil layers in erosion face at Tawin West



6.16Shell Midden in upper layer of eroding face near Tawin Point

6.17Close up of Shell Midden

APPENDIX 7

Generic Compensatory Management Assessment Tables

- Intertidal [EU Codes: 1140 and 1170]
- Stony Bank [EU Codes: 1210 and 1220]
- Saltmarsh [EU Codes: 1330 and 1410]

Compensation – Intertidal Management Proposals

		Ownership	Management				
		Control	**Damaging impacts**	**Constraining works**	**Litter**	**Monitoring**	**Total score**
	Subtopic as per Sect. 1.5 "Criteria for Designing Compensatory Measures" of Guidance Document on Article 6(4) of the 'Habitats Directive' 92/43/EEC Jan. 2007	**1: Purchase if private or "commonage". If not, State owned. (50)**	**2, 3, 4 and 5. No run-off due to controlled grazing, no fertilising and no use of herbicide and medications.(6) 6:Prohibit shooting(1) 7 Reduce/remove tractor access.(2) 8:Remove aquaculture & related structures(10)**	**9:No new land protection sea walls.(2) 10:Repair of sea walls for ecological reasons only (2)**	**11:Pick litter quarterly.(4) 12 Didemnum Removal (8)**	**13:Annual survey(4) 14: Special survey (1) 15:Adjust plan(2) 16: Indep. Audit(2) 17:Adjust plan(1) 18:Signage(2)**	
	Score allocated	**50**	**20**	**6**	**12**	**12**	**100**
1	**Targeted Compensation**	When location agreed : 14.28%	As per Management Plan agreed 14.28%	As adjacent 14.28%	As adjacent 14.28%	As above 14.28%	
2	**Effective Compensation**	When management proposal accepted : 14.28%	Shooting controls 13.57%	As owned / approved bar time lag for approval of repairs if required 12.85%	Litter cannot be perfect 2/4, Didemnum 8/8 Total 10/12 11.90%	Effective 12.85%	
3	**Technical Feasibility**	When purchase agreed : 14.28%	Shooting controls 13.56%	As owned 14.28%	Feasible 14.28%	Feasible 14.28%	
4	**Extent of Compensation**	When purchase agreed 14.28%	On areas agreed / purchased 14.28%	As adjacent 14.28%	As adjacent 14.28%	On area purchased 14.28%	
5	**Location of Compensatory Measures**	Mweeloon Lagoon, Tawin 14.28%	On purchased lands and adjacent intertidal and adjacent Mweeloon Lagoon 14.28%	As adjacent 14.28%	As adjacent 14.28%	Mweeloon Lagoon, Tawin 14.28%	
6	**Timing of Compensation**	Commence on Grant of Planning Permission 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	Annually 14.30%	
7	**Long Term Implementation**	Assured by purchase: 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	Assured 14.30%	
	Score Achieved	**100% 50 x 100% = 50 50/50**	**98.57% 20 x 98.57% = 19.71 19.71/20**	**98.57% 6 x 98.57% 5.91/6**	**97.62% 12 x 97.62% = 11.71 11.71/12**	**98.57% 12 x 98.57% 11.83/12**	**99.16/100**

Compensation – Stony Bank Management Proposals

		Control	Damaging Impacts	Damaging works	Constraining works	Litter	Monitoring	Total score
	Subtopic	**1:Purchase / Management agreement.(50)**	**2: Control grazing(4) 3: Nil fert./slurry(4) 4: Nil herbicide(4) 5: Nil meds./anthel(4) 6: No shooting (2)**	**7:Limit tractor access(2) 8: No Winter feeding(4) 9:Protect cobble(4)**	**10:No new land protection sea walls (2) 11: Repair of sea walls for ecological reasons (4)**	**12:Pick litter quarterly.(4)**	**13:Annual survey(4) 14: Special survey (1) 14:Adjust plan(2) 15: Indep. Audit(2) 16:Adjust plan(1) 17:Signage(2)**	
	Score allocated	**50**	**18**	**10**	**6**	**4**	**12**	**100**
1	**Targeted Compensation**	When location agreed : 14.28%	If existing condition of 2 equals 2/4 and shooting1/2, total value of enhancement available 15/18 83.33% x 14.28% = 11.90%	As above 14.28%	As above 14.28%	As above 14.28%	As above 14.28%	
2	**Effective Compensation**	When management proposal accepted : 14.28%	As adjacent 11.90%	Minor cobble loss 12.85%	Time lag for approval of repairs if required 12.85%	Litter not perfect 50% x 14.28 = 7.14%	Effective 12.85%	
3	**Technical Feasibility**	When purchase agreed : 14.28%	Bar shooting 17/18 x 14.28% 13.49%	Minor cobble loss 12.85%	Time lag for approval 14.28%	On purchased lands 14.28%	Feasible 14.28%	
4	**Extent of Compensation**	When purchase agreed 14.28%	As adjacent 14.28%	As adjacent 14.28%	As adjacent 14.28%	As adjacent 14.28%	On area purchased 14.28%	
5	**Location of Compensatory Measures**	Mweeloon Lagoon, Tawin 14.28%	On purchased lands 14.28%	As adjacent 14.28%	As adjacent 14.28%	As adjacent 14.28%	Mweeloon Lagoon, Tawin 14.28%	
6	**Timing of Compensation**	Commence on Grant of Planning Permission 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	Annually 14.30%	
7	**Long Term Implementation**	Assured by purchase: 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	Assured 14.30%	
	Score achieved	**100% 50 x 100% = 50 50/50**	**94.45% 18 x 94.45% = 17.00% 17.00/18**	**97.24% 10 x 97.24% = 9.72% 9.72/10**	**98.57% 6 x 98.57% = 5.91% 5.91/6**	**92.86% 4 x 92.86% = 3.71% 3.71/4**	**98.57% 12 x 98.57% 11.83/12**	**98.17/100**

Compensation – Salt Marsh Management Proposals

		Ownership	Management					
		Control	**Damaging Impacts**	**Damaging Works**	**Constraining works**	**Litter**	**Monitoring**	**Total Score**
	Subtopics	**1: Purchase / Management agreement**	**2 : Control grazing (10)** **3 : Nil fert / slurry (2)** **4 : Nil herbicide (2)** **5 : Nil med / anthelmin(2)** **6: No shooting (2)**	**7: Limit tractor access (2)** **8 : No winter feeding (4)** **9 : No drainage (4)** **Repair field walls**	**10 : No new land protection walls (2)** **11 : Repair of sea walls for ecological reasons (4)**	**12 : Pick litter quarterly (4)**	**13 : Annual survey (4)** **14: Special survey (1)** **15 : Adjust plan (2)** **16 : Indept audit (1)** **17 : Audit adjust (1)** **18 : Signage, view (2)**	
	Score Allocated	**50**	**18**	**10**	**6**	**4**	**12**	**100**
1.	**Targeted Compensation**	When location agreed : 14.28%	Subject to qualitative studies of item 2 as above. If existing condition equals 8/18 Total value of enhancement available 10 / 18 = 55.5% 55.6% x 14.28% = 7.94%	As above 14.28%	As above 14.28%	As above 14.28%	As above 14.28%	
2.	**Effective Compensation**	When management proposal accepted : 14.28%	2-5 fully and 6 as much as possible 17/18 = 94.4% 94.4% x 14.28% = 13.49%	As per management plan agreed 14.28%	Time lag for approval of repairs if required 12.85%	Will never be 100% 7.14%	Effective 12.85%	
3.	**Technical Feasibility**	When purchase agreed : 14.28%	As above 13.49%	As much tractor control as possible 12.85%	Feasible 14.28%	By hand 14.28%	Feasible 14.28%	
4.	**Extent of Compensation**	When purchase agreed 14.28%	As adjacent 14.28%	As adjacent 14.28%	As adjacent 14.28%	Quarterly 14.28%	Area purchased 14.28%	
5.	**Location of Compensatory Measures**	Mweeloon Lagoon, Tawin 14.28%	Purchased lands 14.28%	As adjacent 14.28%	As adjacent 14.28%	As adjacent 14.28%	Mweeloon Lagoon, Tawin 14.28%	
6.	**Timing of Compensation**	Commence on Grant of Planning Permission 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	Annually 14.30%	
7.	**Long Term Implementation**	Assured by purchase: 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	As adjacent 14.30%	As assured 14.30%	
	Score Achieved	**100%** **50 x 100% = 50** **50/50**	**92.08%** **18 x 92.08% = 16.57** **16.57/18**	**98.57%** **10 x 98.57% = 9.86** **9.86/10**	**98.57%** **6 x 98.57% = 5.91** **5.91/6**	**92.86%** **4 x 92.86%** **3.71/4**	**98.57%** **12 x 98.57%** **11.83/12**	**97.88/ 100**

APPENDIX 8

Proposed Methodologies for Sampling at
Mweeloon Lagoon, Tawin and Renmore

Proposed Methodologies for Sampling at Mweeloon Lagoon, Tawin, Co. Galway.

1. Intertidal Sampling

The intertidal sampling will focus on the following Annex I habitat: Mud and sandflats and Reefs. The National Parks and Wildlife Conservation Objectives for this habitat (and for perennial vegetation of stony banks and salt marsh) are included in Appendix 1 of this document.

Sampling will be carried out at low tide during a Spring tide period. The north shore of the proposed management area will be surveyed every 100m giving a total number of 10 transects. Profiles of each transect will be generated.

Because the intertidal area of the lagoonal habitat cannot expose to the same extent as the outer shore, the extent of the shore line that does expose is very markedly shorter. For this reason, it is considered that only two levels will need to be sampled - high water and low water. The extent of the shore line of the lagoonal area has been estimated at 4 km and using the same spatial distance of 100m as used above, this gives a total number of 35 transects in the lagoon. The total number might be reduced once the survey work has commenced.

Three x 0.25 m^2 quadrates will be examined to determine the macroalgal species and % cover in each of the three intertidal zones - HW, MW and LW – on the outer north shore.

Macrofaunal species within each quadrate will be identified and scored in terms of abundance using the SACFOR scale.

Where possible, a 1m^2 quadrate at each tidal height will be dug over and macrofaunal species will either be identified on site or brought back to the lab for identification.

Where possible, five x 15 cm diameter sediment cores will be collected at each tidal height, washed through a 1mm sieve, stained with Rose Bengal and fixed in 6% formaldehyde for 48 hrs before preserving in 70% alcohol.

A further sediment sample will be collected for granulometric and organic carbon analysis.

The estimated depth of the REDOX layer will be made on site and notes will be made on the colour and odour of the sediment.

Representative photographs will be taken of each site and each quadrate sampled.

Part of the lagoon dries out at Low Water and this sand bank will be surveyed using the same methodology as described above.

2. Subtidal Sampling

The subtidal sampling will focus on the following Annex I habitat: Lagoons.

Ten subtidal sampling locations will be sampled at high water during a Spring tide period.

Five x 0.025m^2 van Veen grab samples will be collected at each sampling location. An additional sample will be collected for granulometric and organic carbon analysis. The faunal samples will be washed through a 1mm sieve, stained with Rose Bengal and fixed in 6% formaldehyde for 48 hrs before preserving in 70% alcohol.

Temperature, pH, DO and salinity profiles will be recorded and water samples will be collected for nutrient analysis.

3. Bathymetric Survey

A bathymetric survey will be carried out in the Annex I lagoon habitat using a Precision SonarMite single beam Echo Sounder

Levels will be recorded every 1 m along transect lines set 10m apart to cover the entire survey area. The survey lines will run perpendicular to the direction of the residual flow. Tidal data will be recorded during each survey and used to reduce the levels to Ordinance Data Malin

AQUAFACT has two complete survey units incorporating DGPS and echo sounding as detailed below. In the event of equipment malfunction or damage during a survey, the second unit can be set up immediately to complete the survey without loss of survey time. The primary equipment used will be the SonarMite echo sounder in conjunction with a Trimble® GeoXT™.

The SonarMite Echo Sounder is the result of nearly two years research and development to further extend the boundaries of shallow water hydrographic surveying equipment. The SonarMite HPR includes a six axis accelerometer device to calculate heave, pitch and roll parameters. The purpose of including the HPR data is to compensate for typical attitude movement in a small boat system such as offset of an RTK antenna due to pitch and roll. Attitude is optimized to be measured normal to gravity reference and assumes a fairly constant speed with minimal change in acceleration. The heave measurement is used to compensate for waves in simple DGPS systems where absolute

height is derived from a Tide Gauge reading. The heave measurement is internally integrated with the sounder electronics, its integration period gated by start/end of a depth reading. Typical SonarMite heave measurement sample frequency is 25Hz, this is optimized for wave periods between 2.0 and 0.2 Hz.

Specifications:

Transducer Frequency: 235KHz Active Transducer

Beam Spread: 8 to 10 Degrees

Depth Range: 0.30m to 75.00m (Software limited)

Accuracy: +/-0.025m (RMS)

A continuous real-time record of the survey track will be made in conjunction with depth data output from the echo sounder. Continuous recording echo sounding will be carried out at the prescribed line intervals with data records (xyz) being recorded every second (approximately record every 1m). The records of position and depth will be time tagged to enable subsequent correction for tidal height with continuously recorded tidal data recorded by means of an Envirmon TD-Diver, which will be deployed within the survey area to automatically record tidal elevations to coincide with the fieldwork.

Speed of sound through the water will be checked prior to surveying and input to the echo sounder. Calibration of the echo sounder by the bar-check method will be undertaken prior to and upon completion of each survey period. In addition, regular checks will be made during the survey with a graduated pole to ensure accurate readings.

Dynamic horizontal positioning for the survey boat will be achieved by means of Differential Global Positioning system (DGPS), which will deliver precise, homogenous and continuous navigational output over the entire study area. The receiver antenna (Trimble Hurricane Antenna) will be located directly above the sounders transducer, thereby negating the need to transform the incoming data. The Trimble GeoXT™ is a high performance DGPS receiver combined with a rugged handheld computer, the GeoXT handheld is optimized to provide reliable location data, when and where you need it. Rugged design and powerful functionality are the hallmarks of the GeoExplorer® series. When accuracy is critical, the GeoXT handheld delivers with unprecedented efficiency and reliability.

Key features:

- Real-time submeter GPS with integrated SBAS and EVEREST multipath rejection technology
- High-resolution VGA display for crisp and clear map viewing

- Bluetooth and wireless LAN connectivity options
- 1 GB onboard storage plus SD slot for removable cards
- Windows Mobile version 6 operating system
- Rugged handheld with all-day battery

All bathymetric data will be downloaded and post processed using Surfer, a powerful contouring, gridding, and surface mapping package, to output depth contour maps at prescribed intervals. Data will be provided as an xyz digital file and in Autocad format if required.

4. Sample Processing

The procedure to extract fauna from the sediment residues is as follows:

- All samples will be logged in a central sample log book.
- The faunal samples will then be processed in a systematic way to ensure that no samples are omitted.
- Prior to sorting and identification, the alcohol will be removed from the sample by thorough rinsing through a 1mm sieve. The sample retained on the sieve (sieve residue) will then be transferred, by backwashing, into a white sorting tray, with care taken not to leave any specimens on the sieve.
- A daily inventory of what samples have been sorted will be maintained by AQUAFACT.
- All conspicuous fauna will be extracted by hand, using forceps or pipette, first by eye to remove large specimens and then sorted using a stereo microscope at 6 to 10 times magnification.
- Following the removal of larger specimens, the samples will be placed into Petri dishes, approximately one half teaspoon at a time and sorted using a binocular microscope at x10 magnification.
- All fauna will be sorted into four groups (Annelida, Crustacea, Mollusca and Others) and placed into suitable labelled containers. The faunal specimens will then be identified to species level where possible using all relevant taxonomic keys and BEQUALM/NAMBQC guides.
- The specimens will be stored in 70-80% industrial methylated spirits/water preservative.
- A species list will then be generated.

5. Data Analysis

Statistical analysis will be carried out on the grab returns using PRIMER. A description of the analysis that AQUAFACT routinely carries out on benthic datasets is given below.

Statistical evaluation of the data is undertaken using PRIMER v.6 (Plymouth Routines in Ecological Research). Univariate statistics in the form of diversity indices are calculated. Numbers of species and numbers of individuals per sample will be calculated and the following diversity indices will be utilised:

1) Margalef's species richness index (D),

$$D = \frac{S - 1}{\log_2 N}$$

where: N is the number of individuals

S is the number of species

2) Pielou's Evenness index (J)

$$J = \frac{H^{'}(observed)}{H^{'}_{max}}$$

where: $H^{'}_{max}$ is the maximum possible diversity, which could be achieved if all

species were equally abundant (= $\log_2 S$)

3) Shannon-Wiener diversity index (H').

$$H^{'} = -\sum_{i=1}^{S} p_i (\log_2 p_i)$$

where: p_I is the proportion of the total count accounted for by the i^{th} taxa

4) Simpson's Diversity Index

$$1-\lambda' = 1-\{\Sigma_i N_i(N_i-1)\} / \{N(N-1)\}$$

where N is the number of individuals of species i.

Species richness is a measure of the total number of species present for a given number of individuals. Evenness is a measure of how evenly the individuals are distributed among different species. The diversity index incorporates both of these parameters. Richness ranges from 0 (low richness) to 12 (high richness), evenness ranges from 0 (low evenness) to 1 (high evenness), diversity ranges from 0 (low diversity) to 5 (high diversity).

The PRIMER programme (Clarke & Warwick, 2001) is used to carry out multivariate analyses on the station-by-station faunal data. All species/abundance data from the grab surveys is fourth root transformed and used to prepare a Bray-Curtis similarity matrix in PRIMER ®. The fourth root transformation is used in order to down-weigh the importance of the highly abundant species and to allow the mid-range and rarer species to play a part in the similarity calculation. All species/abundance data from the samples is used to prepare a Bray-Curtis similarity matrix. The similarity matrix is then be used in classification/cluster analysis. The aim of this analysis is to find "natural groupings' of samples, i.e. samples within a group that are more similar to each other, than they are similar to samples in different groups (Clarke & Warwick, *loc. Cit.*). The PRIMER programme CLUSTER carries out this analysis by successively fusing the samples into groups and the groups into larger clusters, beginning with the highest mutual similarities then gradually reducing the similarity level at which groups are formed. The result is represented graphically in a dendrogram, the x-axis representing the full set of samples and the y-axis representing similarity levels at which two samples/groups are said to have fused. SIMPROF (Similarity Profile) permutation tests will be incorporated into the CLUSTER analysis to identify statistically significant evidence of genuine clusters in samples which are *a priori* unstructured.

The Bray-Curtis similarity matrix is also be subjected to a non-metric multi-dimensional scaling (MDS) algorithm (Kruskal & Wish, 1978), using the PRIMER programme MDS. This programme produces an ordination, which is a map of the samples in two- or three-dimensions, whereby the placement of samples reflects the similarity of their biological communities, rather than their simple geographical location (Clarke & Warwick, 2001). With regard to stress values, they give an indication of how well the multi-dimensional similarity matrix is represented by the two-dimensional plot. They are calculated by comparing the interpoint distances in the similarity matrix with the corresponding

interpoint distances on the 2-d plot. Perfect or near perfect matches are rare in field data, especially in the absence of a single overriding forcing factor such as an organic enrichment gradient. Stress values increase, not only with the reducing dimensionality (lack of clear forcing structure), but also with increasing quantity of data (it is a sum of the squares type regression coefficient). Clarke and Warwick (*loc. Cit*.) have provided a classification of the reliability of MDS plots based on stress values, having compiled simulation studies of stress value behaviour and archived empirical data. This classification generally holds well for 2-d ordinations of the type used in this study. Their classification is given below:

- Stress value < 0.05: Excellent representation of the data with no prospect of misinterpretation.
- Stress value < 0.10: Good representation, no real prospect of misinterpretation of overall structure, but very fine detail may be misleading in compact subgroups.
- Stress value < 0.20: This provides a useful 2-d picture, but detail may be misinterpreted particularly nearing 0.20.
- Stress value 0.20 to 0.30: This should be viewed with scepticism, particularly in the upper part of the range, and discarded for a small to moderate number of points such as < 50.
- Stress values > 0.30: The data points are close to being randomly distributed in the 2-d ordination and not representative of the underlying similarity matrix.

Each stress value must be interpreted both in terms of its absolute value and the number of data points. In the case of this study, the moderate number of data points indicates that the stress value can be interpreted more or less directly. While the above classification is arbitrary, it does provide a framework that has proved effective in this type of analysis.

The species, which are responsible for the grouping of samples in cluster and ordination analyses, are identified using the PRIMER programme SIMPER (Clarke & Warwick, 1994). This programme determines the percentage contribution of each species to the dissimilarity/similarity within and between each sample group.

6. Sediment Analysis

AQUAFACT will carry out, in-house, the granulometric analysis using the traditional granulometric technique. We have all of the necessary equipment required *e.g.* Wentworth graded sieves, Easysieve computer software, hydrogen peroxide, sodium hexametaphosphate, drying oven,

beakers, mixers, electronic scales. We have carried out sediment analysis for all subtidal sampling programmes that we have been involved in.

AQUAFACT will employ the following methodology for the granulometric analysis:

1. Approximately 100g of dried sediment (previously washed in distilled water and dried) is weighed out and placed in a labelled 1L glass beaker to which 100ml of a 6 percent hydrogen peroxide solution is then added. This is allowed to stand overnight in a fume hood.
2. The beaker is placed on a hot plate and heated gently. Small quantities of hydrogen peroxide are added to the beaker until there is no further reaction. This peroxide treatment removes any organic material from the sediment which can interfere with grain size determination.
3. The beaker is then emptied of sediment and rinsed into a 63µm sieve. This is then washed with distilled water to remove any residual hydrogen peroxide. The sample retained on the sieve is then carefully washed back into the glass beaker up to a volume of approximately 250ml of distilled water.
4. 10ml of sodium hexametaphosphate solution is added to the beaker and this solution is stirred for ten minutes and then allowed to stand overnight. This treatment helps to dissociate the clay particles from one another.
5. The beaker with the sediment and sodium hexametaphosphate solution is washed and rinsed into a 63µm sieve. The retained sampled is carefully washed from the sieve into a labelled aluminium tray and placed in an oven for drying at 100ºC for 24 hours.
6. The dried sediment should then be passed through a Wentworth series of analytical sieves (>8,000 to 63µm; single phi units). The weight of material retained in each sieve is weighed and recorded. The material passing through the 63µm sieve is also weighed and the value added to the value measured in Point 5 above.
7. The total silt/clay fraction is determined by subtracting all weighed fractions from the initial starting weight of sediment as the less than 63µm fraction was lost during the various washing stages.
8. The reporting of sediment samples will be as percentages within the following range of particle sizes:
    - PSA % <63
    - PSA % 63<125
    - PSA % 125<250
    - PSA % 250<500
    - PSA % 500<1000
    - PSA % 1000<2000

- PSA % 2000<4000
- PSA % 4000<8000

The proportions of gravel, sand and mud allow for the determination of Folk (1954) classification. Folk classification is determined for all sediments analysed in AQUAFACT.

The organic matter (Loss on Ignition) will be carried out by ALS Labs in Loughrea using the following methodology:

1. The collected sediments are transferred to aluminium trays, homogenised by hand and dried in an oven at 100º C for 24 hours.
2. A sample of dried sediment is placed in a mortar and pestle and ground down to a fine powder.
3. 1g of this ground sediment is weighed into a pre-weighed crucible and placed in a muffle furnace at 450˚C for a period of 6 hours.
4. The sediment samples are then allowed to cool in a desiccator for 1 hour before being weighed again.
5. The organic content of the sample is determined by expressing as a percentage the weight of the sediment after ignition over the initial weight of the sediment.

7. Salt Marsh and Stony Bank Habitats

Both these habitats will be mapped and their current conservation status will be assessed (at an appropriate time of year) following the methodologies described in Martin *et al.* (in press) both at Renmore Beach and the area around Mweeloon Lagoon (as described above). Based on the data collected, the proposed management plan developed by AQUAFACT for Mweeloon Lagoon will be assessed and refined.

8. Compensation

The Proposed Compensation Plan contains a generic table for each of the habitats for which compensation is required and lists the management proposals for each under two main headings *i.e.* Ownership and Management. As ownership is seen as an important aspect of the long term implementation of the management plan, it is given a score of 50 points. The Management heading is broken down into five sub headings namely:

1. Damaging Impacts *e.g.* grazing, slurry spreading, use of weed killers *etc*
2. Damaging works *e.g.* drainage, machinery tracking over the habitat *etc*
3. Constraining works *e.g.* no construction works on the habitats
4. Removal of litter on an on-going basis and
5. Monitoring.

Each of these headings and subheadings is assessed in terms of its effectiveness and is scored against the seven topics listed EU Article 6 IROPI Guidance document (pages 16 – 20) *i.e.* Targeted Compensation, Effective Compensation, Technical Feasibility, Extent of Compensation, Location of Compensatory Measures, Timing of Compensation and Long Term Implementation and these scores are then used as a basis to arrive at an equivalent compensatory area for each habitat. Subject to agreement of this assessment methodology, the detailed qualitative and quantitative study results are proposed to be presented in this format to show the extent and effectiveness of the compensation to be proposed.

References

Martin, J., Daly, O. and Devaney, F. In press. Survey and assessment of vegetated shingle and associated habitats at 30 coastal sites. Irish Wildlife Manuals. National Parks and Wildlife Service, Dublin.

Appendix 1.

NPWS Conservation Objectives.

Conservation Objectives for Galway Bay Complex SAC [000268]

Habitat type **Mudflats and sandflats not covered by seawater at low tide.**

To maintain the favourable conservation condition of mudflats and sandflats not covered by seawater at low tide in Galway Bay Complex SAC, which is defined by the following list of attributes and targets:

Habitat area. The permanent habitat area is stable or increasing, subject to natural processes.

Community distribution. Conserve the intertidal sandy mud community complex and intertidal sand community complex in a natural condition.

Habitat type **Perennial vegetation of stony banks**

To maintain the favourable conservation condition of perennial vegetation of stony banks in Galway Bay Complex SAC, which is defined by the following list of attributes and targets:

Habitat area. The permanent habitat area is stable or increasing, subject to natural processes.

Community distribution. Conserve the perennial vegetation of stony banks in a natural condition.

Physical structure. Maintain the natural circulation of sediment and organic matter, without any physical obstructions.

Vegetation structure. Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion.

Vegetation composition. Maintain the typical stony bank flora *e.g.* sea sandwort *(Honckenya peploides),* sea beet *(Beta vulgaris ssp maritima),* rock samphire *(Crithmum maritimum),* sea mayweed *(Tripleurospermum maritimum),* yellow-horned *poppy (Glaucium flavum)* and sea campion *(Silene uniflora)* including the range of species within different zones. Negative indicator species to represent less than 5% cover.

Habitat type **Salt meadows (both Atlantic and Mediterranean).**

To maintain the favourable conservation condition of salt meadows in Galway Bay Complex SAC, which is defined by the following list of attributes and targets:

Habitat area. The permanent habitat area is stable or increasing, subject to natural processes.

Habitat distribution. No decline or change in habitat distribution subject to natural processes.

Physical structure. Maintain the natural circulation of sediment and organic matter, without any physical obstructions. Maintain creek and pan structure subject to natural processes including erosion and succession. Maintain natural tidal regime.

Vegetation structure. Maintain range of coastal habitats including transitional zones, subject

to natural processes including erosion. Maintain structural variation within the sward. Maintain more than 90% of the area outside the creeks.

Vegetation composition. Maintain range of sub-communities with typical salt marsh species.

Outline of vegetation survey work to be undertaken at Renmore and Tawin Island, Co, Galway, August 2017.

Description and assessment of shingle habitat at Renmore and north of Tawin Island

At both sites, full plant species list will be compiled for strandline and vegetated shingle habitat. A number of vegetation quadrats (8 to 10) will be described in order to describe and assess the composition and structure of the shingle vegetation. The distribution of the Annex habitat "Perennial vegetation of stony banks (1220)" at both sites will be revised and updated if necessary. The quadrats recorded could form the basis for future monitoring of the habitat in both locations. Particular attention will also be paid to the distribution and composition of the closely related Annex habitat Annual vegetation of drift lines (1210) which occurs below the high tide mark and is more subject disturbance by tides and storms.

Vegetation structure and composition will be compared with communities outlined in the recently published 'Survey and assessment of vegetated shingle and associated habitats at 30 coastal sites in Ireland' (Martin, Daly and Devaney, 2017). Survey methodologies outlined in this publication will be used to assess the quality and condition of the habitat present.

Arising from this survey work, any possible proposals for the enhancement of the habitat will be outlined.

Description and assessment of salt marsh habitat at Tawin Island

At Tawin, a full plant species list of the salt marsh habitat occurring will be compiled. A number of vegetation quadrats (12 to 15) will be described in order to assess the composition and structure of the salt-marsh vegetation present. The distribution of the salt marsh habitat will be revised and updated if necessary. The quadrats recorded could form the basis for future monitoring of the habitat.

Vegetation structure and composition will be compared with communities outlined in McCorry, M. and Ryle, T. (2009), Saltmarsh monitoring project 2007-2008: Final Report. Report for National Parks & Wildlife Service, Dublin. Survey methodologies outlined in this publication will be used to assess the quality and condition of the habitat present.

Arising from this survey work, any possible proposals for the enhancement of the habitat will be outlined. At this location grazing by livestock has been the main land use in the recent past and this has resulted in localized poaching of the salt marsh soil.