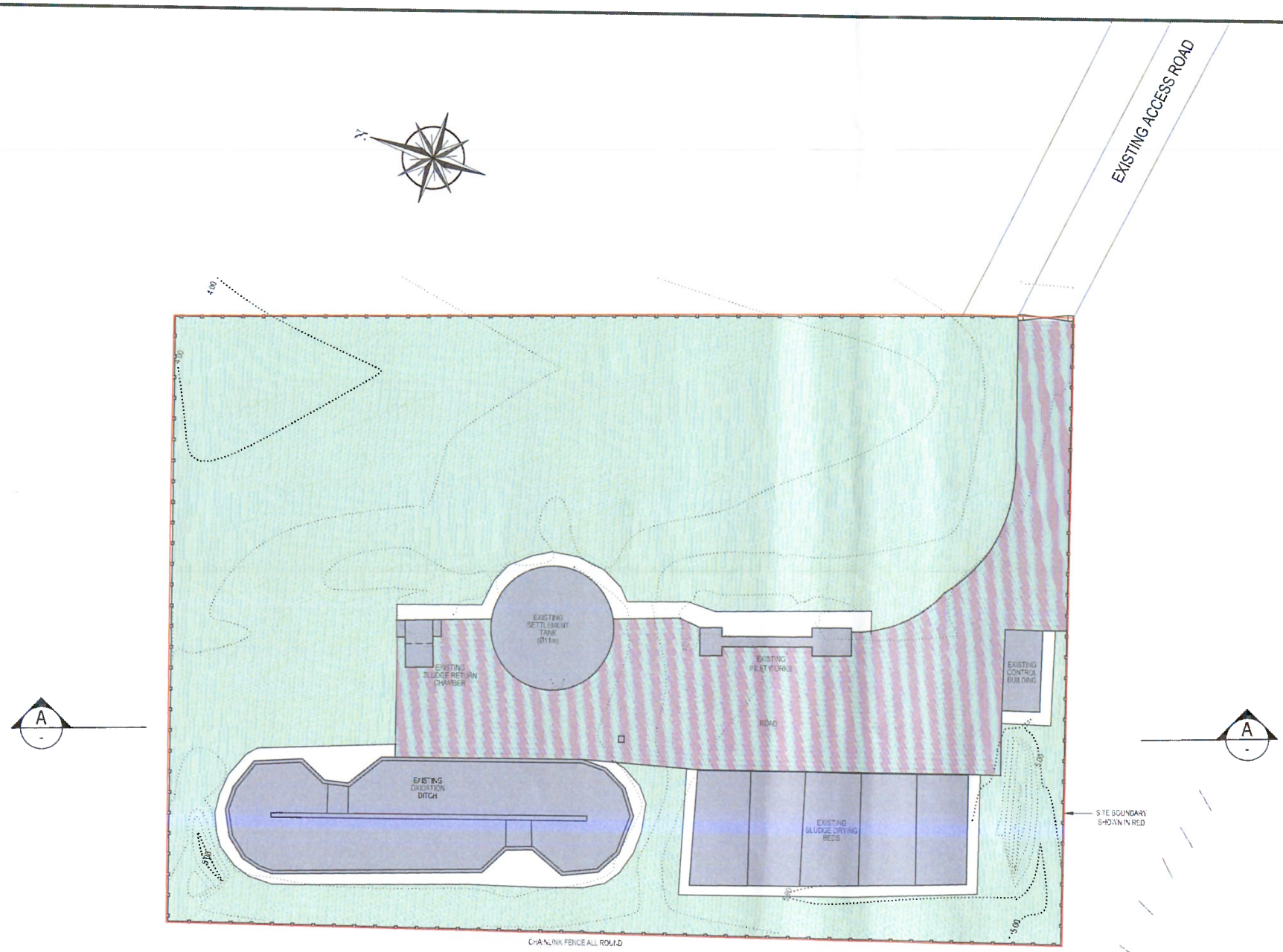


EXISTING SITE LAYOUT PLAN
1:250



SECTIONAL ELEVATION A-A
1:250

SCALE 1 : 250

INCLUDES ORDNANCE SURVEY IRELAND DATA REPRODUCED UNDER O.S.I. LICENCE NUMBER 2003/07/CCMA/SLIGO LOCAL AUTHORITIES. UNAUTHORISED REPRODUCTION INFRINGES ORDNANCE SURVEY IRELAND AND THE GOVERNMENT OF IRELAND COPYRIGHT.

NOTES

LEGEND

- EXISTING FENCELINE
- EXISTING TREATMENT UNITS / STRUCTURES
- PROPOSED TREATMENT UNITS / STRUCTURES
- PROPOSED ACCESS ROAD
- PROPOSED GRASSED AREA
- PROPOSED PROCESS PIPEWORK

REV	DATE	DESCRIPTION
		D
		C
		A

PLANNING

COPYRIGHT RESERVED - THIS DRAWING IS NOT TO BE USED FOR A PURPOSE OTHER THAN THAT FOR WHICH IT HAS BEEN ISSUED BY NICHOLAS O'DWYER LTD. NOR IS IT TO BE COPIED OR REPRODUCED IN ANY MANNER WITHOUT WRITTEN CONSENT

Nicholas O'Dwyer
CONSULTING ENGINEERS
Nutgrove Office Park, Nutgrove Avenue, Dublin 14
Tel: 01-296 9000 Fax: 01-296 9081 E-mail: nodwyer@nicholasodwyer.com

CLIENT
Sligo County Council
County Hall,
Riverside,
Sligo.
Tel: (071) 9156666 Fax: (071) 9141119

PROJECT
TUBBERCURRY,
GRANGE AND STRANDHILL
WASTEWATER TREATMENT PLANTS

TITLE
STRANDHILL
EXISTING
SITE LAYOUT PLAN & SECTION

SCALES	DRAWN	CHECKED	APPROVED
1:100 1:200 1:500	S.McGUINNESS	M. MADDEN	M. DAVITT
	DATE 08-05-07	DATE 08-05-07	DATE 08-05-07

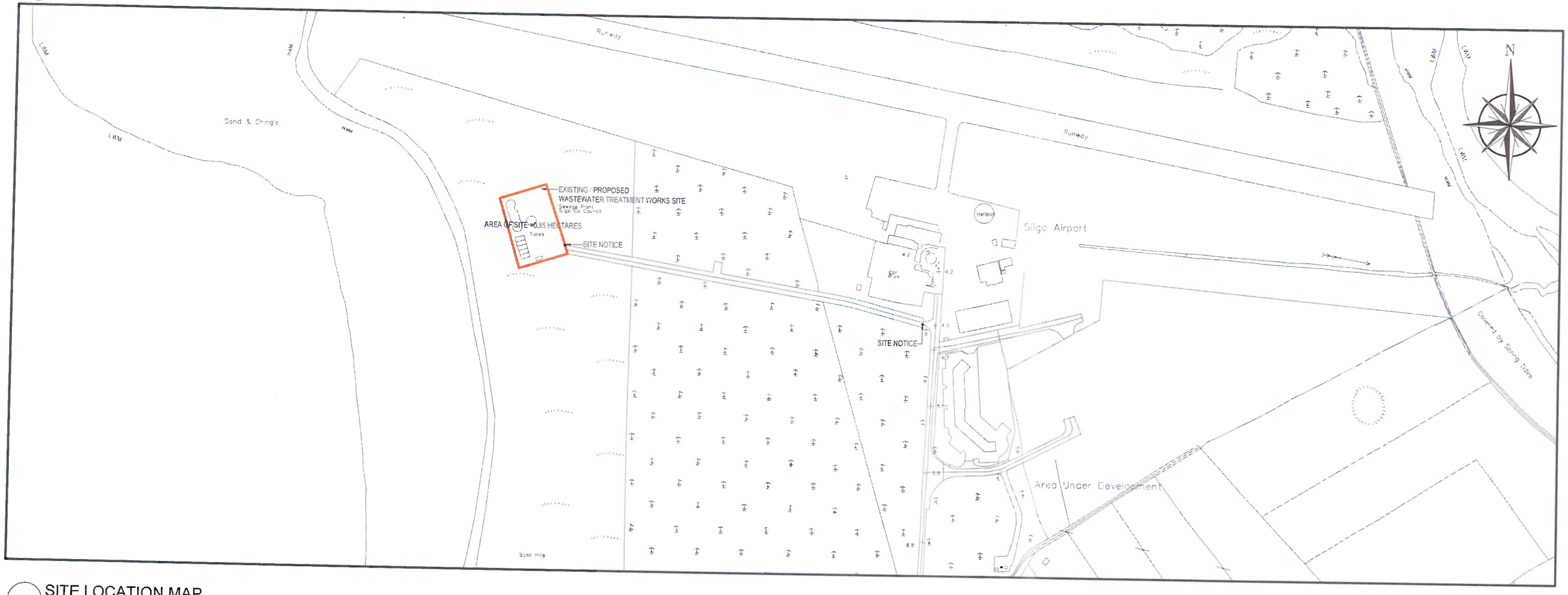
DRAWING No
20391-PC-SL-02

REV



SITE LOCATION PLAN

SCALE 1:1000



SITE LOCATION MAP

SCALE 1:2500

SCALE 1 : 2500

SCALE 1 : 1000

INCLUDES ORDNANCE SURVEY IRELAND DATA REPRODUCED UNDER O.S.I. LICENCE NUMBER 2003/07/CCMA/SLIGO LOCAL AUTHORITIES. UNAUTHORISED REPRODUCTION INFRINGES ORDNANCE SURVEY IRELAND AND THE GOVERNMENT OF IRELAND COPYRIGHT.

O.S.I. SHEET REFERENCE : 0951-C & 1010A

NOTES

LEGEND

EXISITNG / PROPOSED WwTW SITE

REV	DATE	DESCRIPTION	D	C	A

PLANNING

COPYRIGHT RESERVED - THIS DRAWING IS NOT TO BE USED FOR A PURPOSE OTHER THAN THAT FOR WHICH IT HAS BEEN ISSUED BY NICHOLAS O'DWYER LTD. NOR IS IT TO BE COPIED OR REPRODUCED IN ANY MANNER WITHOUT WRITTEN CONSENT.

Nicholas O'Dwyer
CONSULTING ENGINEERS
Nutgrove Office Park, Nutgrove Avenue, Dublin 14
Tel. 01-295 9090 Fax. 01-295 9091 E-mail nodwyer@nicholasodwyer.com

CLIENT

Sligo County Council
County Hall,
Riverside,
Sligo.
Tel : (071) 9156666 Fax : (071) 9141119

PROJECT

TUBBERCURRY, GRANGE & STRANDHILL WASTEWATER TREATMENT PLANTS

TITLE

STRANDHILL
WASTEWATER TREATMENT WORKS
SITE LOCATION PLAN

SCALES	DRAWN	CHECKED	APPROVED
1 : 2500 1 : 1000	J.Rousseau	M.Madden	M.Davitt
	DATE 05.06.07	DATE 05.06.07	DATE 05.06.07

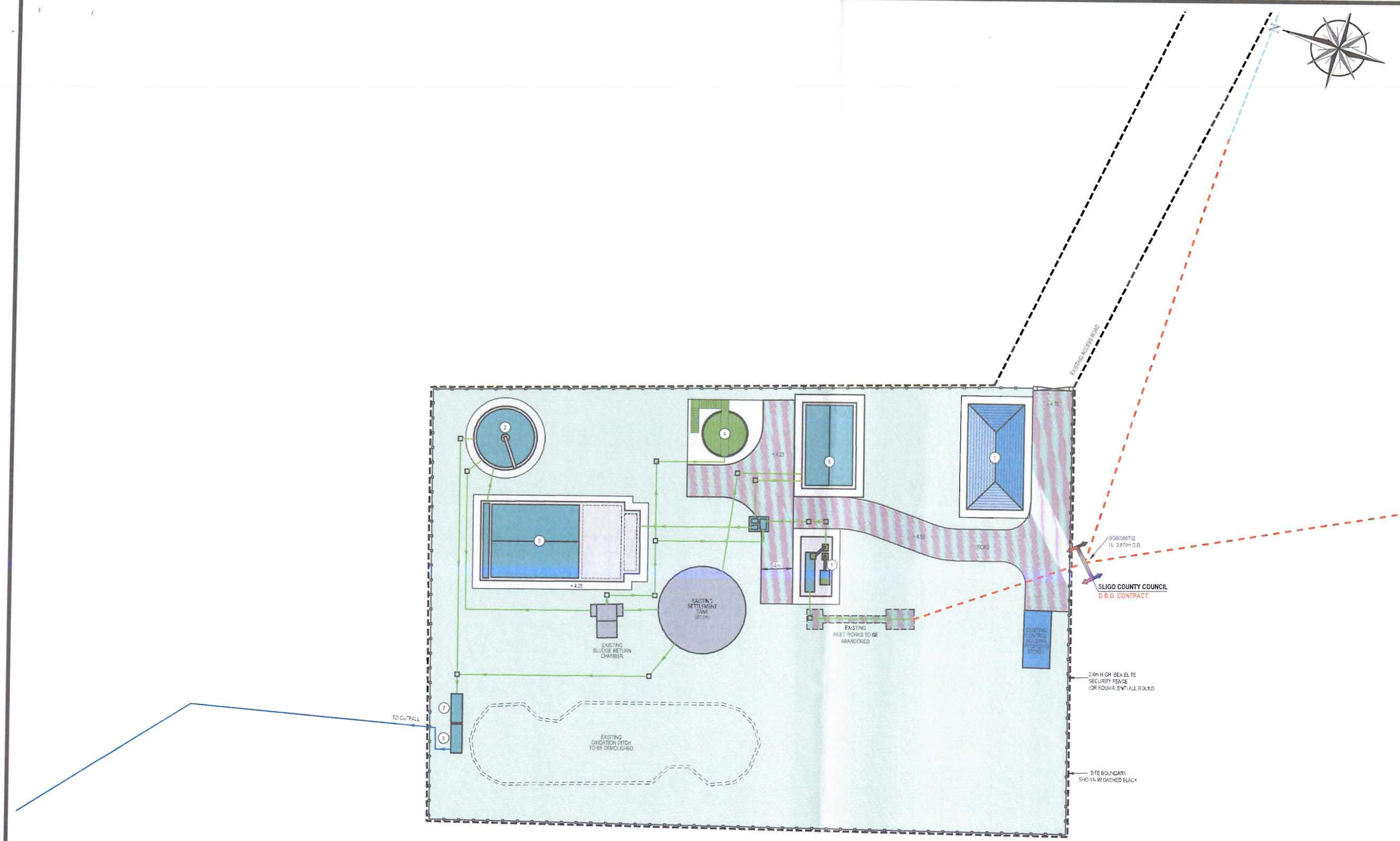
DRAWING No

20391-PC-SL-03

REV

APPENDIX II: DRAWINGS

5110



NOTES

LEGEND

- SITE BOUNDARY
- EXISTING FENCELINE
- EXISTING GRAVITY SEWER
- EXISTING RISING MAIN
- EXISTING TREATMENT UNITS / STRUCTURES
- PROPOSED TREATMENT UNITS / STRUCTURES
- PROPOSED ACCESS ROAD
- PROPOSED GRASSED AREA
- PROPOSED PROCESS PIPEWORK
- PIPELINE INTERFACE BETWEEN D.B.O. CONTRACTOR & SLIGO COUNTY COUNCIL — D.B.O. / S.C.C.

PROPOSED UNITS / STRUCTURES KEY

ADMINISTRATION / CONTROL BUILDING	1
SETTLEMENT TANK (Ø8m)	2
SECONDARY TREATMENT TANK (16m X 10m)	3
SLUDGE HOLDING TANK (Ø6m)	4
INLET WORKS	5
STORM STORAGE TANK (16m x 6m x 5m)	6
OUTLET FLUME	7
POSSIBLE FUTURE U.V. TREATMENT	8

25m 0 25m

SCALE 1 : 500

INCLUDES ORDNANCE SURVEY IRELAND DATA REPRODUCED UNDER O.S.I. LICENCE NUMBER 2003/07CCMA/SLIGO LOCAL AUTHORITIES. UNAUTHORISED REPRODUCTION INFRINGES ORDNANCE SURVEY IRELAND AND THE GOVERNMENT OF IRELAND COPYRIGHT.

REV	DATE	DESCRIPTION	D	C	A

PRELIMINARY

COPYRIGHT RESERVED - THIS DRAWING IS NOT TO BE USED FOR A PURPOSE OTHER THAN THAT FOR WHICH IT HAS BEEN ISSUED BY NICHOLAS O'DWYER LTD. NOR IS IT TO BE COPIED OR REPRODUCED IN ANY MANNER WITHOUT WRITTEN CONSENT

Nicholas O'Dwyer
CONSULTING ENGINEERS
Hedgrove Office Park, Hedgrove Avenue, Dublin 14
Tel 01-295 9700 Fax 01-295 9301 E-mail o.dwyer@nodwyer.com

CLIENT

Sligo County Council
Comhairle Chontae Shligigh
County Hall,
Riverside, Co Sligo
Tel (071) 9156666 Fax (071) 9141119

PROJECT

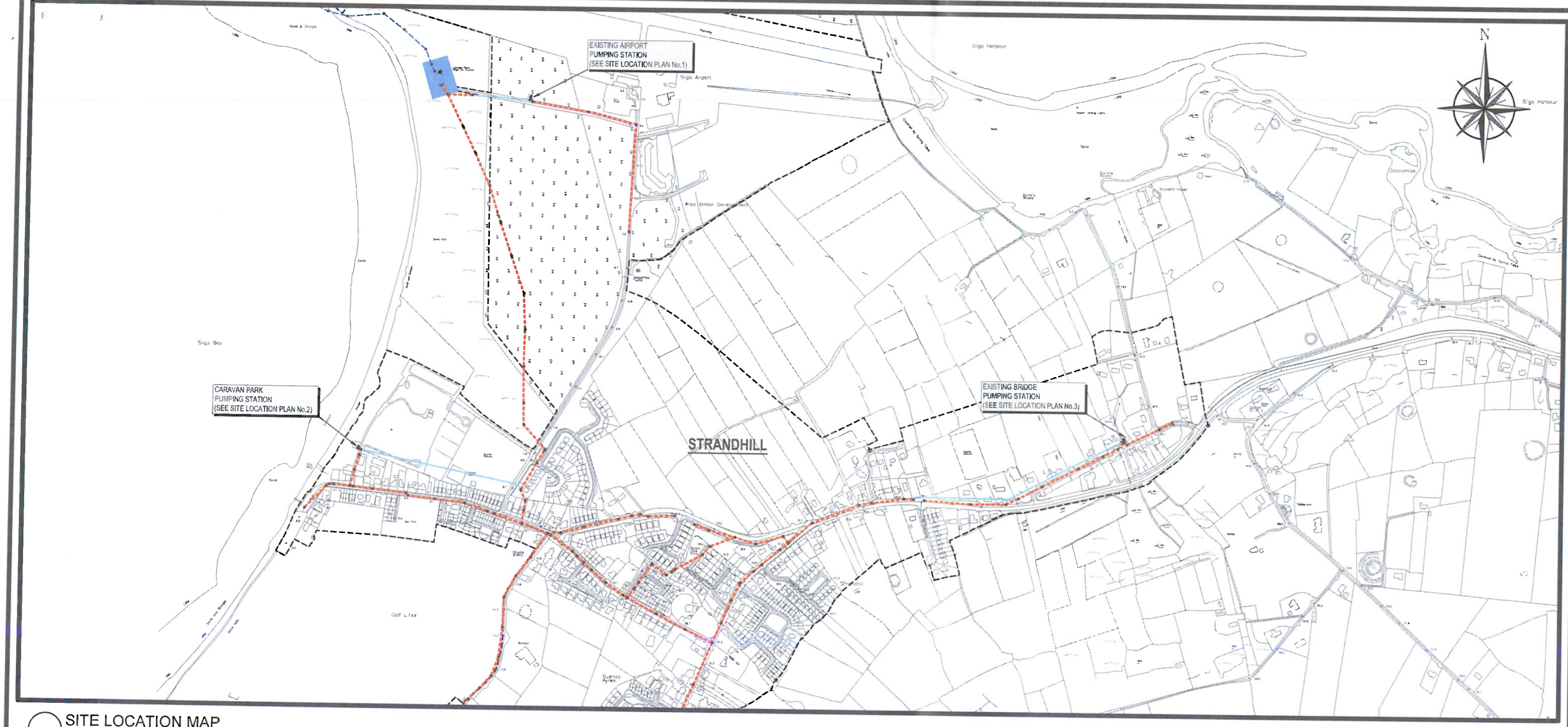
TUBBERCURRY, GRANGE & STRANDHILL DBO BUNDLE

TITLE

STRANDHILL WASTEWATER TREATMENT WORKS INDICATIVE SITE LAYOUT PLAN

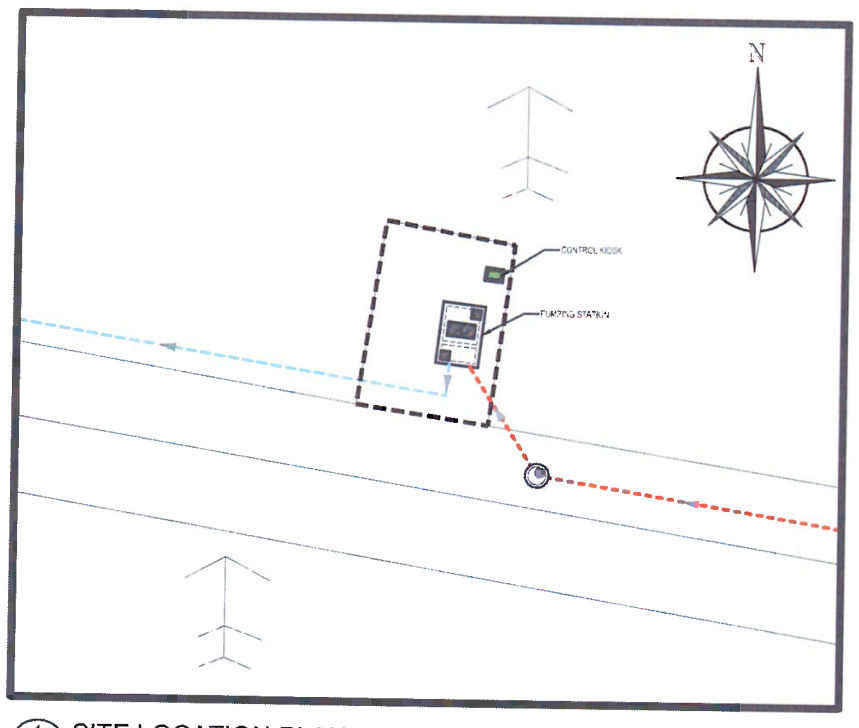
SCALES	DRAWN	CHECKED	APPROVED
1:500 @ A3	D.Rimdzius	F.Lane	N.Delaney
	DATE 02-09-13	DATE 02-09-13	DATE 02-09-13

DRAWING No 20391-AA-01 REV -



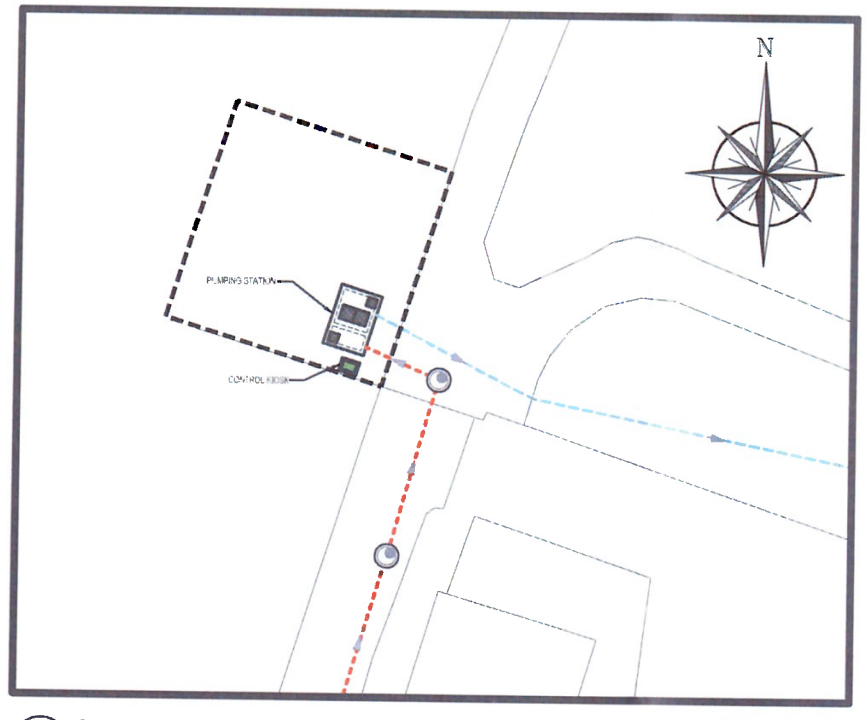
SITE LOCATION MAP

SCALE 1:10,000



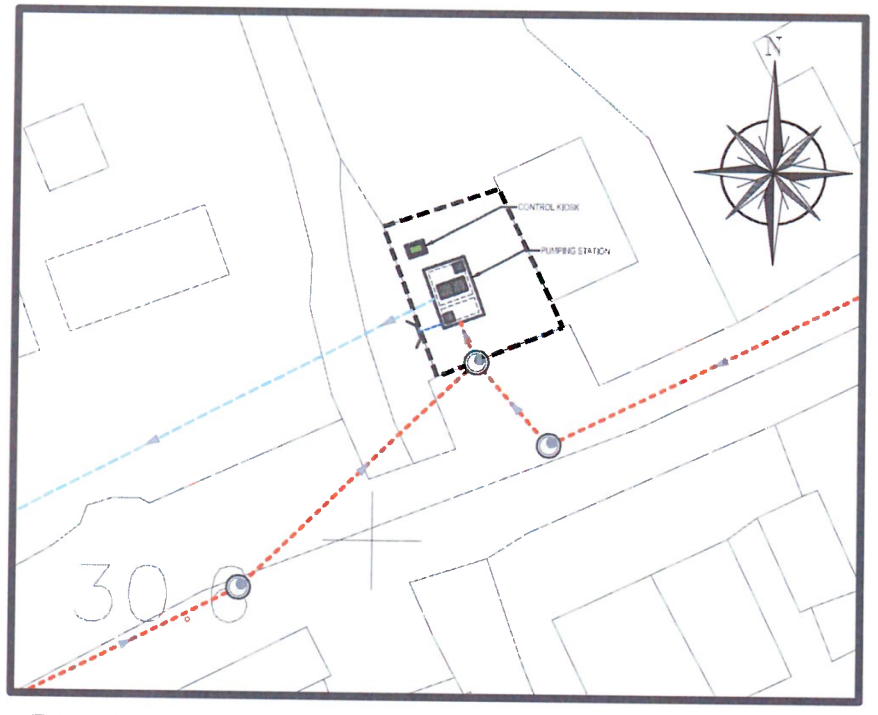
1 SITE LOCATION PLAN - AIRPORT P.S.

SCALE 1:500



2 SITE LOCATION PLAN - CARAVAN PARK P.S.

SCALE 1:500



3 SITE LOCATION PLAN - BRIDGE P.S.

SCALE 1:500

NOTES

LEGEND

- EXISTING TREATMENT WORKS SITE
- EXISTING FOUL SEWER
- EXISTING (FOUL) RISING MAIN
- EXISTING PUMP STATION
- EXISTING (FOUL) RISING MAIN
- EXISTING SITE BOUNDARY
- OVERFLOW

REV.	DATE	DESCRIPTION	D	C	A

PRELIMINARY

COPYRIGHT RESERVED - THIS DRAWING IS NOT TO BE USED FOR A PURPOSE OTHER THAN THAT FOR WHICH IT HAS BEEN ISSUED BY NICHOLAS O'DWYER LTD. NOR IS IT TO BE COPIED OR REPRODUCED IN ANY MANNER WITHOUT WRITTEN CONSENT

Nicholas O'Dwyer
CONSULTING ENGINEERS
Hartnett House, Office Park, Nutgrove Avenue, Dublin 14
Tel 01-296 9000 Fax 01-296 9001 E-mail dublin@nodwyer.com

CLIENT

Sligo County Council
Comhairle Chontae Shligigh
County Hall,
Riverside, Co Sligo
Tel (071) 9156666 Fax (071) 9141119

PROJECT

TUBBERCURRY,
GRANGE & STRANDHILL
DBO BUNDLE

TITLE

STRANDHILL
PUMPING STATION SITES
LOCATION PLAN

SCALES	DRAWN	CHECKED	APPROVED
1:500 @ A3 1:10,000 @A3	D.Smithers	C.Sheehan	N.Delaney
	DATE 20.08.13	DATE 20.08.13	DATE 20.08.13

DRAWING No 20391-AA-03

REV -

APPENDIX III: PROVISIONAL SCREENING EXERCISE

Table III.1 Special Areas of Conservation within 20 km of the Proposed Works

Site Name & Code	Annex I species	Annex II Habitat	Threats to Site Integrity	Distance	Potential Impact	Justification
Ben Bulben, Gleniff and Glenade Complex (000623)	Geyer's whorl snail (Vertigo geyeri) Otter (*Lutra lutra*)	[3260]Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [4030]European dry heaths [4060]Alpine and Boreal heaths [5130]*Juniperus communis* formations on heaths or calcareous grasslands [7220]Petrifying springs with tufa formation (Cratoneurion) [8120] Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii)* [8210]Calcareous rocky slopes with chasmophytic vegetation	Changes in local hydrology including drainage; Peat Extraction; Overgrazing; Forestry; Burning; Direct loss of habitat to development; Arterial drainage/water abstraction/lowering of the regional water table; Agricultural reclamation; Introduction of alien invasive species; Illegal Dumping; Burning.	11.17 km	No impact	There is no route for the proposed works to impact on this SAC
Cummeen Strand/Drumcliff Bay (000627)	Narrow-mouthed whorl snail (*Vertigo angustior*) Common Seal (*Phoca vitulina*)	[1130] Estuaries [1140] Mudflats and sandflats not covered by seawater at low tide [2110] Embryonic shifting dunes [2120] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) [7220] Petrifying springs with tufa formation (Cratoneurion) [5130] *Juniperus communis*	Decrease in water quality/Increased pollution; Development of marinas and ports; Disturbance to marine mammals; Dumping at sea; Direct loss of habitat to development; Recreational/amenity use; Agricultural improvements/Reclamation; Drainage/Changes in local hydrology including water abstraction; Erosion (natural and anthropogenic); Agricultural abandonment Overgrazing/undergrazing; Bracken and scrub encroachment; Tourism related development;	0 metres	Potential for impact	Given the proximity of the proposed works to the SAC and in line with the precautionary principle further assessment is required.

Site Name & Code	Annex I Species	Annex II Habitat	Threats to Site Integrity	Distance	Potential Impact	Justification
		formations on heaths or calcareous grasslands	Introduction of alien invasive species; Illegal Dumping; Burning; Quarrying/removal of sand; Aquaculture.			
Lough Gill (001976)	Sea Lamprey (*Petromyzon marinus*) River Lamprey (*Lampetra fluviatilis*) Brook Lamprey (*Lampetra planeri*) White -clawed Crayfish (*Austropotamobius pallipes*) Atlantic Salmon (*Salmo salar*) European Otter (*Lutra lutra*)	[3150] Natural eutrophic lakes with Magnopotamion or Hydrocharitiontype vegetation [91e0] Alluvial forests with *Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae*) [91a0] Old sessile oak woods with Ilex and Blechnum in British Isles	Decrease in water quality/Increased pollution; Changes in water flow rates; Arterial drainage/water abstraction/lowering of the regional water table; Siltation; Loss of fringe vegetation; Changes in seasonal water levels/fluctuations; Direct loss of habitat to development; Loading from effluents(WwTW); Recreation/amenity use; Developments – marinas; Introduction of alien invasive species; Illegal Dumping; Crayfish Fishing.	8.61 km	No impact	There is no route for the proposed works to impact on this SAC.
Ballysadare Bay (000622)	Narrow-mouthed whorl snail (*Vertigo angustior)* Common Seal (*Phoca vitulina)*	[1130] Estuaries [1140] Mudflats and sandflats not covered by seawater at low tide [2110] Embryonic shifting dunes [2120] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2190] Humid dune slacks	Decrease in water quality/Increased pollution; Development of marinas and ports; Disturbance to marine mammals; Dumping at sea; Direct loss of habitat to development; Recreational/amenity use Agricultural; improvements/Reclamation Drainage/Changes in local hydrology; including water abstraction; Erosion (natural and anthropogenic), Agricultural abandonment; Overgrazing/undergrazing; Bracken and scrub encroachment; Tourism related development;	1.4 km	Potential for impact	Given the proximity of the proposed works to the SAC and in line with the precautionary principle further assessment is required.

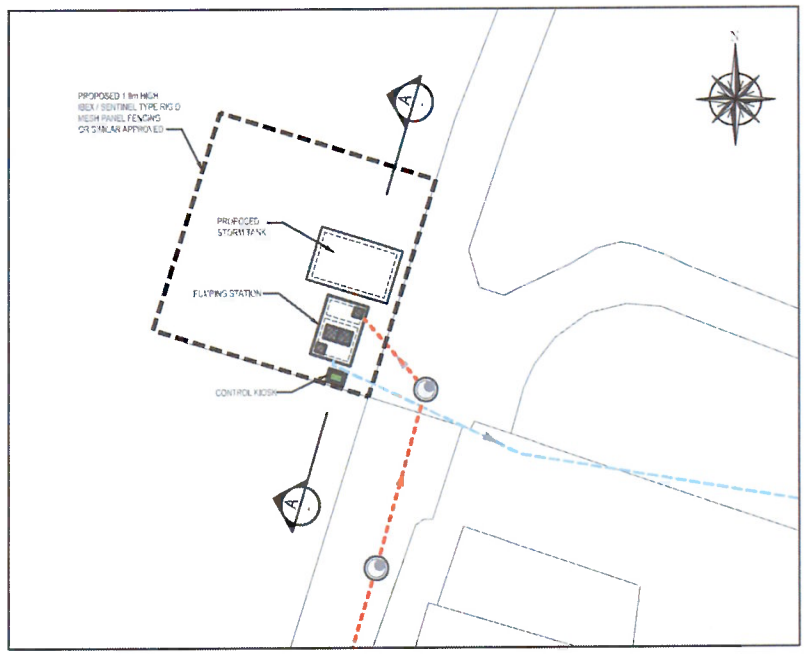
Site Name & Code	Annex I Species	Annex II Habitat	Threats to Site Integrity	Distance	Potential Impact	Justification
			Introduction of alien invasive species; Illegal Dumping; Burning; Quarrying/removal of sand; Aquaculture.			
Knockalongy and Knockachree Cliffs (001669)	Killarney fern (*Trichomanes speciosum*)	[3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [4010]Northern Atlantic wet heaths with *Erica tetralix* [7130]Blanket bog (*active only) [8210]Calcareous rocky slopes with chasmophytic vegetation [8220]Siliceous rocky slopes with chasmophytic vegetation	Pollution and acidification of the watercourses and lakes; Changes in local hydrology including drainage; Peat Extraction; Overgrazing; Forestry; Burning; Direct loss of habitat to development; Arterial drainage/water; abstraction/lowering of the regional water table; Agricultural reclamation; Introduction of alien invasive species; Illegal Dumping; Increased pollution/reduction in water quality; Quarrying/removal of sand.	11.44 km	No impact	There is no route for the proposed works to impact on this SAC
Unshin River (001898)	Atlantic Salmon (*Salmo salar)* European Otter (*Lutra lutra)*	[3260] Water courses of plain to montane levels with the Ranunculion fluitantis and *Callitricho-Batrachion* vegetation [91E0] Alluvial forests with *Alnus glutinosa and Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	Decrease in water quality/Increased pollution; Changes in water flow rates; Arterial drainage/water; abstraction/lowering of the regional water table; Siltation; Loss of fringe vegetation; Changes in seasonal water levels/fluctuations; Direct loss of habitat to development; Loading from effluents(WwTW); Recreation/amenity use; Developments –marinas; Introduction of alien invasive species;	9.48 km	No impact	There is no route for the proposed works to impact on this SAC

Site Name & Code	Annex I Species	Annex II Habitat	Threats to Site Integrity	Distance	Potential Impact	Justification
			Illegal Dumping.			
Union Wood (000638)		[91A0] Old sessile oak woods with Ilex and Blechnum in British Isles	Direct loss of habitat to development; Amenity/recreational use; Invasive species; Lack of/inappropriate woodland management; Overgrazing (deer); Introduction of alien invasive species; Illegal Dumping; Felling/Removal of Trees.	11.08 km	No impact	There is no route for the proposed works to impact on this SAC
Ox Mountains Bogs (002006)	Geyer's Whorl Snail *(Vertigo geyeri)*	[7130] Blanket bog (*active only) [4010] Northern Atlantic wet heaths with *Erica tetralix* [3160] Natural dystrophic lakes and ponds [3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae)* [7150] Depressions on peat substrates of the Rhynchosporion	Changes in local hydrology including drainage; Peat Extraction; Overgrazing; Forestry; Burning; Direct loss of habitat to development; Arterial drainage/water abstraction/lowering of the regional water table; Agricultural reclamation; Introduction of alien invasive species; Illegal Dumping; Increased pollution/reduction in water quality.	14.17 km	No impact	There is no route for the proposed works to impact on this SAC

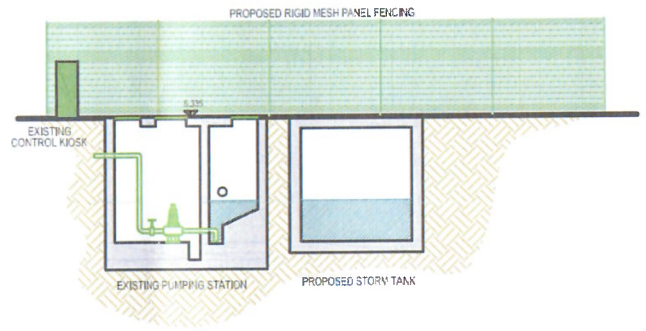
Table III.2 Special Protection Areas within 20 km of the Proposed Works

Site Name & Code	Conservation Interests	Threats to Site Integrity	Distance	Potential Impact	Justification
Sligo/Leitrim Uplands (004187)	Peregrine (*Falco peregrinus*) Chough (*Pyrrhocorax pyrrhocorax)*	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development Water quality/pollution; Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.	11.13 km	No impact	There is no route for the proposed works to impact on this SPA.
Ballintemple and Ballygilgan (004234)	Barnacle Goose (*Branta leucopsis)*	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development; Water quality/pollution; Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.	6.73 km	No impact	There is no route for the proposed works to impact on this SPA.
Ardboline Island and Horse Island (004135)	Cormorant (*Phalacrocorax carbo)* Barnacle Goose (*Branta leucopsis)* Additional Special Conservation Interests: Corncrake (*Crex crex*)	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development; Water quality/pollution; Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.	8.02 km	No impact	Due to the distance of the scheme from the site and the high dilution capacity of Donegal Bay will be no significant impact on this site.
Drumcliff Bay (004013)	Barnacle Goose (*Branta leucopsis)* Sanderling (*Calidris alba*) Additional Special Conservation Interests: Wetland & Water birds	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development; Water quality/pollution; Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.	4.9km	No impact	Due to the distance of the scheme from the site and the high dilution capacity of Sligo Bay there will be no significant impact on this site.
Cummeen Strand (004035)	Light-bellied Brent Goose (*Branta bernicla hrota)* Additional Special Conservation Interests:	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development; Water quality/pollution;	~300m	Potential for impact	Given the proximity of the proposed works to the SAC and in line with the precautionary principle

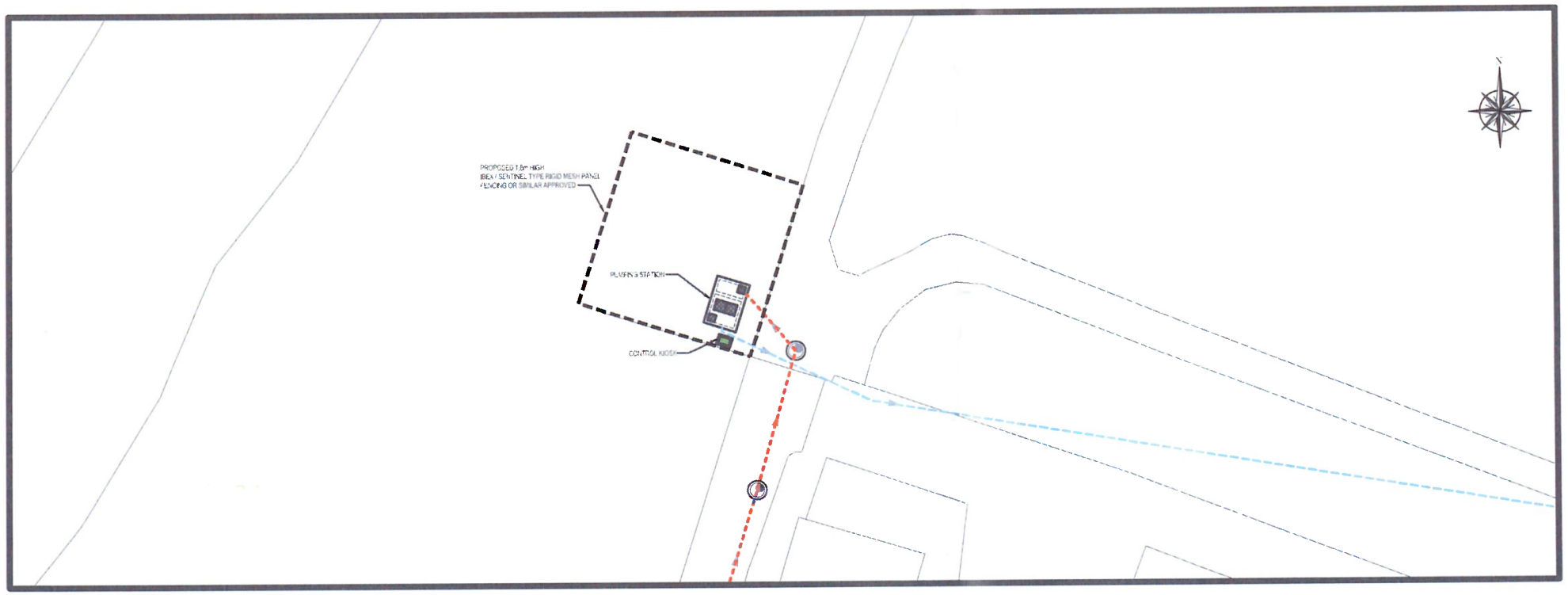
Site Name & Code	Conservation Interests	Threats to Site Integrity	Distance	Potential Impact	Justification
	Oystercatcher (*Haematopus ostralegus*) Redshank (*Tringa totanus*) Wetland & Water birds	Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.			further assessment is required.
Aughris Head (004133)	Kittiwake (*Rissa tridactyla*)	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development; Water quality/pollution; Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.	10.42 km	No impact	There is no route for the proposed works to impact on this SPA.
Ballysadare Bay (004129)	Light-bellied Brent Goose (*Branta bernicla hrota*) Bar-tailed Godwit (*Limosa lapponica*) Additional Special Conservation Interests: Grey Plover (*Pluvialis squatarola*) Dunlin (*Calidris alpina*) Redshank (*Tringa totanus*) Wetland & Water birds	Direct and indirect impacts to the habitats of the bird species of conservation interests (loss of habitat); Direct loss of habitat to development; Water quality/pollution; Disturbance including recreation/amenity use; Introduction of alien invasive species; Illegal Dumping; Disturbance from Recreational/amenity use; Inappropriate land management.	1.4 km	Potential for impact	Given the proximity of the proposed works to the SAC and in line with the precautionary principle further assessment is required.



- PROPOSED INDICATIVE SITE LAYOUT PLAN
SCALE 1:500



A - PROPOSED INDICATIVE SITE LAYOUT PLAN SECTION
SCALE 1:200



- EXISTING SITE LAYOUT PLAN
SCALE 1:500

NOTES

LEGEND

EXISTING FOUL SEWER

EXISTING (FOUL) RISING MAIN

EXISTING (FOUL) RISING MAIN

EXISTING SITE BOUNDARY

REV	DATE	DESCRIPTION
D		
C		
A		

PRELIMINARY

COPYRIGHT RESERVED - THIS DRAWING IS NOT TO BE USED FOR A PURPOSE OTHER THAN THAT FOR WHICH IT HAS BEEN ISSUED BY NICHOLAS O'DWYER LTD. NOR IS IT TO BE COPIED OR REPRODUCED IN ANY MANNER WITHOUT WRITTEN CONSENT

Nicholas O'Dwyer
CONSULTING ENGINEERS
Nutgrove Office Park, Nutgrove Avenue, Dublin 14
Tel: 01-296 9000 Fax: 01-296 9001 E-mail: nodwyer@nicholasodwyer.com

CLIENT

Sligo County Council
Comhairle Chontae Shligigh
County Hall,
Riverside, Co. Sligo
Tel: (071) 9156666 Fax: (071) 9141119

PROJECT

TUBBERCURRY,
GRANGE & STRANDHILL
DBO BUNDLE

TITLE

STRANDHILL
EXISTING & PROPOSED CARAVAN
PARK SITE LAYOUT PLAN

SCALES	DRAWN	CHECKED	APPROVED
1:200 @ A3 1:500 @A3	D.Smithers	C.Sheehan	N.Delaney
	DATE 20.08.13	DATE 20.08.13	DATE 20.08.13

DRAWING No. 20391-AA-04

REV -

SAC Corrections Map Viewer

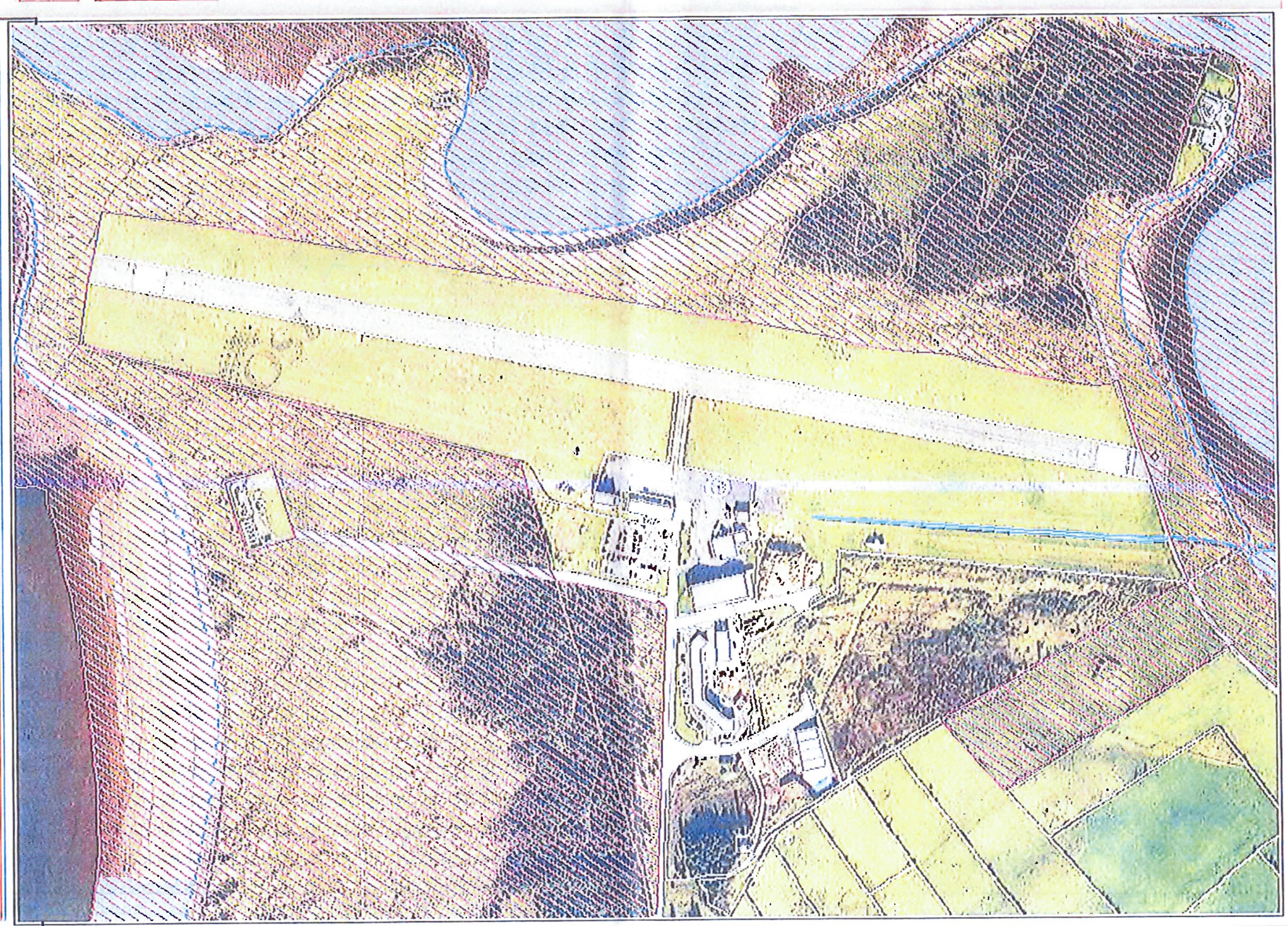
Logged in as nlockhart Logout

000627 | Search | Toggle Dual Maps | Anomaly Identify | Measure

IG Map Contents

ITM Map Contents

- PAI/SACCorrectio
  - MarkUp Points
    - Done
    - Done
    - Done
    - Done
    - Done
    - Done
    - Done but Please Ch
    - Need More Info
    - Not Done
    - Not yet Checked by
    - Not yet Checked by
    - Not yet Checked by
    - Not yet Checked by
    - Checked by Ecols -
    - Checked by Ecols -
    - Checked by Ecols -
    - Checked by Ecols -
    - Checked by Ecols -
    - Checked by Ecols -
    - Checked by Ecols -



APPENDIX IV: CORRESPONDENCE

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

Mr. Frank Moylan,
Acting Senior Planner
Planning Office,
Sligo County Council,
County Hall,
Riverside,
Sligo.

20th June 2013

Re: Mapping issues relating to Cummeen Strand/Drumcliff Bay candidate Special Area of Conservation (cSAC) (Site Code: 000627)

Dear Mr. Moylan,

I refer to recent communications between Sligo County Council and Regional Management of the National Parks and Wildlife Service regarding the boundary of Cummeen Strand/Drumcliff Bay candidate Special Area of Conservation (cSAC) in the vicinity of Sligo Airport.

I wish to confirm that the boundary of the site has been reviewed internally as part of a project to transfer the boundary of all cSAC sites to a 1:5000 mapping base and address any relevant digitising errors. I have attached a map of the revised boundary of Cummeen Strand/Drumcliff Bay cSAC in the vicinity of Sligo Airport.

It should be noted that the revised boundary has not been publicised and it is not intended to publicise the revised boundaries resulting from this project until such time as the cSAC sites are assigned statutory instruments.

However, for the purpose of carrying out assessments on potential impacts of plans or projects on the cSAC I wish to confirm that it is acceptable to use the attached revised boundary.

I trust this clarified the issues relating to the boundary.

Yours sincerely,

Francis Donohoe

Francis Donohoe
Assistant Principal
National Parks & Wildlife Service

CC: Siobhán Ryan, Heritage Officer, Sligo County Council,
Declan Cawley, Acting Senior Executive Engineer, Water Services, Sligo County Council,

APPENDIX V: SITE SYNOPSES & NATURA 2000 STANDARD DATA FORMS

SITE SYNOPSIS

SITE NAME: CUMMEEN STRAND/DRUMCLIFF BAY (SLIGO BAY)

SITE CODE: 000627

This large coastal site extends from Cullamore in the north-west to Killaspug in the south-west, and from Sligo town in the south-east to Drumcliff village in the north-east. It encompasses two large, shallow bays (Drumcliff Bay and Sligo Harbour), Ardboline and Horse Islands, sand dunes and sand hills at Rosses Point, Killaspug, Yellow Strand and Coney Island, grassland at Ballintemple and Ballygilgan (Lissadell) and a variety of other habitats (woodland, salt marsh, sandy beaches, boulder beaches, shingle, fen, freshwater marshes, rocky sea cliffs, lakes). The site is largely underlain by Carboniferous limestone, but acidic rocks are also found on the Rosses Point peninsula. At Serpent Rock in the north-western section of the site the most complete section of the north-western Carboniferous strata is exposed. Here are found an excellent series of fossilised corals which, in some strata, stand out from the rock matrix.

The dominant habitats on the site are estuaries and intertidal sand and mud flats. Sligo Harbour receives the waters of the Garavogue River, which flows from Lough Gill, while Drumcliff Bay receives the Drumcliff River which flows from Glencar Lough. At low tide extensive areas of intertidal flats are exposed in both of these sheltered estuarine bays. The intertidal flats support a diverse macrofauna, with invertebrate species such as lugworm (*Arenicola marina*), cockles (*Cerastoderma edule*), sand mason (*Lanice conchilega*), Baltic tellin (*Macoma balthica*), spire shell (*Hydrobia ulvae*) and mussels (*Mytilus edulis*) being frequent. Of particular note is the presence of eelgrass (*Zostera noltii* and *Z. angustifolia*) beds in both bays. Both estuaries and intertidal flats are of conservation significance and are listed on Annex I of the EU Habitats Directive. Areas of salt marsh fringe both bays in places.

Sand dunes, sand hills and dune grassland are found at Rosses Point, Killaspug, Yellow Strand and Coney Island. The dominant species of the dune grassland behind Yellow Strand are Sand Sedge (*Carex arenaria*) and Meadow-grass (*Poa pratensis*), with associated species including Lady's Bedstraw (*Galium verum*), Mouse-ear Hawkweed (*Hieracium pilosella*), Common Milkwort (*Polygala vulgaris*), Common Dog-violet (*Viola riviniana*), Mountain Everlasting (*Antennaria dioica*), Common Spotted-orchid (*Dactylorhiza fuchsii*), Early Marsh-orchid (*D. incarnata*), Frog Orchid (*Coeloglossum viride*) and Autumn Lady's-tresses (*Spiranthes spiralis*). Embryonic dunes, with characteristic species, including Sand Couch (*Elymus farctus*), occur at the southern end of the sand spit at Rosses Point. Sand dune habitats are rare and threatened in Europe and three types found on the site, embryonic dunes, Marram (*Ammophila arenaria*) dunes and fixed dunes, are listed on Annex I of the E.U. Habitats Directive, the last-named with priority status.

Wetlands on the site include Doonweelin Lake, a freshwater lake on the Rosses Point peninsula, which supports interesting vegetation communities that reflect the

SITE SYNOPSIS

SITE NAME: CUMMEEN STRAND SPA

SITE CODE : 004035

Cummeen Strand is a large shallow bay stretching from Sligo town westwards to Coney Island. It is one of three estuarine bays within Sligo Bay, with Drumcliff Bay to the north and Ballysadare Bay to the south. The Garavogue River flows into the bay and forms a permanent channel.

At low tide, extensive sand and mud flats are exposed. These support a diverse macro-invertebrate fauna which provide the main food supply for the wintering waterfowl. Invertebrate species such as lugworm (*Arenicola marina*), ragworm (*Hediste diversicolor*), cockles (*Cerastoderma edule*), sand mason (*Lanice conchilega*), Baltic tellin (*Macoma balthica*), spire shell (*Hydrobia ulvae*) and mussels (*Mytilus edulis*) are frequent. Of particular note is the presence of eelgrass (*Zostera noltii* and *Z. angustifolia*) beds, which provide a valuable food stock for herbivorous wildfowl. The estuarine and intertidal flat habitats are of conservation significance and are listed on Annex I of the EU Habitats Directive. Areas of salt marsh fringe the bay in places and provide roosting sites for birds during the high tide periods. There are sand dunes at Killaspug Point and Coney Island, with a shingle spit at Standalone Point near Sligo town.

Cummeen Strand is of ornithological importance as it supports important concentrations of wintering waterfowl. The site supports an Internationally Important flock of Brent Geese (peak of 232 individuals in the winter of 1999/00, with the mean of peak monthly counts in the period 1996/99 (except 1998) being 228, peaking at 309) and Nationally Important populations of a further two species – Oystercatcher 891 and Redshank 501 (all figures are average peaks for the period). Other species which occurred in significant numbers included Shelduck 80, Wigeon 178, Teal 70, Mallard 170, Red-breasted Merganser 17, Golden Plover 567, Lapwing 734, Knot 18, Sanderling 18, Dunlin 601, Bar-tailed Godwit 57, Curlew 546, Greenshank 18 and Turnstone 80. Whooper Swans also occurred (9), though they are not regular visitors. The presence of Golden Plover, Bar-tailed Godwit and Whooper Swan is of particular note as these species are listed on Annex I of the EU Birds Directive.

This site is of high ornithological importance, with one species having a population of International Importance and two having populations of National Importance. In addition, there are three species that are listed on Annex I of the Birds Directive. The site is also important as a component of the much larger Sligo Bay complex.

28.02.2002

SITE SYNOPSIS

SITE NAME : BALLYSADARE BAY

SITE CODE : 000622

Ballysadare Bay extends for about 10km westwards from the town of Ballysadare, County Sligo and is the most southerly of three inlets of the larger Sligo Bay. The estuarine channel of the Ballysadare River winds its way through the Bay, finally reaching the open sea near the spit at Strandhill Dunes. The Bay is underlain by sedimentary rocks of limestones, sandstones and shales, which are exposed as low cliffs and small sections of bedrock shore at several locations. Knocknarea Mountain overlooks the site.

The bay contains extensive intertidal sand and mudflats, approximately 1,500ha in extent. The mud provides an abundance of food for wildfowl, in the form of colonising plants such as Eel Grass (*Zostera marina*) and Tasselweed (*Ruppia maritima*), as well as numerous species of invertebrates on which both wildfowl and waders feed. Well-developed saltmarshes occur at several locations around the bay. Typical species of these areas are Sea Rush (*Juncus maritimus*), Saltmarsh Rush (*Juncus gerardi*), Creeping Bent (*Agrostis stolonifera*) and Parsley Water-dropwort (*Oenanthe lachenalii*). In hollows and ditches, Sea Arrow Grass (*Triglochin maritima*), Sea Club Rush (*Scirpus maritimus*), Sea Milkwort (*Glaux maritima*), Thrift (*Armeria maritima*), Sea Plantain (*Plantago maritima*), Sea Aster (*Aster tripolium*) and Red Fescue (*Festuca rubra*) occur. Particularly interesting species found on the saltmarshes are Flowering Rush (*Butomus umbellatus*), Slender Spike-rush (*Eleocharis uniglumis*) and Hard Grass (*Parapholis strigosa*).

There is a large sand dune system at Strandhill which has been relatively undisturbed by grazers. The dune system is highly dynamic, with the tip of the peninsula actively growing and displaying a good, though limited, example of embryonic shifting dunes. The characteristic species found in this habitat type include Couch Grass (*Elymus farctus*), Spear-leaved Orache (*Atriplex prostratus*) and Sea Rocket (*Cakile maritima*). Shifting marram dunes are fairly extensive in area, occurring along the entire seaward side of the spit and are especially active towards the tip. While Marram (*Ammophila arenaria*) is the dominant species, Colt's Foot (*Tussilago farfara*), Red Goosefoot (*Chenopodium rubrum*) and Cat's-ear (*Hypochoeris radicata*) can also be found. The seaward dunes reach considerable heights (up to 20m). They are very steep on the seaward edge, but to the east of this there is an undulating expanse of dune hills. The largest proportion of the dune system is made up of fixed dunes, a priority habitat listed on Annex I of the EU Habitats Directive. In from the marram dunes, there is a low-growing, closed sward which is particularly species rich, with Field Wood-rush (*Luzula campestris*), Kidney Vetch (*Anthyllis vulneraria*), Bee Orchid (*Ophrys apifera*), Oxeye Daisy (*Leucanthemum vulgare*), Common Centuary (*Centaurium erythraea*), Thyme (*Thymus praecox*), Harebell (*Campanula rotundifolia*), Burnet Rose (*Rosa pimpinellifolia*), Carline Thistle (*Carlina vulgaris*) and Fairy Flax (*Linum catharticum*). The fixed dune areas are also rich in brophytes and lichens. Moss

species include *Tortula ruraliformis, Homalothecium lutescens, Ditrichum flexicaule and Hypnum cupressiforme,* while lichens (*Peltigera* spp. and *Cladonia* spp.) are also present. Some humid dune slacks occur amongst the fixed dunes. Characteristic species include Creeping Willow (*Salix repens*), Carnation Sedge (*Carex panicea*), Marsh Helleborine (*Epipactis palustris*) and Jointed Rush (*Juncus articulatus*).

A range of habitats fringe the Bay, adding diversity. Some of these areas have particular features of interest, e.g. the old oyster farm at Tanrego is important for waterfowl, while the uncommon plant species, Ivy Broom (*Orobanche hederae*), occurs in scrubland adjacent to the bay.

Ballysadare Bay is important for a range of waterfowl species in autumn and winter and is part of the larger Sligo Bay complex. Brent Geese occur in internationally important numbers while a further seven species have populations of national importance. These are as follows, with numbers referring to the average peaks over winters 1994/95 - 1997/98: Brent Goose (259), Red-breasted Merganser (48), Oystercatcher (796), Grey Plover (231), Dunlin (1129), Bar-tailed Godwit (431), Redshank (481) and Greenshank (24). The presence of Bar-tailed Godwit and also smaller numbers of Golden Plover (66) is of particular note as these species are listed on Annex I of the EU Birds Directive.

Two animals listed on Annex II of the EU Habitats Directive occur within the site: the Bay supports a colony of Common Seals, with up to 170 adults recorded here at one time; and the rare snail, *Vertigo angustior*, occurs in dune slacks or hollows at Strandhill.

The Bay is little used for fishing or boating, but marsh shooting is common in the upper reaches of the Bay. Aquaculture is little developed in this bay compared to nearby Sligo and Drumcliff Bays. Dune systems are sensitive to developments which alter their structure. Grazing is also a critical factor: the correct level of grazing maintains an open, species-rich sward, but the presence of too many grazers causes damage to the vegetation and may exacerbate dune erosion. Agricultural improvement, and particularly the application of fertilisers, threatens dune vegetation, leading to the eventual loss of species diversity.

Ballysadare Bay is of ecological value for its range of good quality coastal habitats. Actively developing dune systems are rare on the west coast and the sand dune system at Strandhill is of particular interest as a large and intact example of a habitat type which is under general threat from development. The rarity of intact dune systems is recognised in the listing of "Fixed Dunes" as priority habitat on Annex I of the EU Habitats Directive. The saltmarshes at Ballysadare Bay are relatively good examples for the west coast and that at Abbeytown is unusual as it is forming on quarry waste. The presence of two Annex II species within the site adds further importance. Furthermore, the bay supports nationally important numbers of waterfowl.

15.10.2001

SITE SYNOPSIS

SITE NAME: BALLYSADARE BAY SPA

SITE CODE: 004129

Ballysadare Bay extends for about 10km westwards from the town of Ballysadare, County Sligo and is the most southerly of three inlets of the larger Sligo Bay complex. The estuarine channel of the Ballysadare River winds its way through the bay, finally reaching the open sea near the spit at Strandhill Dunes. The bay is underlain by sedimentary rocks of limestones, sandstones and shales, which are exposed as low cliffs and small sections of bedrock shore at several locations.

The bay contains extensive intertidal sand and mudflats. The flats support good populations of macro-invertebrates which are important food items for wintering waterfowl. Common species include the polychaete worms *Hediste diversicolor, Arenicola marina, Lanice conchilega* and *Nepthys hombergii*, and the bivalves *Cerastoderma edule, Macoma balthica* and *Scrobicularia plana*. Also present on the intertidal flats are the vascular plants Eelgrass (*Zostera marina*) and Beaked Tasselweed (*Ruppia maritima*), which provide food for herbivorous wildfowl.

Well-developed salt marshes, which provide roosting sites for birds at high tide, occur at several locations around the bay. Typical species of these areas are Sea Rush (*Juncus maritimus*), Saltmarsh Rush (*J. gerardi*), Sea Arrowgrass (*Triglochin maritima*), Sea Milkwort (*Glaux maritima*) and Red Fescue (*Festuca rubra*). There is a large sand dune system at Strandhill. The dune system is highly dynamic, with the tip of the peninsula actively growing and displaying a good, though limited, example of embryonic shifting dunes. The sandy beaches around the peninsula are used by roosting birds.

The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Light-bellied Brent Goose, Grey Plover, Dunlin, Bar-tailed Godwit and Redshank. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetlands & Waterbirds.

Ballysadare Bay is important for a range of waterfowl species in autumn and winter. Counts over four winters in the period 1995/96 to 1999/00 showed that the population of Light-bellied Brent Goose (188) meets the qualifying level for international importance. The populations of five other species are of national importance, i.e. Grey Plover (70), Dunlin (1,420), Bar-tailed Godwit (251), Redshank (435) and Greenshank (22) - figures are the average peaks. A range of other species occur in regionally important concentrations - these include Cormorant (43), Shelduck (55), Wigeon (617), Teal (179), Mallard (304), Red-breasted Merganser (26), Oystercatcher (516), Ringed Plover (96), Golden Plover (301), Lapwing (467), Curlew (508) and Turnstone (40). It also supports populations of Goldeneye (17), Black-headed Gull (261) and Common Gull (174). A small flock of Whooper Swan (15) occurs.

A colony of Common Seals, a species listed on Annex II of the E.U. Habitats Directive occur within the site, with up to 170 adults recorded here at one time.

The bay is little used for fishing or boating, but marsh shooting is common in its upper reaches. Aquaculture is little developed here compared to nearby Sligo Harbour and Drumcliff Bay. The wintering bird populations are monitored annually as part of I-WeBS.

Ballysadare Bay SPA is of high ornithological importance; it supports a Light-bellied Brent Goose population of international importance as well as nationally important populations of five other species of wintering waterfowl. The presence of Bar-tailed Godwit, Golden Plover and Whooper Swan is of particular note as these species are listed on Annex I of the E.U. Birds Directive. The site forms an important component of the larger Sligo Bay complex.

2.10.2007

9110

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)

FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)

AND

FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. SITE IDENTIFICATION

1.1. TYPE	*1.2. SITE CODE*	*1.3. COMPILATION DATE*	*1.4. UPDATE*
F	IE0000627	199912	

1.5. RELATION WITH OTHER NATURA 2000 SITES:

NATURA 2000 SITE CODES

IE0001994
IE0002251

1.6. RESPONDENT(S):

National Parks & Wildlife Service of the Department of the Environment, Heritage and Local Government. 7 Ely Place, Dublin 2, Ireland.

1.7. SITE NAME:

Cummeen Strand/Drumcliff Bay (Sligo Bay)

1.8. SITE INDICATION AND DESIGNATION/CLASSIFICATION DATES:

DATE SITE PROPOSED AS ELIGIBLE AS SCI:	*DATE CONFIRMED AS SCI:*
199912	
DATE SITE CLASSIFIED AS SPA:	*DATE SITE DESIGNATED AS SAC:*

2. SITE LOCATION

2.1. SITE CENTRE LOCATION

LONGITUDE	LATITUDE
W 8 31 48	54 19 21

W/E (Greenwich)

2.2. AREA (HA):

4919.12

2.3. SITE LENGTH (KM):

2.4. ALTITUDE (M):

MINIMUM	MAXIMUM	MEAN
0	33	5

2.5. ADMINISTRATIVE REGION:

NUTS CODE	REGION NAME	% COVER
IE011	Border	20
Marine area not covered by a NUTS-region		8

2.6. BIOGEOGRAPHIC REGION:

Alpine	Atlantic	Boreal	Continental	Macaronesian	Mediterranean
☐	☑	☐	☐	☐	☐

3. ECOLOGICAL INFORMATION

3.1. HABITAT types present on the site and assessment for them:

ANNEX I HABITAT TYPES:

CODE	%COVER	REPRESENTATIVITY	RELATIVE SURFACE	CONSERVATION STATUS	GLOBAL ASSESSMENT
1140	46	A	A	B	A
1130	14	A	B	B	A
5130	1	C	C	C	C
7220	1	B	C	B	B
2110	1	B	C	B	B
2130	1	C	C	C	C
2120	1	C	C	C	C

3.2. SPECIES

covered by Article 4 of Directive 79/409/EEC

and

listed in Annex II of Directive 92/43/EEC

and

site assessment for them

3.2.a. BIRDS listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION				SITE ASSESSMENT			
		Resident	Migratory			Population	Conservation	Isolation	
			Breed	Winter	Stage				
A045	Branta leucopsis			2000 i		A	A	C	
A140	Pluvialis apricaria			419 i		C	B	C	
A157	Limosa lapponica			327 i		C	A	C	
A346	Pyrrhocorax pyrrhocorax	1 p				C	B	C	

3.2.b. Regularly occuring Migratory Birds not listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION				SITE ASSESSMENT			
		Resident	Migratory			Population	Conservation	Isolation	
			Breed	Winter	Stage				
A009	Fulmarus glacialis		30+ p			C	C	C	
A017	Phalacrocorax carbo		261 p			B	A	C	
A046	Branta bernicla			395 i		C	A	C	
A048	Tadorna tadorna			120 i		C	A	C	
A050	Anas penelope			750 i		C	A	C	
A052	Anas crecca			250 i		C	B	C	
A053	Anas platyrhynchos			200 i		C	B	C	
A070	Mergus merganser			48 i		C	A	C	
A130	Haematopus ostralegus			906 i		C	A	C	
A137	Charadrius hiaticula			118 i		C	A	C	
A141	Pluvialis squatarola			77 i		C	A	C	
A142	Vanellus vanellus			1238 i		C	B	C	
A149	Calidris alpina			1405 i		C	A	C	
A160	Numenius arquata			750 i		C	B	C	
A162	Tringa totanus			562 i		B	A	C	
A164	Tringa nebularia			18 i		B	A	C	

3.2.c. MAMMALS listed on Annex II of Council directive 92/43/EEC

CODE	NAME	POPULATION				SITE ASSESSMENT			
		Resident	Migratory			Population	Conservation	Isolation	
			Breed	Winter	Stage				

			Breed	Winter	Stage			
1365	Phoca vitulina	86+ i				B	A	C

3.2.d. AMPHIBIANS and REPTILES listed on Annex II of Council directive 92/43/EEC

3.2.e. FISHES listed on Annex II of Council directive 92/43/EEC

3.2.f. INVERTEBRATES listed on Annex II of Council directive 92/43/EEC

CODE	NAME	POPULATION				SITE ASSESSMENT		
		Resident	Migratory			Population	Conservation	Isolation
			Breed	Winter	Stage			
1014	Vertigo angustior	p				B	B	A

3.2.g. PLANTS listed on Annex II of Council directive 92/43/EEC

3.3. Other Important Species of Flora and Fauna

GROUP							SCIENTIFIC NAME	POPULATION	MOTIVATION			
B	M	A	R	F	I	P						
						P	Draba incana	p	A			
						P	Orobanche hedera	p	A			
B							Cepphus grylle	10 i			C	
B							Somateria mollissma	2 p			C	
		A					Rana temporaria	p	A			
		A					Rana temporaria	p			C	
	M						Lepus timidus hibernicus	p	A			
	M						Lepus timidus hibernicus	p		B		
	M						Lepus timidus hibernicus	p			C	
	M						Meles meles	p	A			
	M						Meles meles	p			C	

(B = Birds, M = Mammals, A = Amphibians, R = Reptiles, F = Fish, I = Invertebrates, P = Plants)

4. SITE DESCRIPTION

4.1. GENERAL SITE CHARACTER:

Habitat classes	% cover
Marine areas, Sea inlets	20
Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	60
Salt marshes, Salt pastures, Salt steppes	1
Coastal sand dunes, Sand beaches, Machair	3
Shingle, Sea cliffs, Islets	4
Inland water bodies (Standing water, Running water)	1
Bogs, Marshes, Water fringed vegetation, Fens	1
Heath, Scrub, Maquis and Garrigue, Phygrana	1
Dry grassland, Steppes	2
Humid grassland, Mesophile grassland	1
Improved grassland	3
Broad-leaved deciduous woodland	1
Artificial forest monoculture (e.g. Plantations of poplar or Exotic trees)	1
Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites)	1
Total habitat cover	**100 %**

Other site characteristics

This large coastal site is made up largely of two estuarine bays, Sligo Harbour and Drumcliff Bay. These are the estuaries of the Garavoge and Drumcliff rivers respectively. The estuaries are well sheltered and have extensive intertidal sand and mud flats. Coney Island provides the main shelter for Sligo Harbour, while a sandy/grassy spit protrudes from the Rosses peninsula and provides shelter for inner Drumcliff Bay. The site continues to the north-west of Drumcliff Bay to include the shallow marine waters of Brown's Bay. A series of small islands, notably Ardbolin, occur here. Other coastal habitats are represented, including sand dunes, salt marshes, sandy and boulder beaches, and bedrock shoreline. In addition, there is a scattering of dry grassland, wet grassland, swamp vegetation and broad-leaved woodland. Improved grassland is included for the benefit of wintering geese. The site is largely underlain by Carboniferous limestone, but acidic rocks are also found at Rosses Point. An excellent series of fossilised corals occur at Serpent Rock in the north west of the site. The town of Sligo, a substantial urban centre with a regional port, is located along the eastern boundary of the Sligo Harbour section of the site. Agriculture is the dominant landuse in the surrounding catchments.

4.2. QUALITY AND IMPORTANCE:

The estuarine and intertidal sand and mud flat habitats at this site are extensive in area, generally of good quality and show a good diversity of species and biotopes. Zostera spp. occur. These habitats are considered typical for the north-west region. The fixed dunes and shifting Ammophila dunes are small in area and only of moderate quality, though embryonic dunes are well represented. The site has a good example of petrifying springs with tufa formations, with several species of bryophyte typical of the Cratoneurion. The springs occur along seepage zones in clay sea cliffs. The site supports an area of Juniper scrub. The site has a nationally important colony of Phoca vitulina. Site is important for occurrence of the Annex II mollusc Vertigo angustior. A good diversity of waterfowl winter at site, notably internationally important populations of Branta leucopsis and Branta bernicla hrota. Site has regular

populations of Pluvialis apricaria and Limosa lapponica, both Annex I Bird Directive species, and eight other species winter in nationally important numbers. Phalacrocorax carbo has a nationally important breeding colony and small numbers of other breeding seabirds occur.

4.3. VULNERABILITY

The main activities affecting the estuarine and intertidal sand and mud flat habitats are pollution and aquaculture. Sewage, largely untreated, currently enters the site from Sligo town. A new treatment works is to be built which will significantly lessen this problem. Shellfish farming occurs at both Sligo Harbour and Drumcliff Bay on a large scale. While such activities cause localised disturbance to sediments and to wintering birds, all aquaculture applications are now assessed by Duchas to minimise impacts. Owing to growth of Sligo town, reclamation of estuarine habitat is a threat. The sand dune systems are subject to natural erosion which is exacerbated by intense recreational pressures. A significant area of dune has already been developed as a golf course.

4.4. SITE DESIGNATION:

4.5. OWNERSHIP

State : Department of the Marine

State : Department of Arts, Heritage, Gaeltacht and the Islands

Local Authority : Sligo County Council

Semi-state : Coillte

Private : multiple

4.6. DOCUMENTATION

Bowman, J.J., Clabby, K.J., Lucey, J., Mc Garrigle, M.L. and Toner, P.H. (1996). Water Quality in Ireland 1991-1994. Environmental Protection Agency, Wexford.

Cawley, M. (1996). Notes on some non-marine mollusca from Co Sligo and Co Leitrim, including a new site for Vertigo geyeri Lindholm. Irish Naturalists' Journal 25: 183-185.

Colhoun, K. (1998). I-WeBS Report 1996-97. BirdWatch Ireland, Dublin.

Curtis, T.G.F. and Sheehy Skeffington, M.J. (1998). The salt marshes of Ireland: an inventory and account of their geographical variation. Biology and the Environment, Proceedings of the Royal Irish Academy 98B: 87-104.

Curtis, T.G.F. (1991a). A site inventory of the sandy coasts of Ireland. In Quigley, M.B. (ed.) A Guide to the Sand Dunes of Ireland. E.U.C.C. Dublin.

Curtis, T.G.F. (1991b). The flora and vegetation of sand dunes in Ireland. In Quigley, M.B. (ed.) A Guide to the Sand Dunes of Ireland. E.U.C.C., Dublin.

Falvey, J.P., Costello, M.J. and Dempsey, S. (1997). Survey of Intertidal Biotopes in Estuaries in Ireland. Unpublished report to the National Parks and Wildlife Service, Dublin.

Goodwillie, R. (1972). A Preliminary Report on Areas of Scientific Interest in County Sligo. An Foras Forbartha, Dublin.

Jennings O'Donovan & Partners (1998). Sligo Main Drainage Waste Water Treatment Works. Environmental Impact Statement, Main Report Volumes 1 and 2. Report prepared for Sligo Corporation.

Lockley, R.M. (1966). The distribution of grey and common seals on the coasts of Ireland. Irish Naturalists' Journal 15: 136-143.

Lloyd, C. (1982). Inventory of Seabird Breeding Colonies in Republic of Ireland, Unpublished report, Forestry and Wildlife Service, Dublin.

Merne, O.J. (1989). Important bird areas in the Republic of Ireland. In: Grimmett, R.F.A. and Jones, T.A. (eds) Important Bird Areas in Europe. ICBP Technical Publication No. 9., Cambridge.

Moorkens, E.A. (1997). An Inventory of Mollusca in Potential SAC Sites, with Special Reference to Vertigo angustior, V. moulinsiana and V. geyeri. Unpublished report, National Parks & Wildlife Service, Dublin.

Praeger, R.L. (1934). The Botanist in Ireland. Hodges, Figgis & Co, Dublin.

Sheppard, R. (1993). Ireland's Wetland Wealth. IWC, Dublin.

Summers, C.F., Warner, P.J., Nairn R.G.W., Curry, M.G. and Flynn, J. (1980). An assessment of the status of the common seal (Phoca vitulina vitulina) in Ireland. Biological Conservation 17: 115-123.

Warner, P. (1983). An assessment of the breeding populations of common seal (Phoca vitulina vitulina L.) in the Republic of Ireland during 1979. Irish Naturalists' Journal 21: 24-26.

Warner, P. (1984). Report on the Census of Common Seals (Phoca vitulina vitulina) in the Republic of Ireland during 1984. Unpublished document to the Forest & Wildlife Service, Dublin.

Cronin, M., Duck, C., Ó Cadhla, O., Nairn, R., Strong, D. and O'Keeffe, C. (2004). Harbour seal population assessment in the Republic of Ireland: August 2003. Irish Wildlife Manuals No. 11. National Parks & Wildlife Service, Department of Environment, Heritage and Local Government., 7 Ely Place, Dublin 2, Ireland. 34 pp.

Cronin, M., Duck, C., Ó Cadhla, O., Nairn, R., Strong, D. and O'Keeffe, C. (2007). An assessment of harbour seal population size and distribution in the Republic of Ireland during the 2003 moult season. J. Zool. Lond. 273 Issue 2: 131-139.

Harrington, R. (1990). 1989 survey of breeding herds of common seal Phoca vitulina with reference to previous surveys. Report to the National Parks & Wildlife Service. 10pp.

Lyons, D.O. (2004). Summary of National Parks & Wildlife Service surveys for common (harbour) seals (Phoca vitulina) and grey seals (Halichoerus grypus), 1978 to 2003. Irish Wildlife Manuals No. 13. National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, 7 Ely Place, Dublin 2, Ireland. 67pp.

Roderick, T. (2009). Seal counts from Drumcliff Bay. Unpublished National Parks & Wildlife Service data, June 2007 - May 2008

5. SITE PROTECTION STATUS AND RELATION WITH CORINE BIOTOPES

5.1. DESIGNATION TYPES at National and Regional level:

CODE	% COVER
IE01	1
IE05	24

5.2. RELATION OF THE DESCRIBED SITE WITH OTHER SITES:

designated at National or Regional level:

TYPE CODE	SITE NAME	OVERLAP TYPE	% COVER
IE01	Ballygilgan, Lissadell, Nature Reserve	+	1
IE05	Drumcliff Bay (part) Wildfowl Sanctuary	*	24

designated at International level:

5.3. RELATION OF THE DESCRIBED SITE WITH CORINE BIOTOPE SITES:

CORINE SITE CODE	OVERLAP TYPE	% COVER
800000466		
800000473		
800000476		

6. IMPACTS AND ACTIVITIES IN AND AROUND THE SITE

6.1. GENERAL IMPACTS AND ACTIVITIES AND PROPORTION OF THE SURFACE OF THE SITE AFFECTED

IMPACTS AND ACTIVITIES WITHIN the site

CODE	INTENSITY	% OF SITE	INFLUENCE
120	**A** B C	2	+ 0 -
120	A **B** C	1	+ 0 -
140	A **B** C	3	+ **0** -
140	A **B** C	3	+ 0 -
160	A **B** C	1	+ 0 -
200	**A** B C	10	+ 0 -
211	A **B** C	10	+ 0 -
220	A **B** C	30	+ **0** -
230	A B **C**	30	+ 0 -
301	A **B** C	1	+ 0 -
420	**A** B C	60	+ 0 -
505	A B **C**	1	+ 0 -
622	**A** B C	5	+ 0 -
870	A **B** C	2	+ 0 -
900	A **B** C	10	+ 0 -

IMPACTS AND ACTIVITIES AROUND the site

CODE	INTENSITY	INFLUENCE
120	A **B** C	+ 0 -
400	**A** B C	+ 0 -
410	**A** B C	+ 0 -
601	A **B** C	+ 0 -

6.2. SITE MANAGEMENT AND PLANS

BODY RESPONSIBLE FOR THE SITE MANAGEMENT

National Parks and Wildlife is responsible for managing the Ballygilgan Nature Reserve, and for maintaining the Drumcliff Bay Wildfowl Sanctuary as a No-shooting Area.

SITE MANAGEMENT AND PLANS

A management plan for the entire site is in preparation.

Ballygilgan Nature Reserve is managed for the benefit of Branta leucopsis and other waterfowl species. A hide and interpretative panels exist. The goose population is monitored by Duchas staff.

The Drumcliff Wildfowl Sanctuary is patrolled by Duchas staff so as to prevent shooting.

7. MAPS OF THE SITE

- Physical map

- Aerial photograph(s) included:

NUMBER	AREA	SUBJECT	DATE
0207041	Sligo Harbour - Drumcliff Bay	Overview of Site	199506
0207045	Sligo Harbour - Drumcliff Bay	Overview of Site - Outer Party	199506

8. SLIDES

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)

FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)

AND

FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. SITE IDENTIFICATION

1.1. TYPE	*1.2. SITE CODE*	*1.3. COMPILATION DATE*	*1.4. UPDATE*
J	IE0004035	200311	

1.5. RELATION WITH OTHER NATURA 2000 SITES:

NATURA 2000 SITE CODES

IE0000627

1.6. RESPONDENT(S):

National Parks & Wildlife Service of the Department of the Environment, Heritage and Local Government. 7 Ely Place, Dublin 2, Ireland.

1.7. SITE NAME:

Cummeen Strand SPA

1.8. SITE INDICATION AND DESIGNATION/CLASSIFICATION DATES:

DATE SITE PROPOSED AS ELIGIBLE AS SCI:	*DATE CONFIRMED AS SCI:*

DATE SITE CLASSIFIED AS SPA:	*DATE SITE DESIGNATED AS SAC:*
199502	

2. SITE LOCATION

2.1. SITE CENTRE LOCATION

LONGITUDE	LATITUDE
W 8 32 0	54 17 30

W/E (Greenwich)

2.2. AREA (HA):

1732.43

2.3. SITE LENGTH (KM):

2.4. ALTITUDE (M):

MINIMUM	MAXIMUM	MEAN
-5	5	-2

2.5. ADMINISTRATIVE REGION:

NUTS CODE	REGION NAME	% COVER
IE011	Border	1
Marine area not covered by a NUTS-region		9

2.6. BIOGEOGRAPHIC REGION:

Alpine	Atlantic	Boreal	Continental	Macaronesian	Mediterranean
☐	☑	☐	☐	☐	☐

3. ECOLOGICAL INFORMATION

3.1. HABITAT types present on the site and assessment for them:

ANNEX I HABITAT TYPES:

CODE	%COVER	REPRESENTATIVITY	RELATIVE SURFACE	CONSERVATION STATUS	GLOBAL ASSESSMENT

3.2. SPECIES

covered by Article 4 of Directive 79/409/EEC

and

listed in Annex II of Directive 92/43/EEC

and

site assessment for them

3.2.a. BIRDS listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION			SITE ASSESSMENT		
		Resident	Migratory		Population	Conservation	Isolation
			Breed	Winter Stage			
A140	Pluvialis apricaria			567 i	C	B	C
A157	Limosa lapponica			57 i	C	B	C

3.2.b. Regularly occuring Migratory Birds not listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION			SITE ASSESSMENT		
		Resident	Migratory		Population	Conservation	Isolation
			Breed	Winter Stage			
A046	Branta bernicla			232 i	C	A	C
A048	Tadorna tadorna			80 i	C	A	C
A050	Anas penelope			178 i	C	B	C
A052	Anas crecca			70 i	C	B	C
A053	Anas platyrhynchos			170 i	C	B	C
A069	Mergus serrator			17 i	C	B	C
A130	Haematopus ostralegus			891 i	C	A	C
A137	Charadrius hiaticula			32 i	C	B	C
A142	Vanellus vanellus			734 i	C	B	C
A143	Calidris canutus			104 i	C	B	C
A144	Calidris alba			18 i	C	B	C
A149	Calidris alpina			601 i	C	B	C
A160	Numenius arquata			546 i	C	A	C
A162	Tringa totanus			501 i	C	A	C
A164	Tringa nebularia			18 i	C	A	C
A169	Arenaria interpres			80 i	C	B	C
A179	Larus ridibundus			353 i	C	B	C
A182	Larus canus			43 i	C	B	C

3.2.c. MAMMALS listed on Annex II of Council directive 92/43/EEC

3.2.d. AMPHIBIANS and REPTILES listed on Annex II of Council directive 92/43/EEC

3.2.e. FISHES listed on Annex II of Council directive 92/43/EEC

3.2.f. INVERTEBRATES listed on Annex II of Council directive 92/43/EEC

3.2.g. PLANTS listed on Annex II of Council directive 92/43/EEC

3.3. Other Important Species of Flora and Fauna

GROUP B M A R F I P	SCIENTIFIC NAME	POPULATION	MOTIVATION
B	Ardea cinerea	13 i	D

(B = Birds, M = Mammals, A = Amphibians, R = Reptiles, F = Fish, I = Invertebrates, P = Plants)

4. SITE DESCRIPTION

4.1. GENERAL SITE CHARACTER:

Habitat classes	% cover
Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins)	95
Salt marshes, Salt pastures, Salt steppes	2
Shingle, Sea cliffs, Islets	2
Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites)	1
Total habitat cover	**100 %**

Other site characteristics

Cummeen Strand SPA comprises the greater part of Sligo Harbour, the middle one of the three 'arms' forming Sligo Bay. The site extends for up to 7 km from east to west and has an average width of c.2.5 km. The site is the estuary of the Garavoge River, a short slow-flowing river which flows from Lough Gill. The harbour is very enclosed, with the mouth of the harbour being sheltered by two islands (Coney Island and Oyster Island). A large proportion of the estuary is intertidal (> 80%). Sediments are predominantly sands or coarser materials, though muddy sands or muds also occur. Zostera beds are present. The intertidal sand and mud flats are fringed by salt marshes in places but mostly stony shoreline. Sligo Harbour is a regional port for the town of Sligo.

4.2. QUALITY AND IMPORTANCE:

Cummeen Strand is of importance for the diversity of wintering waterfowl and is an integral part of the larger unit of Sligo Bay. The site has an internationally important population of Branta bernicla hrota and supports nationally important numbers of Haematopus ostralegus and Tringa totanus. Both Pluvialis apricaria and Limosa lapponica utilise the site though in relatively low numbers. The intertidal flats, which have well-developed macro-invertebrate communities and Zostera beds, provide good feeding grounds for the wintering birds. Birds roost on the salt marshes and upper shoreline though on high tides some may leave the site to roost elsewhere.

4.3. VULNERABILITY

There are no significant imminent threats to the wintering bird populations. Shellfish farming occurs in Sligo Harbour on a large scale and could cause localised disturbance to sediments and to the wintering birds. Sewage, largely untreated, currently enters the site from Sligo town, though this may not necessarily have adverse effects on the birds. A new treatment works is to be built which will significantly improve water quality.

4.4. SITE DESIGNATION:

4.5. OWNERSHIP

State : Department of Communications, Marine and Natural Resources

Private

4.6. DOCUMENTATION

Colhoun, F. (2001). I-WeBS Report 1998-99. BirdWatch Ireland, Dublin.

Curtis, T.G.F. and Sheehy Skeffington, M.J. (1998). The salt marshes of Ireland: an inventory and account of their geographical variation. Biology and Environment, Proceedings of the Royal Irish Academy 98B: 87-104.

Falvey, J.P., Costello, M.J. and Dempsey, S. (1997). Survey of intertidal biotopes in estuaries in Ireland. Unpublished report to the National Parks and Wildlife Service, Dublin.

Goodwillie, R. (1972). A Preliminary Report on Areas of Scientific Interest in County Sligo. An Foras Forbartha, Dublin.

Hunt, J., Derwin, J., Coveney, J. and Newton, S. (2000). Republic of Ireland. Pp. 365-416 in Heath, M.F. and Evans, M.I. (eds). Important Bird Areas in Europe: Priority Sites for Conservation 1: Northern Europe. Cambridge, UK: BirdLife International (BirdLife Conservation Series No. 8).

Irish Wetland Birds Survey (I-WeBS) Database, 1994/95-2000/01. BirdWatch Ireland, Dublin.

Jennings O'Donovan and Partners (1998). Sligo Main Drainage Waste Water Treatment Works. Environmental Impact Statement, Main Report Volumes 1 and 2. Report prepared for Sligo Corporation.

McGarrigle M.L., Bowman J.J., Clabby K.J., Lucey J., Cunningham P., MacCarthaigh M., Keegan M., Cantrell B., Lehane M., Clenaghan C. and Toner P.F. (2002). Water Quality in Ireland 1998-2000. Environmental Protection Agency, Wexford.

Merne, O.J. (1989). Important bird areas in the Republic of Ireland. In: Grimmett, R.F.A. and Jones, T.A. (eds). Important Bird Areas in Europe. ICBP Technical Publication No. 9. Cambridge.

Sheppard, R. (1993). Ireland's Wetland Wealth. IWC, Dublin.

5. SITE PROTECTION STATUS AND RELATION WITH CORINE BIOTOPES

5.1. DESIGNATION TYPES at National and Regional level:

5.2. RELATION OF THE DESCRIBED SITE WITH OTHER SITES:

designated at National or Regional level:

designated at International level:

5.3. RELATION OF THE DESCRIBED SITE WITH CORINE BIOTOPE SITES:

CORINE SITE CODE	OVERLAP TYPE	% COVER
800000473		

6. IMPACTS AND ACTIVITIES IN AND AROUND THE SITE

6.1. GENERAL IMPACTS AND ACTIVITIES AND PROPORTION OF THE SURFACE OF THE SITE AFFECTED

IMPACTS AND ACTIVITIES WITHIN the site

CODE	INTENSITY	% OF SITE	INFLUENCE
200	**A** B C	10	+ 0 -
220	A B **C**	20	+ **0** -
410	**A** B C	1	+ 0 -
520	**A** B C	10	+ **0** -
700	A **B** C	100	+ 0 -
802	**A** B C	1	+ 0 -

IMPACTS AND ACTIVITIES AROUND the site

CODE	INTENSITY	INFLUENCE
120	A **B** C	+ 0 -
400	**A** B C	+ 0 -
410	**A** B C	+ 0 -
502	A **B** C	+ **0** -

6.2. SITE MANAGEMENT AND PLANS

BODY RESPONSIBLE FOR THE SITE MANAGEMENT

SITE MANAGEMENT AND PLANS

A Conservation Plan for the management of this site is being prepared.

7. MAPS OF THE SITE

- Physical map

- Aerial photograph(s) included:

8. SLIDES

NATURA 2000

STANDARD DATA FORM

FOR SPECIAL PROTECTION AREAS (SPA)

FOR SITES ELIGIBLE FOR IDENTIFICATION AS SITES OF COMMUNITY IMPORTANCE (SCI)

AND

FOR SPECIAL AREAS OF CONSERVATION (SAC)

1. SITE IDENTIFICATION

1.1. TYPE	*1.2. SITE CODE*	*1.3. COMPILATION DATE*	*1.4. UPDATE*
J	IE0004129	200404	

1.5. RELATION WITH OTHER NATURA 2000 SITES:

NATURA 2000 SITE CODES

IE0000622

1.6. RESPONDENT(S):

National Parks & Wildlife Service of the Department of the Environment, Heritage and Local Government. 7 Ely Place, Dublin 2, Ireland

1.7. SITE NAME:

Ballysadare Bay SPA

1.8. SITE INDICATION AND DESIGNATION/CLASSIFICATION DATES:

DATE SITE PROPOSED AS ELIGIBLE AS SCI: *DATE CONFIRMED AS SCI:*

DATE SITE CLASSIFIED AS SPA: *DATE SITE DESIGNATED AS SAC:*

2. SITE LOCATION

2.1. SITE CENTRE LOCATION

LONGITUDE	LATITUDE
W 8 35 0	54 14 0

W/E (Greenwich)

2.2. AREA (HA):

2146.13

2.3. SITE LENGTH (KM):

2.4. ALTITUDE (M):

MINIMUM	MAXIMUM	MEAN
-5	39	-1

2.5. ADMINISTRATIVE REGION:

NUTS CODE	REGION NAME	% COVER
IE011	Border	10
Marine area not covered by a NUTS-region		9

2.6. BIOGEOGRAPHIC REGION:

Alpine	Atlantic	Boreal	Continental	Macaronesian	Mediterranean
☐	☑	☐	☐	☐	☐

3. ECOLOGICAL INFORMATION

3.1. HABITAT types present on the site and assessment for them:

ANNEX I HABITAT TYPES:

CODE	%COVER	REPRESENTATIVITY	RELATIVE SURFACE	CONSERVATION STATUS	GLOBAL ASSESSMENT

3.2. SPECIES

covered by Article 4 of Directive 79/409/EEC

and

listed in Annex II of Directive 92/43/EEC

and

site assessment for them

3.2.a. BIRDS listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION			SITE ASSESSMENT		
		Resident	Migratory		Population	Conservation	Isolation
			Breed	Winter Stage			
A157	Limosa lapponica			251 i	C	A	C
A140	Pluvialis apricaria			301 i	C	B	C
A038	Cygnus cygnus			15 i	C	C	C

3.2.b. Regularly occuring Migratory Birds not listed on Annex I of Council directive 79/409/EEC

CODE	NAME	POPULATION			SITE ASSESSMENT		
		Resident	Migratory		Population	Conservation	Isolation
			Breed	Winter Stage			
A046	Branta bernicla			188 i	C	B	C
A048	Tadorna tadorna			55 i	C	B	C
A050	Anas penelope			617 i	C	B	C
A052	Anas crecca			179 i	C	B	C
A053	Anas platyrhynchos			304 i	C	B	C
A067	Bucephala clangula			17 i	C	C	C
A069	Mergus serrator			26 i	C	B	C
A130	Haematopus ostralegus			516 i	C	B	C
A137	Charadrius hiaticula			96 i	C	B	C
A141	Pluvialis squatarola			67 i	C	B	C
A142	Vanellus vanellus			467 i	C	B	C
A149	Calidris alpina			1420 i	C	A	C
A160	Numenius arquata			508 i	C	B	C
A162	Tringa totanus			435 i	C	A	C
A164	Tringa nebularia			22 i	C	B	C
A169	Arenaria interpres			40 i	C	B	C
A179	Larus ridibundus			261 i	C	B	C
A182	Larus canus			174 i	C	B	C
A017	Phalacrocorax carbo			43 i	C	B	C

3.2.c. MAMMALS listed on Annex II of Council directive 92/43/EEC

3.2.d. AMPHIBIANS and REPTILES listed on Annex II of Council directive 92/43/EEC

3.2.e. FISHES listed on Annex II of Council directive 92/43/EEC

3.2.f. INVERTEBRATES listed on Annex II of Council directive 92/43/EEC

3.2.g. PLANTS listed on Annex II of Council directive 92/43/EEC

3.3. Other Important Species of Flora and Fauna

GROUP	SCIENTIFIC NAME	POPULATION	MOTIVATION
B M A R F I P			
B	Ardea cinerea	16 i	C

(B = Birds, M = Mammals, A = Amphibians, R = Reptiles, F = Fish, I = Invertebrates, P = Plants)

1/2

AQUAFACT

WWTP
- MAPS underpinning My submission
- Whorl Snail

Hydrodynamic Dispers
Strandhill Sewerag

Produced by

AQUAFACT International Services Ltd

On behalf of

Nicholas O'Dwyer Ltd.

June 2013

AQUAFACT INTERNATIONAL SERVICES ltd
12 KILKERRIN park
TUAM rd
GALWAY city
www.aquafact.ie

info@aquafact.ie

tel +353 (0) 91 756812
fax +353 (0) 91 756888

Table of Contents

1. Introduction 1

2. Hydrodynamic and Dispersion Model Description 2

2.1. TELEMAC Hydraulic Software System 2
2.2. Data Sources 3
2.3. Model Domain 3

3. Hydrodynamics 6

4. Water Quality Dispersion Simulations 13

4.1. Water Quality Standards 13
4.2. Total Coliform Simulations 14
4.3. DIN Simulations 24

5. Conclusion 33

List of Figures

Figure 1.1: Outfall option locations off Killaspug Point, Strandhill 2
Figure 2.1: Model domain Study Area 4
Figure 2.2: Extent and resolution of Finite element Mesh developed for Strandhill Dispersion Model 5
Figure 2.3: Tide elevation boundary used to drive model 5
Figure 2.4: Model bathymetry for Strandhill dispersion model extracted from Admiralty Charts 6
Figure 3.1: Location of ADCP meter used to measure tide velocities 7
Figure 3.2: Velocity rose for near-surface velocities over monitoring period 8
Figure 3.3: Velocity rose for mid-depth velocities over monitoring period 9
Figure 3.4: Velocity rose for near-bottom velocities over monitoring period 10
Figure 3.5: Comparison of measured and computed velocity magnitudes at ADCP location 11
Figure 3.6: Typical mid-flood velocities within the study area 12
Figure 3.7: Typical mid-ebb velocities within the study area 12
Figure 4.1: Reference sites for model output 14
Figure 4.2: Maximum total coliform concentrations for outfall option 1 and treated effluent of 1.0E+07 No./100ml 17
Figure 4.3: Tidal averaged total coliform concentrations for outfall option 1 and treated effluent of 1.0E+07 No./100ml. 18
Figure 4.4: Maximum total coliform concentrations for outfall option 1 and treated effluent of 1.0E+04 No./100ml (with disinfection) 19

Figure 4.5: Tidal averaged total coliform concentrations for outfall option 1 and treated effluent of 1.0E+04 No./100ml (with disinfection) 20
Figure 4.6: Total coliform concentrations for outfall option 2 and treated effluent of 1.0E+07 No./100ml 21
Figure 4.7: Tidal averaged total coliform concentrations for outfall option 2 and treated effluent of 1.0E+07 No./100ml 22
Figure 4.8: Maximum total coliform concentrations for outfall option 3 and treated effluent of 1.0E+08 No./100ml 23
Figure 4.9: Tidal averaged total coliform concentrations for outfall option 3 and treated effluent of 1.0E+08 No./100ml 24
Figure 4.10: Maximum DIN concentrations for outfall option 1 and treated effluent of 8.5 mg/l DIN as N 26
Figure 4.11: Tidal averaged DIN concentrations for outfall option 1 and treated effluent of 8.5 mg/l DIN as N 27
Figure 4.12: Maximum DIN concentrations for outfall option 1 and treated effluent of 40mg/l DIN as N 28
Figure 4.13: Tidal averaged DIN concentrations for outfall option 1 and treated effluent of 40mg /l DIN as N 29
Figure 4.14: Maximum DIN concentrations for outfall option 2 and treated effluent of 40mg/l DIN as N 30
Figure 4.15: Tidal averaged DIN concentrations for outfall option 2 and treated effluent of 40mg/l DIN as N 31
Figure 4.16: Maximum DIN concentrations for outfall option 3 and treated effluent of 50mg/l DIN as N 32
Figure 4.17: Tidal averaged DIN concentrations for outfall option 3 and treated effluent of 50mg/l DIN as N 33

List of Tables

Table 1.1: Dispersion treatment standards for the three outfall options. 1
Table 4.1: Extract From Surface Water Regulations 2009 pertaining to limits for Dissolved Inorganic Nitrogen and total coliforms. 13
Table 4.2: Predicted total coliform concentrations for outfall option 1 – secondary treatment with final effluent total coliform concentration of 1.0E+07 15
Table 4.3: Total coliform concentrations for outfall option 1 with disinfection with final effluent total coliform concentration of 1.0E+04 15
Table 4.4: Predicted total coliform concentrations for outfall option 2 – secondary treatment with final effluent total coliform concentration of 1.0E+07 16
Table 4.5: Predicted total coliform concentrations for Outfall Option 3 –with final effluent total coliform concentration of 1.0E+08 16
Table 4.6: Predicted DIN concentrations at reference sites for outfall option 1 (Site A) with final DIN effluent concentration of 8.5mg/l 25
Table 4.7: Predicted DIN concentrations at reference sites for outfall option 1 (Site A) with final DIN effluent concentration of 40.0mg/l 25
Table 4.8: Predicted DIN concentrations at reference sites for outfall option 2 (Site B) with final DIN effluent concentration of 40.0mg/l 25
Table 4.9: Predicted DIN concentrations at reference sites for outfall option 3 (Site C) with final DIN effluent concentration of 50.0mg/l 26

1. Introduction

AQUAFACT International Services Ltd. was commissioned by Nicholas O'Dwyer Ltd. to undertake hydrodynamic dispersion modelling of a proposed marine sewage outfall for the Strandhill Sewerage Scheme. The objective of the study was to evaluate the most suitable outfall location and treatment option that complies with the surface water regulations for the Coastal Waters.

For purposes of this study, the TELEMAC hydrodynamic and dispersion modelling software was used to develop a two-dimensional depth averaged hydrodynamic, dispersion and water quality model of the Ballysadare Bay, Sligo Harbour and Drumcliff Bay area and their approaches.

Three outfall locations for the Strandhill marine outfall were considered (refer to Figure 1.1), namely:

Option 1 Locate at existing outfall (Site A) just below the low water mark

Option 2 Extend outfall 600m offshore (Site B)

Option 3 Extend outfall 1500m offshore (Site C)

Different treatment standards for respective outfall locations were considered and can be seen in Table 1.1

Table 1.1: Dispersion treatment standards for the three outfall options.

Effluent Concentrations	Outfall Option 1	Outfall Option 2	Outfall Option 3
BOD (mg/l)	25	25	187
Suspended Solids (mg/l)	35	35	183
DIN (mg/l)	(A) 8.5 (B) 40.0	40.0	50.0
Total coliform MPN/100ml Secondary Treatment Disinfection	(A) 1.0E+07 (B) 1.0E+04	1.0E+07	1.0E+08

The Wastewater Treatment Plant daily dry weather flow (DWF) is 7.8l/s and peak flow capacity of the outfall is designed to accommodate 6DWF (47l/s).

The critical water quality parameters for outfall site selection were identified as Total Coliform and DIN (Dissolved Inorganic Nitrogen) concentrations.

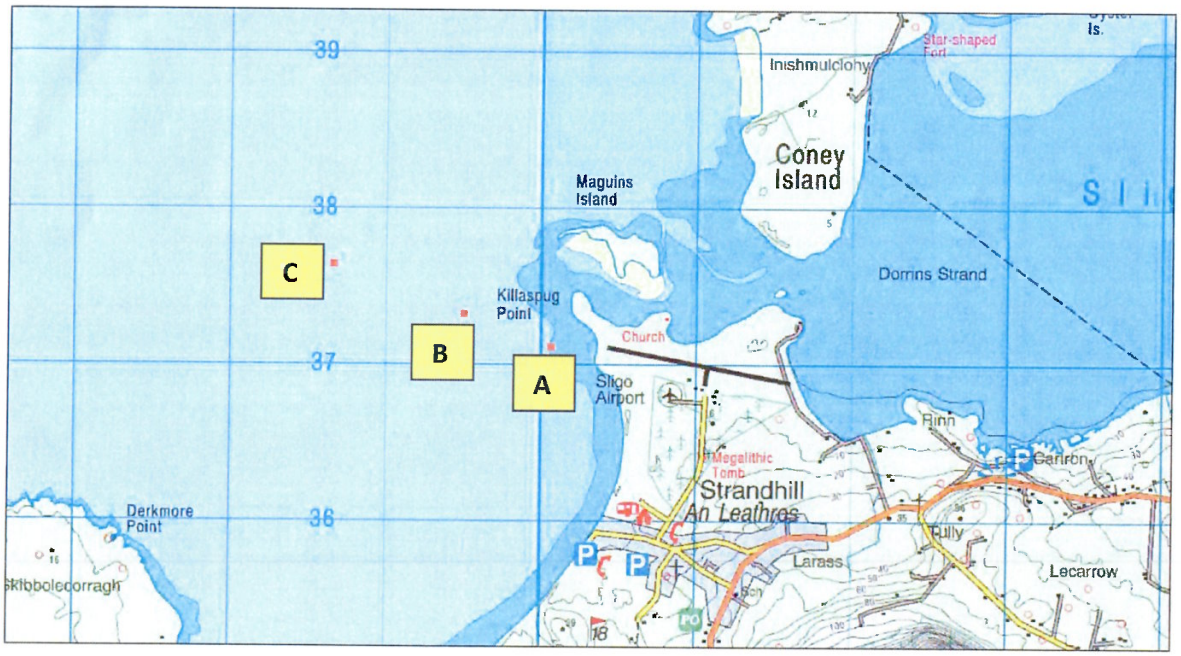


Figure 1.1: Outfall option locations off Killaspug Point, Strandhill

2. Hydrodynamic and Dispersion Model Description

2.1. TELEMAC Hydraulic Software System

The TELEMAC system is the software of choice for modelling the complicated hydrodynamics of the coastal water and tidal flats near Strandhill, particularly given the very high computation refinement required to model the narrow low water channels entrances to Sligo Harbour, Ballysadare Bay and Drumcliff Bay. TELEMAC is a software system designed to study environmental processes in free surface transient flows. It is therefore applicable to seas and coastal domains, estuaries, rivers and lakes. Its main fields of application are in hydrodynamics, water quality, sedimentology and water waves.

TELEMAC is an integrated, user friendly software system for free surface waters. TELEMAC was originally developed by Laboratoire National d'Hydraulique of the French Electricity Board (EDF-LNHE), Paris. It is now under the directorship of a consortium of organisations including EDF-LNHE, HR Wallingford, SOGREAH, BAW and CETMEF. It is regarded as one of the leading software packages internationally for free surface water hydraulic applications.

The TELEMAC system is a powerful integrated modelling tool for use in the field of free-surface flows. Having been used in the context of very many studies throughout the world (many thousand to date), it has become

one of the major standards in its field. The various simulation modules use high-capacity algorithms based on the finite-element method. Space is discretised in the form of an unstructured grid of triangular elements, which means that it can be refined particularly in areas of special interest. This avoids the need for systematic use of embedded models, as is the case with the finite-difference method. Telemac-2D is a two-dimensional computational code describing the horizontal velocities, water depth and free surface over space and time. In addition it solves the transport of several tracers which can be grouped into two categories, active and passive, with salinity and temperature being the active tracers which alter density and thus the hydrodynamics.

2.2. *Data Sources*

Bathymetric

The bathymetry defining the sea bed and mudflats is presented in Figure 2.4 below. The sources of data used to define the existing bathymetry is from relevant admiralty charts in the vicinity of the proposed outfall route, which was checked and found to be reasonably representative.

Hydrometric Data

- ADCP survey 27th March 2013 to 12th April 2013
- Ungauged catchments analysis for watercourses
- Tide elevation measurements 27th March 2013 to 12th April 2013

2.3. *Model Domain*

The model domain area is presented in Figure 2.1 which covers the Ballysadare Bay to the south, Sligo Harbour and Drumcliff Bay to the north and their coastal approaches. The model domain represents a tidal waterbody of some 87km^2 in area with extensive dry areas and highly variable bathymetry and channel widths.



Figure 2.1: Model domain Study Area

The TELEMAC software being finite element based allows for a variable density triangular meshing which allows high refinement in the areas of interest and narrow channel sections and coarser meshing away from such areas and in the wider estuary areas. Figure 2.2 presents the model domain and the meshing used.

The hydrodynamic and dispersion simulations were driven by a tide elevation boundary condition specified along the western model opensea boundary, refer to Figure 2.3 below. Mean freshwater inflow was also specified for the Garvoge, Drumcliff and Ballysadare rivers.

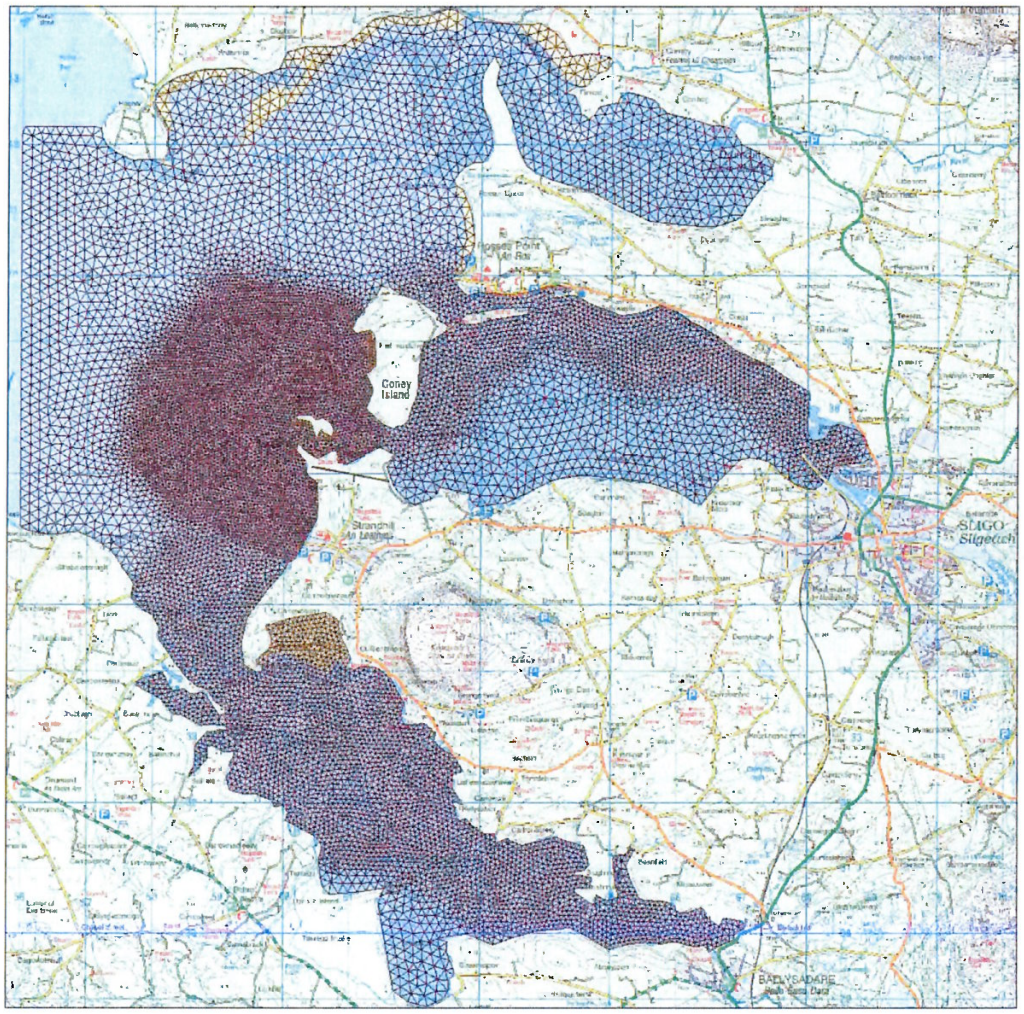


Figure 2.2: Extent and resolution of Finite element Mesh developed for Strandhill Dispersion Model

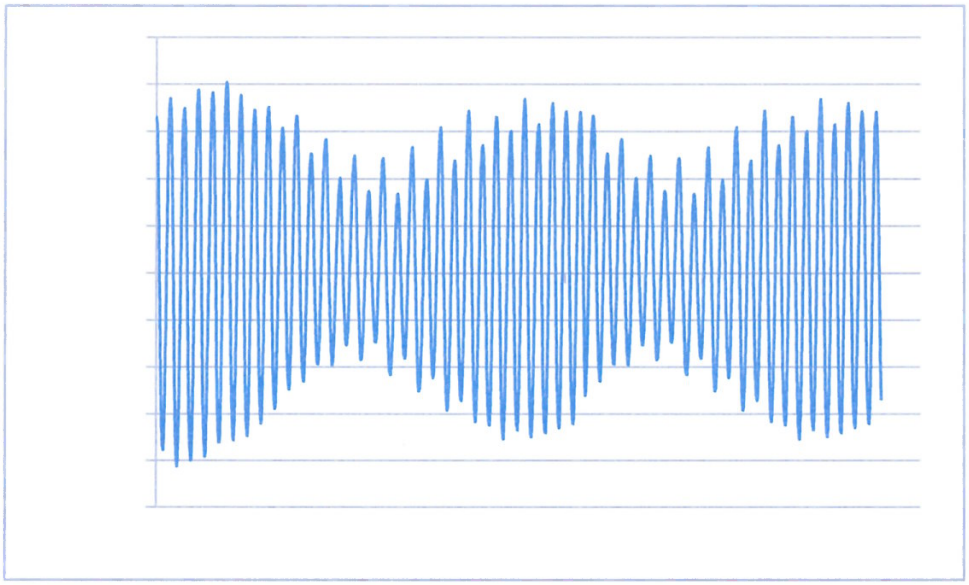


Figure 2.3: Tide elevation boundary used to drive model

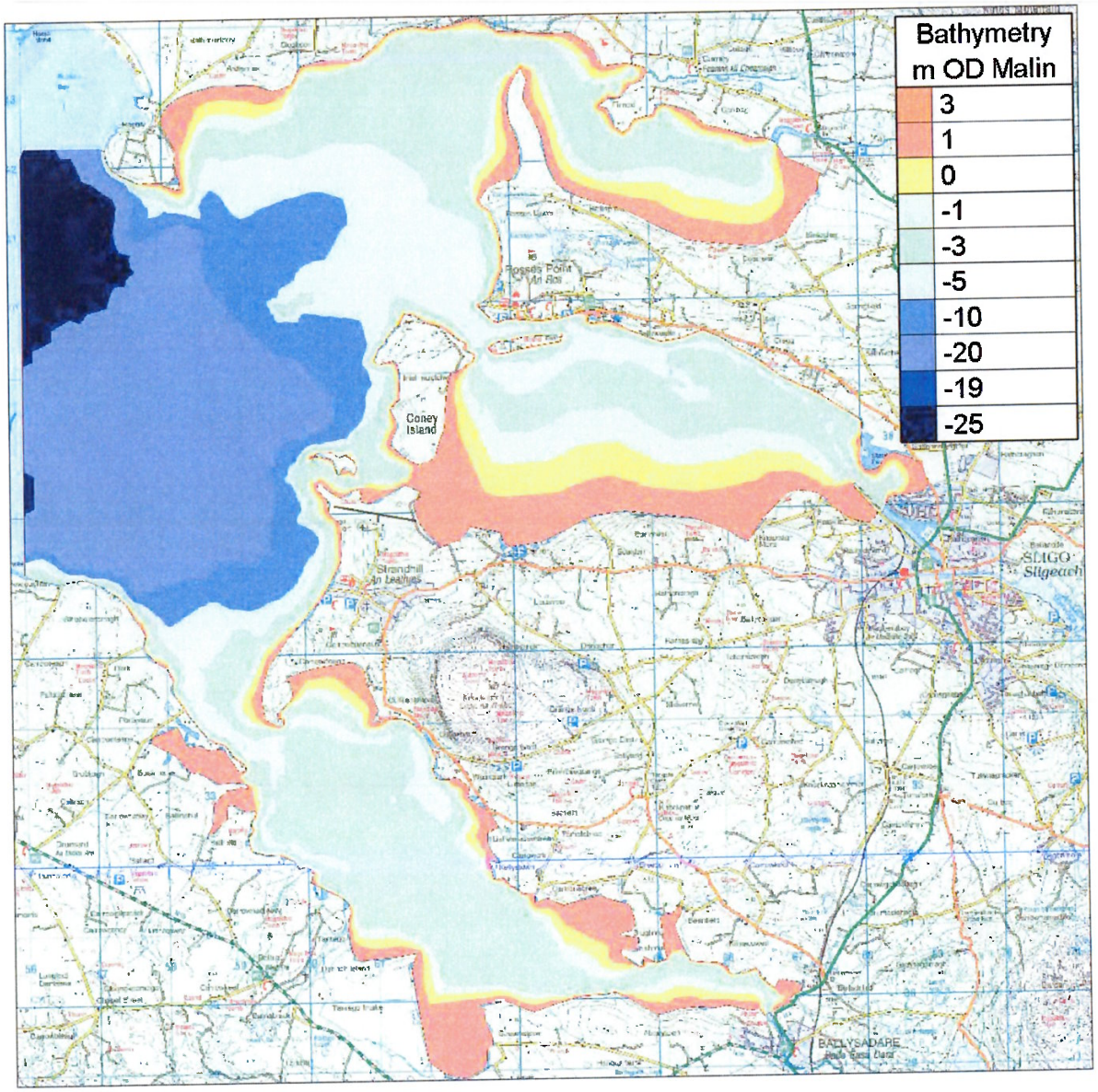


Figure 2.4: Model bathymetry for Strandhill dispersion model extracted from Admiralty Charts

3. Hydrodynamics

An ADCP current meter was deployed 1200m off (west of) Killaspug Point at grid location (159026E, 337424N, refer to Figure 3.1) for 16 days from the 27th March to the 12th April 2013 to provide information on spring neap tidal range and velocity magnitude through the water column. The deployment location was located midway between outfall option 2 and option 3 sites, refer to Figure 3.1. Velocity roses from this data are presented for the near surface layer, mid-depth layer and near bottom layer in Figures 3.2 to 3.4.



Figure 3.1: Location of ADCP meter used to measure tide velocities

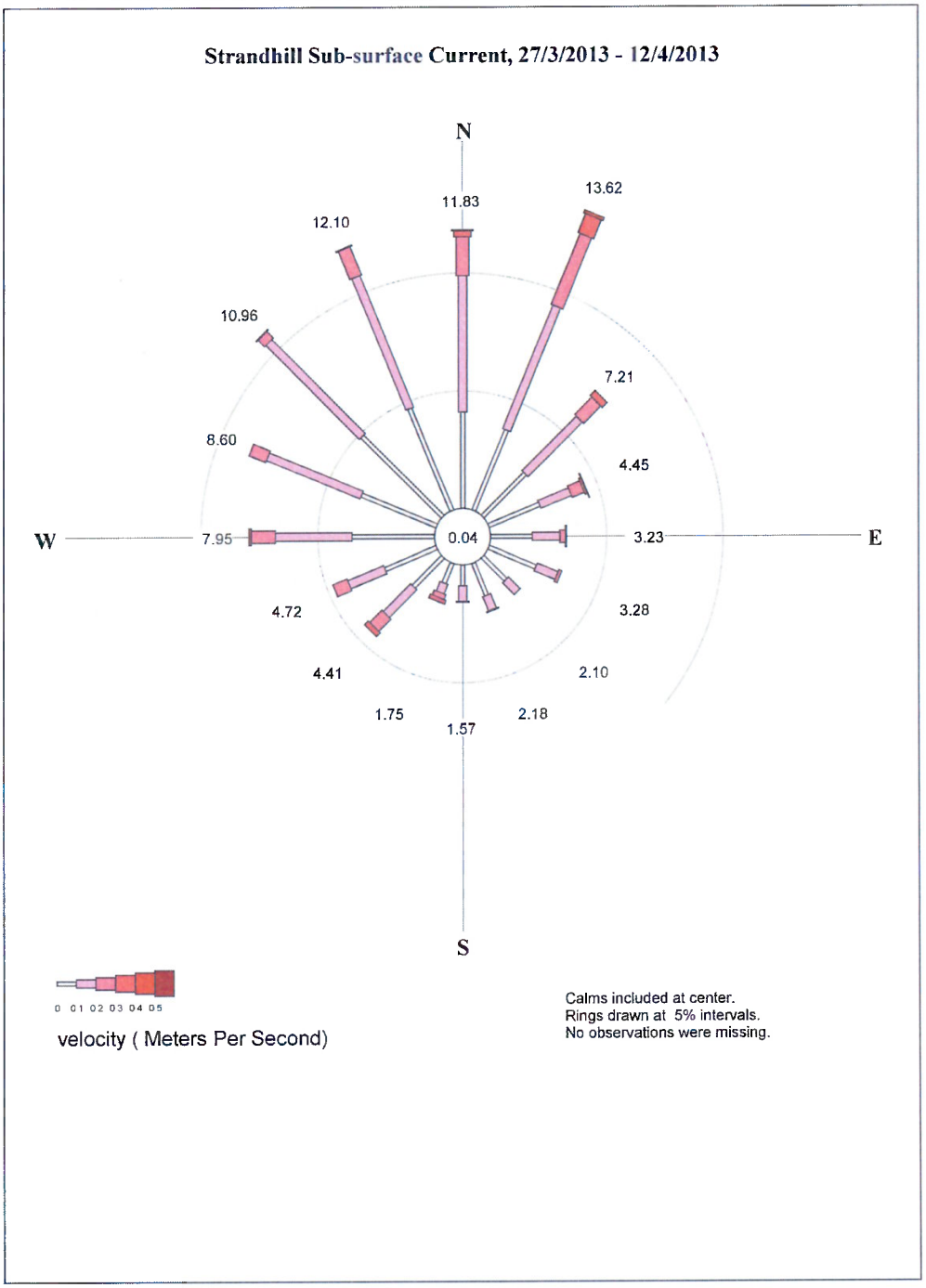


Figure 3.2: Velocity rose for near-surface velocities over monitoring period

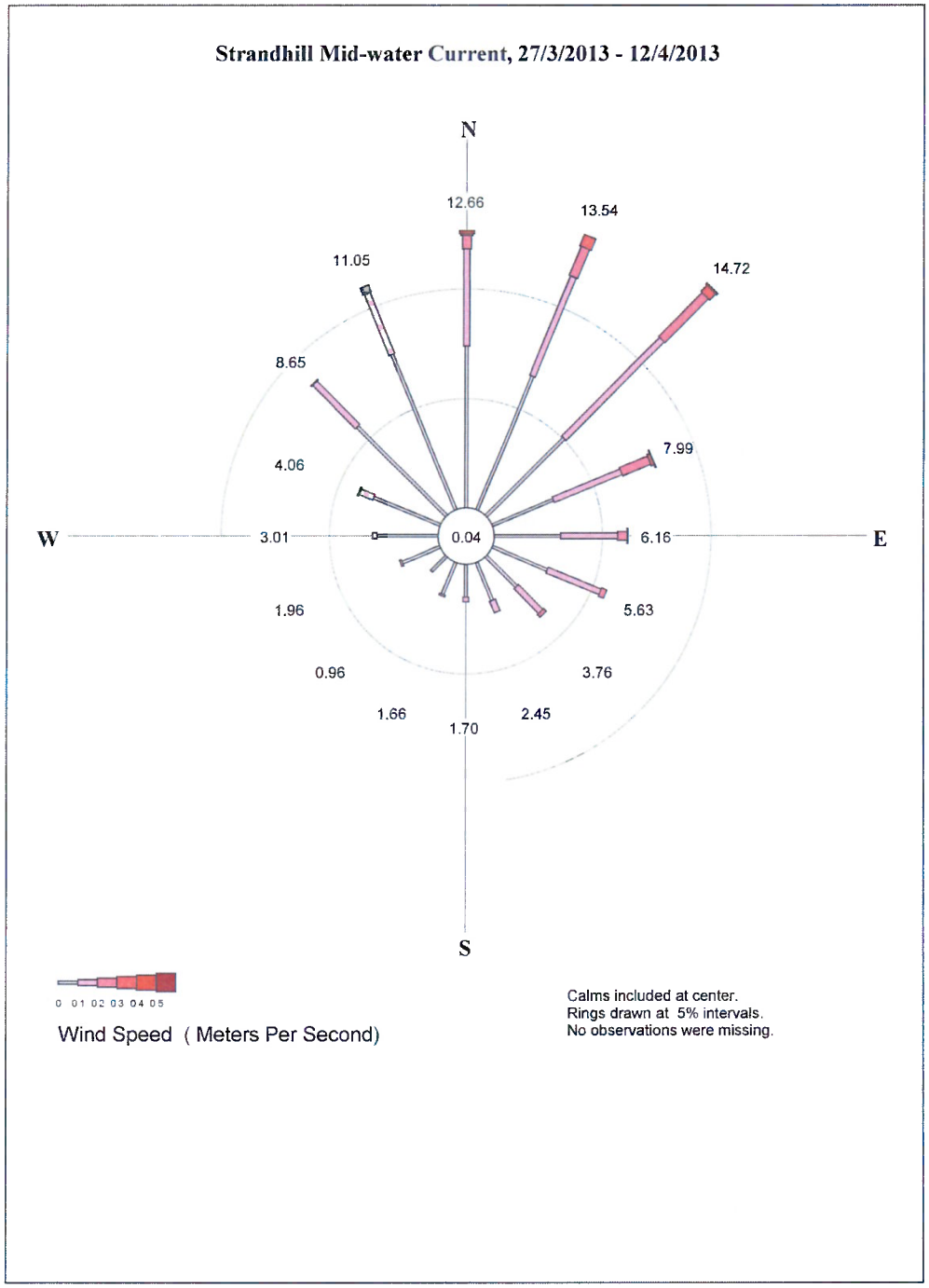


Figure 3.3: Velocity rose for mid-depth velocities over monitoring period

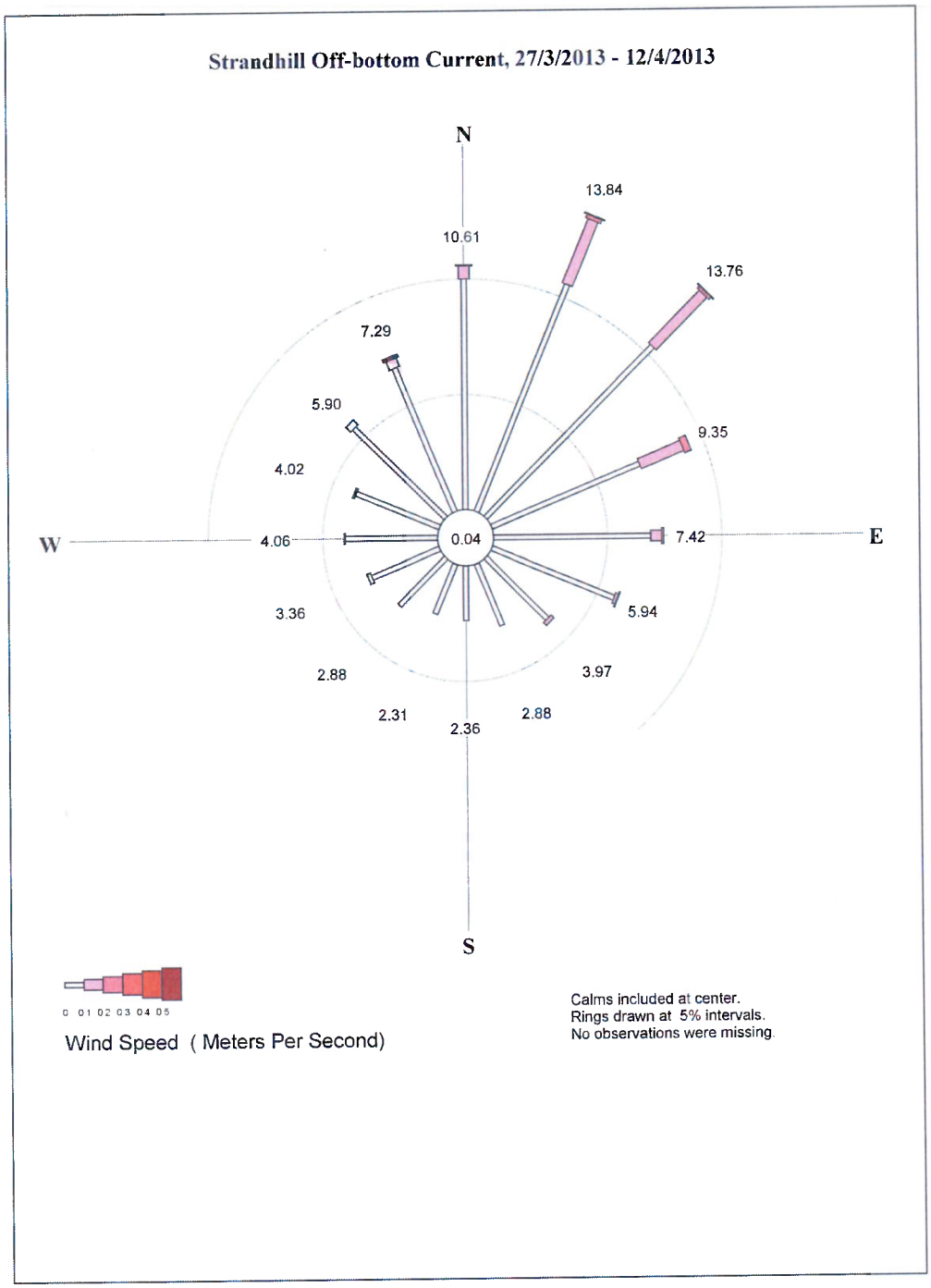


Figure 3.4: Velocity rose for near-bottom velocities over monitoring period

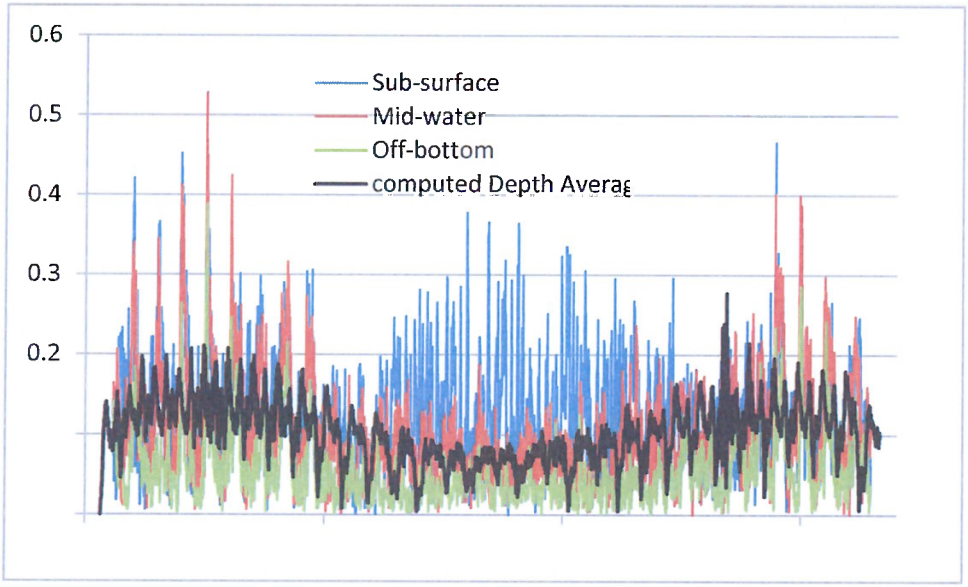


Figure 3.5: Comparison of measured and computed velocity magnitudes at ADCP location

The model predictions of velocity at the ADCP measurement site (Figure 3.5) shows reasonably good agreement with the measured data.

The hydrodynamic simulations show relatively slack velocities in the vicinity of the proposed outfall locations off Strandhill over spring and neap tides. Strong currents exist in the vicinity of the mouths to Ballysadare Bay, Sligo Harbour and Drumcliff Bay, refer to Figures 3.6 and 3.7. The sea bed bathymetry gives a depth below malin head datum of 2.5m for outfall option 1, 11m for outfall option 2 and 13m for outfall option 3.

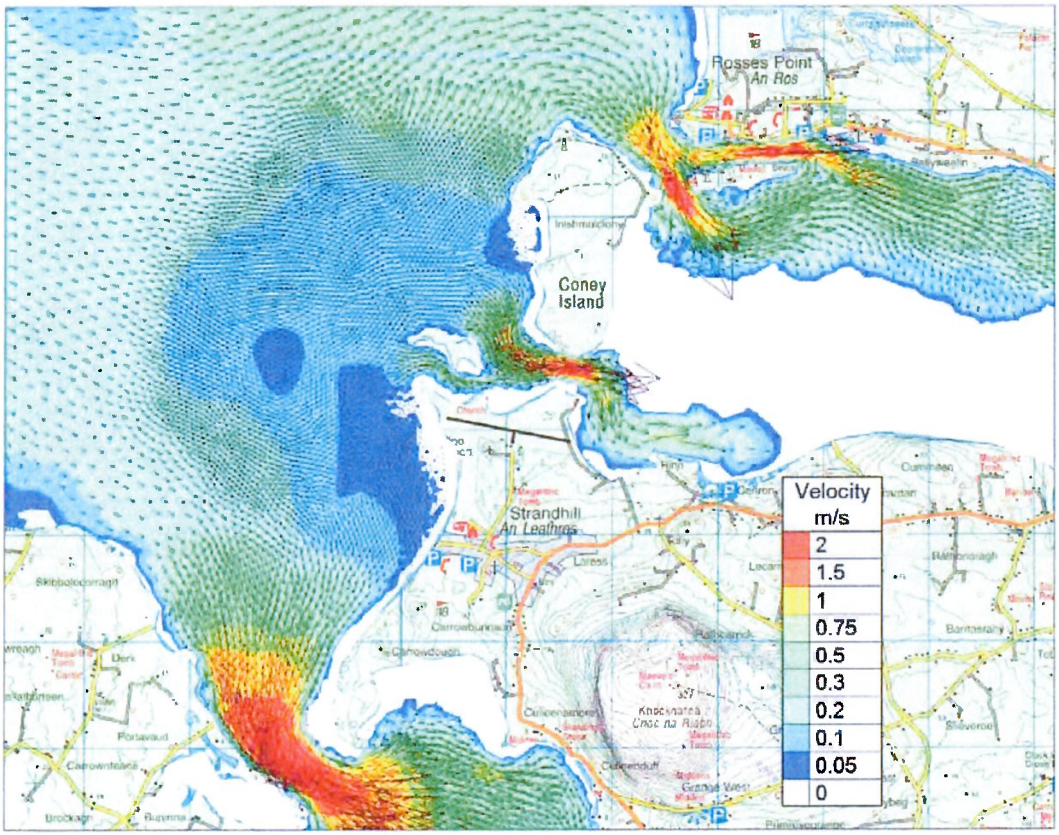


Figure 3.6: Typical mid-flood velocities within the study area

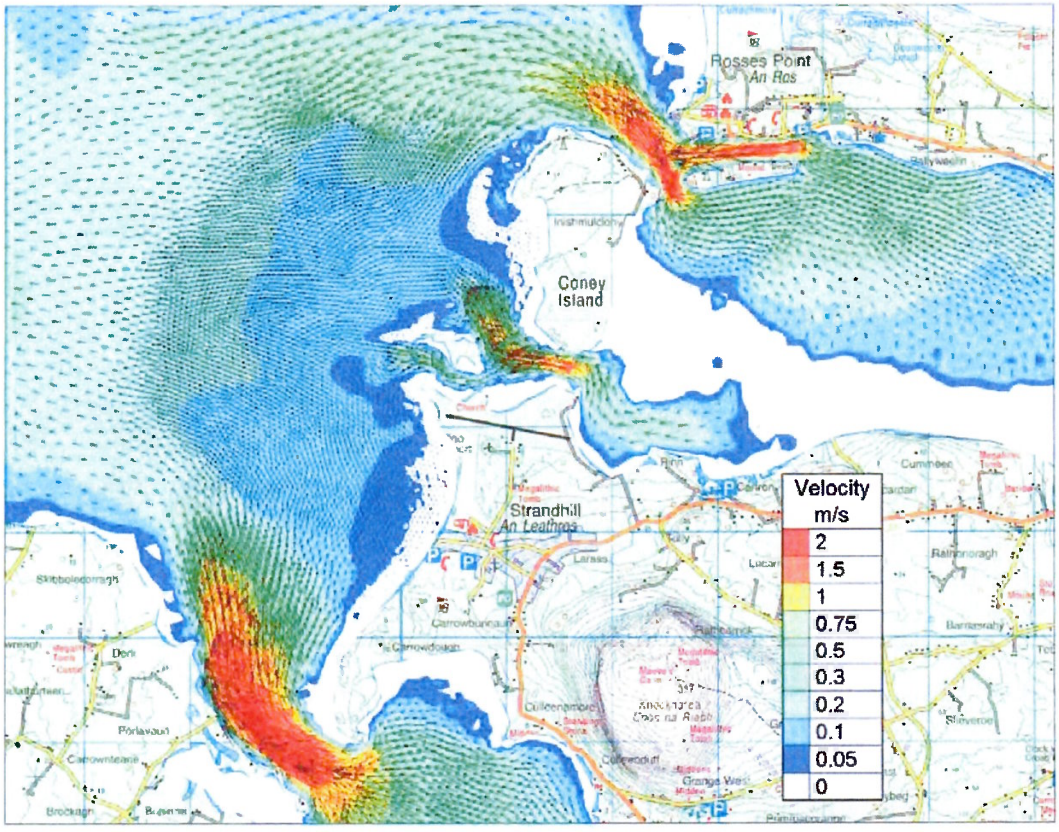


Figure 3.7: Typical mid-ebb velocities within the study area

4. Water Quality Dispersion Simulations

4.1. Water Quality Standards

WFD classification systems and environmental quality standards (EQS) were developed for the purpose of assessing the ecological status of surface waters in Ireland using these suites of quality elements. These standards were brought into force under the European Communities Environmental Objectives (Surface Waters) Regulations 2009 that came into operation on the 30th July 2009. These regulations apply to all surface waters and are made to give effect to the measures needed to achieve the environmental objectives established for bodies of surface water by Directive 2000/60/EC of the European Parliament and of the Council including the environmental quality standards established by Directive 2008/105/EC and to give further effect to the requirements of Directive 2006/11/EC.

Table 4.1: Extract From Surface Water Regulations 2009 pertaining to limits for Dissolved Inorganic Nitrogen and total coliforms.

	Surface Water Regulations 2009 Coastal
Dissolved Inorganic Nitrogen (mg N/l)	Good Status (34.5 psu) ≤0.25 High Status (34.5 psu) ≤0.17

	EC Directive concerning the quality of bathing waters 76/160/EEC		National Limit Values (SI No.155 of 1992)
Parameter	**Guide**	**Mandatory**	
***Total Coliforms* (cfu/100ml)**	≤500*	≤10,000**	≤5000*, ≤10,000**
***Faecal Coliforms* (cfu/100ml)**	≤100*	≤2,000**	≤1,000*, ≤2,000**

* ≥80% of samples ** ≥90% of samples

Twelve reference sites within the study area were selected plus the outfall location where time series of parameter concentration were output for detailed analysis, refer to Figure 4.1. The simulations were performed for a full lunar cycle which insured that equilibrium conditions were attained to assess the spring-neap variation and the long term build-up of DIN and total coliforms.

A conservative die off rate T_{90} of 36hours was specified for the total coliform simulation which allows for low night time die-off of 60hours and day light die-off T_{90} of 12hours. In the simulations DIN was treated as a fully conservative water quality parameter (i.e. no decay).

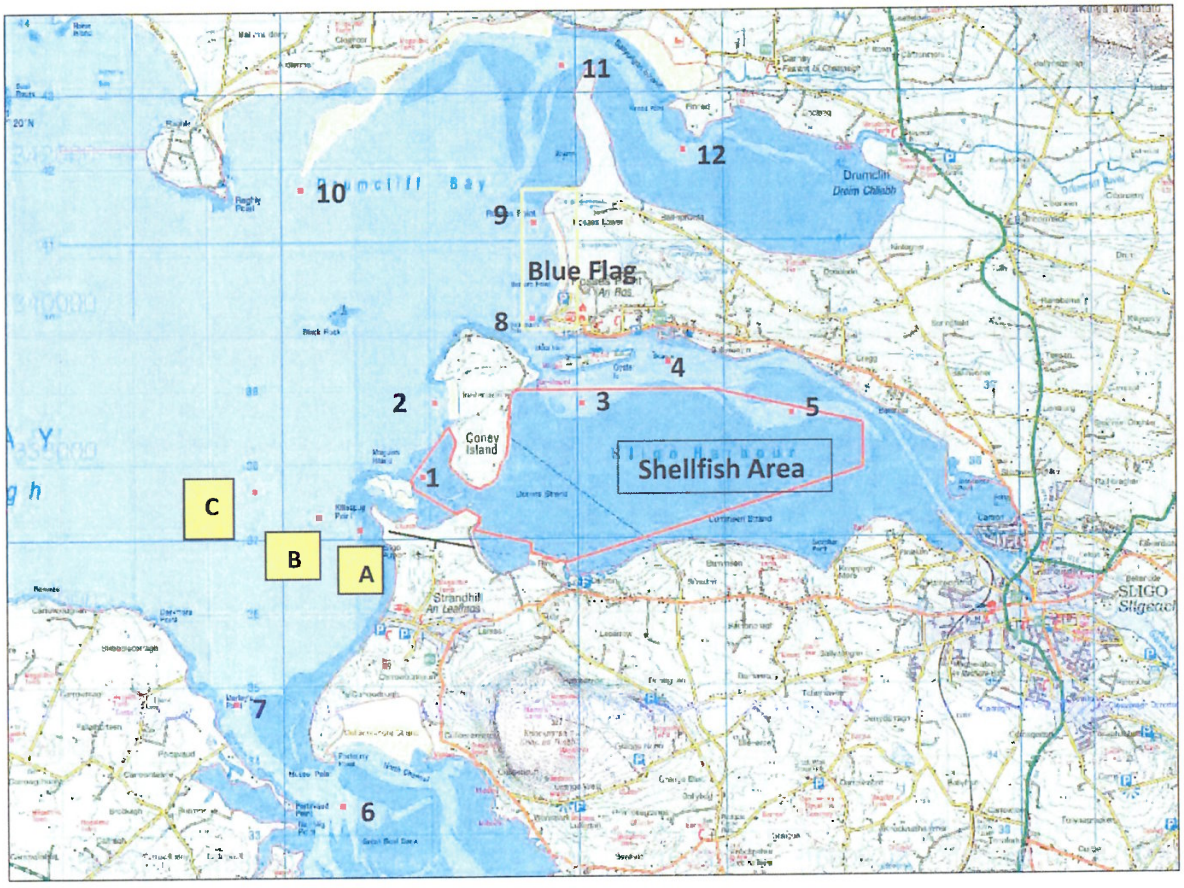


Figure 4.1: Reference sites for model output

4.2. *Total Coliform Simulations*

Four simulation runs over a lunar month was carried out modelling total coliform, two simulation runs for outfall option 1 involving secondary treatment with and without disinfection, secondary treatment at outfall option 2 and primary treatment at outfall option 3. The location of the designated shellfish area within Sligo Beach and the Blue Flag beach area at Rosses Point, (refer to Figure 4.1) are the primary target areas to be considered by this assessment. The model was run for a lunar cycle and the final 2 week period which includes full spring-neap cycle was assessed in terms of mean and maximum coliform concentrations. The simulations were carried out independent of ambient background concentrations. Tables 4.2 to 4.5 present summary statistics of predicted coliform concentrations over the spring-neap cycle for the 4 simulations and Figures 4.2 to 4. 9present maximum and mean coliform concentration contour plots within the study area for

the four model runs.

These clearly show that outfall option 1 with disinfection has minimal impact on the receiving waters and will protect the designated shellfish areas and the Blue flag beach from discernible impact. The option of extending the outfall offshore and reducing the level of treatment is shown not to sufficiently protect the inshore bathing and shellfish areas and such outfall options would still require disinfection.

Table 4.2: Predicted total coliform concentrations for outfall option 1 – secondary treatment with final effluent total coliform concentration of 1.0E+07

Sites	A	1	2	3	4	5	6
Average	17,191.6	143.44	49.11	12.37	6.74	2.408	0.157
Median	11,715.4	130.50	48.69	8.54	4.42	0.765	0.101
Maximum	52,101.2	396.36	76.46	42.90	23.74	13.560	0.988
Minimum	3,331.7	32.11	29.15	0.59	0.18	0.016	0.003
Sites	**7**	**8**	**9**	**10**	**11**	**12**	
Average	0.085	5.877	3.492	1.601	1.053	0.791	
Median	0.028	4.821	3.349	1.523	0.785	0.429	
Maximum	22.380	22.380	7.968	4.333	2.942	2.942	
Minimum	0.000	1.031	1.299	0.274	0.053	0.020	

Table 4.3: Total coliform concentrations for outfall option 1 with disinfection with final effluent total coliform concentration of 1.0E+04

Sites	A	1	2	3	4	5	6
Average	17.195	0.143	0.049	0.012	0.007	0.002	0.000
Median	11.723	0.130	0.049	0.009	0.004	0.001	0.000
Maximum	52.101	0.396	0.076	0.043	0.024	0.014	0.001
Minimum	3.332	0.032	0.029	0.001	0.000	0.000	0.000
Sites	**7**	**8**	**9**	**10**	**11**	**12**	
Average	0.000	0.006	0.003	0.002	0.001	0.001	
Median	0.000	0.005	0.003	0.002	0.001	0.000	
Maximum	0.022	0.022	0.008	0.004	0.003	0.003	
Minimum	0.000	0.001	0.001	0.000	0.000	0.000	

Table 4.4: Predicted total coliform concentrations for outfall option 2 – secondary treatment with final effluent total coliform concentration of 1.0E+07

Sites	B	1	2	3	4	5	6
Average	3019.8	86.53	43.66	11.27	6.47	2.42	0.01
Median	2801.8	69.80	41.83	7.97	4.174	0.77	0.01
Maximum	6992.4	301.98	83.52	37.03	22.29	13.26	0.06
Minimum	1177.2	17.71	22.71	0.48	0.15	0.01	0.00
Sites	**7**	**8**	**9**	**10**	**11**	**12**	
Average	0.01	6.36	4.55	1.95	1.22	0.90	
Median	0.01	4.95	4.89	1.80	0.86	0.48	
Maximum	20.01	20.01	9.02	5.47	3.77	3.57	
Minimum	0.00	0.93	1.16	0.31	0.05	0.02	

Table 4.5: Predicted total coliform concentrations for Outfall Option 3 –with final effluent total coliform concentration of 1.0E+08

Sites	C	1	2	3	4	5	6
Average	17590.9	24.93	31.62	16.759	12.45	4.65	5.12
Median	16335.6	21.28	26.37	8.498	6.36	1.36	3.32
Maximum	52557.4	118.24	100.02	88.406	52.69	33.71	33.71
Minimum	7150.7	1.60	3.42	0.376	0.19	0.021	0.14
Sites	**7**	**8**	**9**	**10**	**11**	**12**	
Average	3.80	19.19	24.63	10.66	5.00	3.27	
Median	2.95	13.02	20.36	10.36	3.06	1.66	
Maximum	83.07	83.07	80.00	31.68	20.46	15.27	
Minimum	0.38	1.00	1.92	0.86	0.09	0.04	

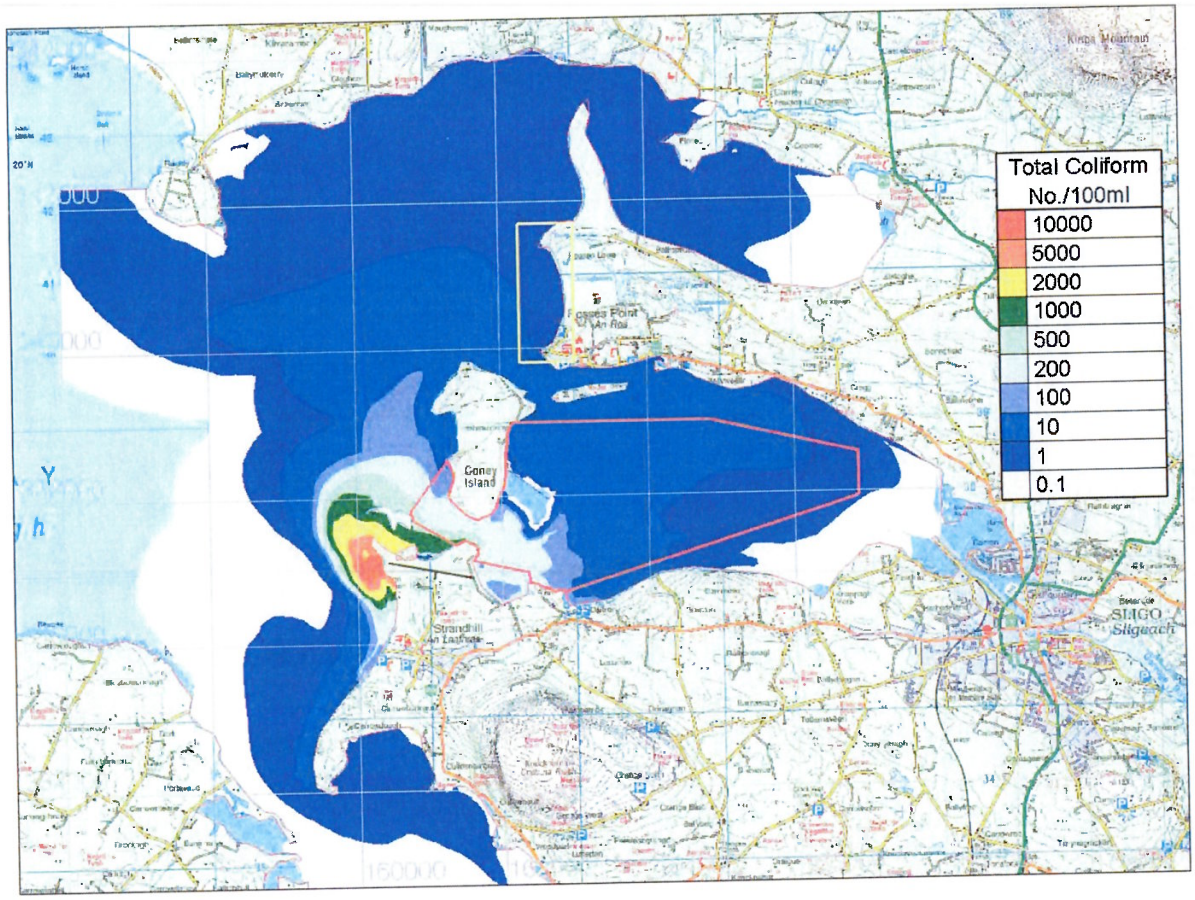


Figure 4.2: Maximum total coliform concentrations for outfall option 1 and treated effluent of 1.0E+07 No./100ml

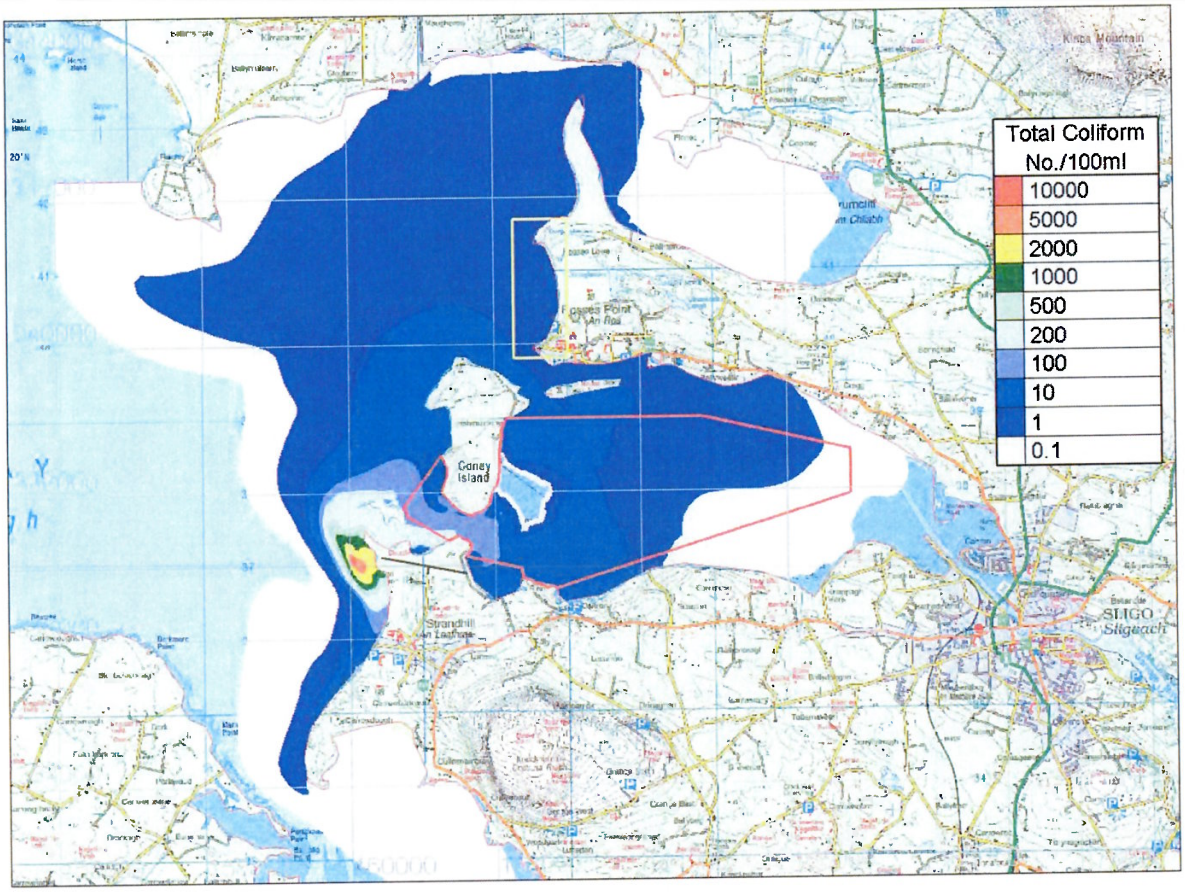


Figure 4.3: Tidal averaged total coliform concentrations for outfall option 1 and treated effluent of 1.0E+07 No./100ml.

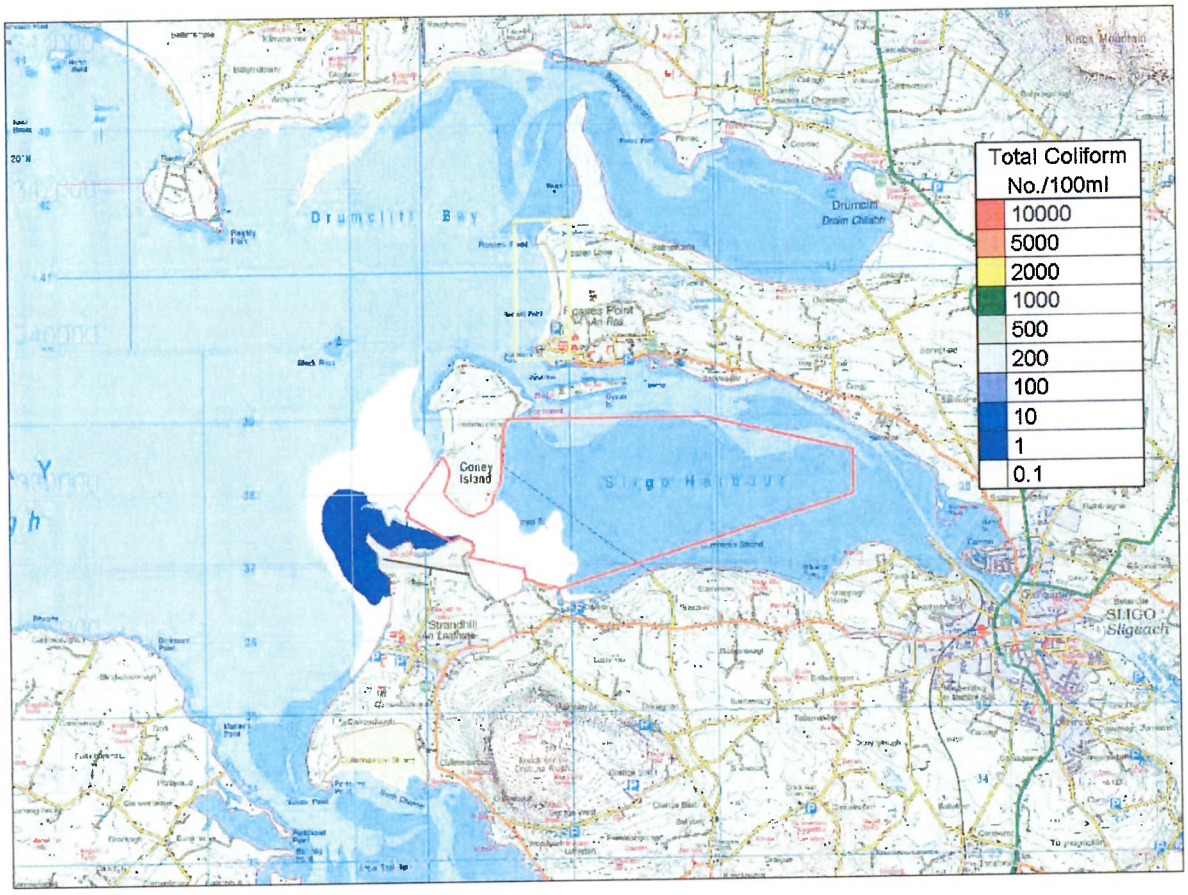


Figure 4.4: Maximum total coliform concentrations for outfall option 1 and treated effluent of 1.0E+04 No./100ml (with disinfection)

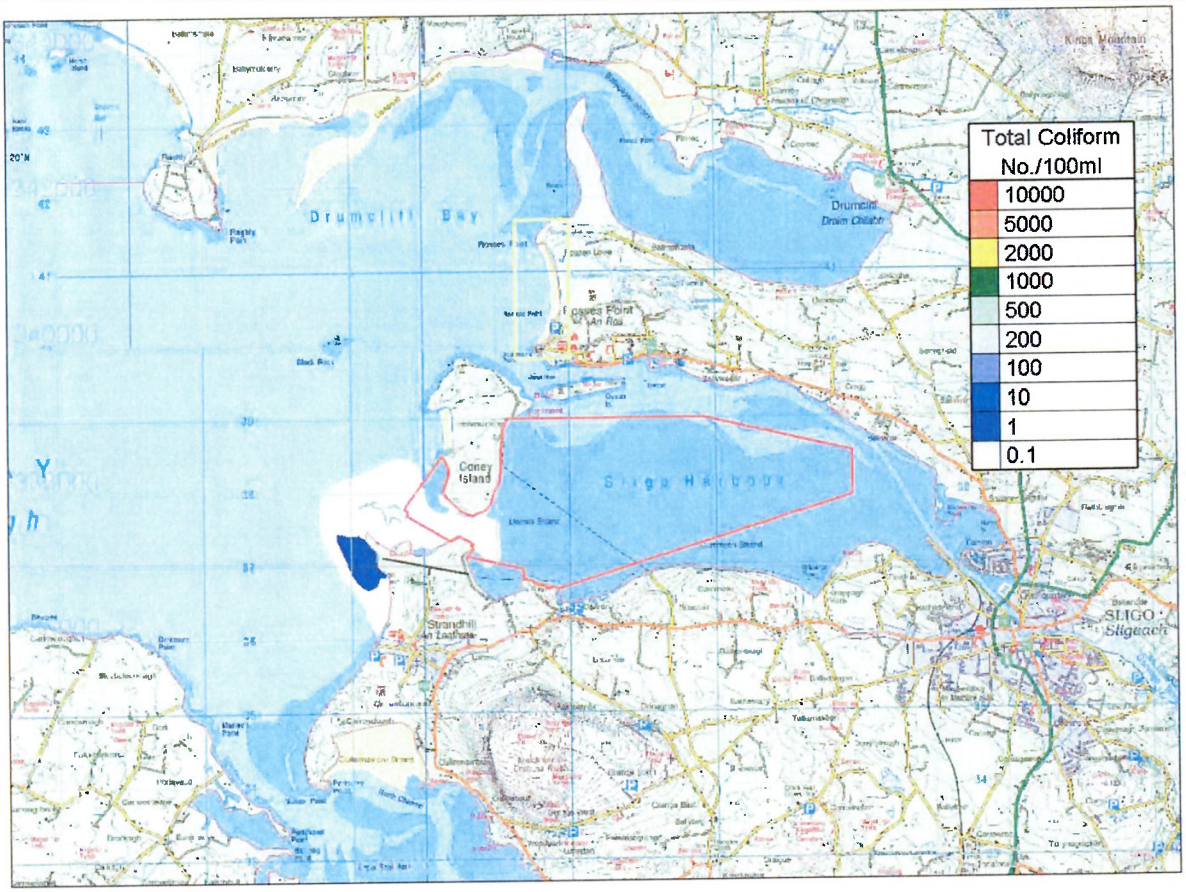


Figure 4.5: Tidal averaged total coliform concentrations for outfall option 1 and treated effluent of 1.0E+04 No./100ml (with disinfection)

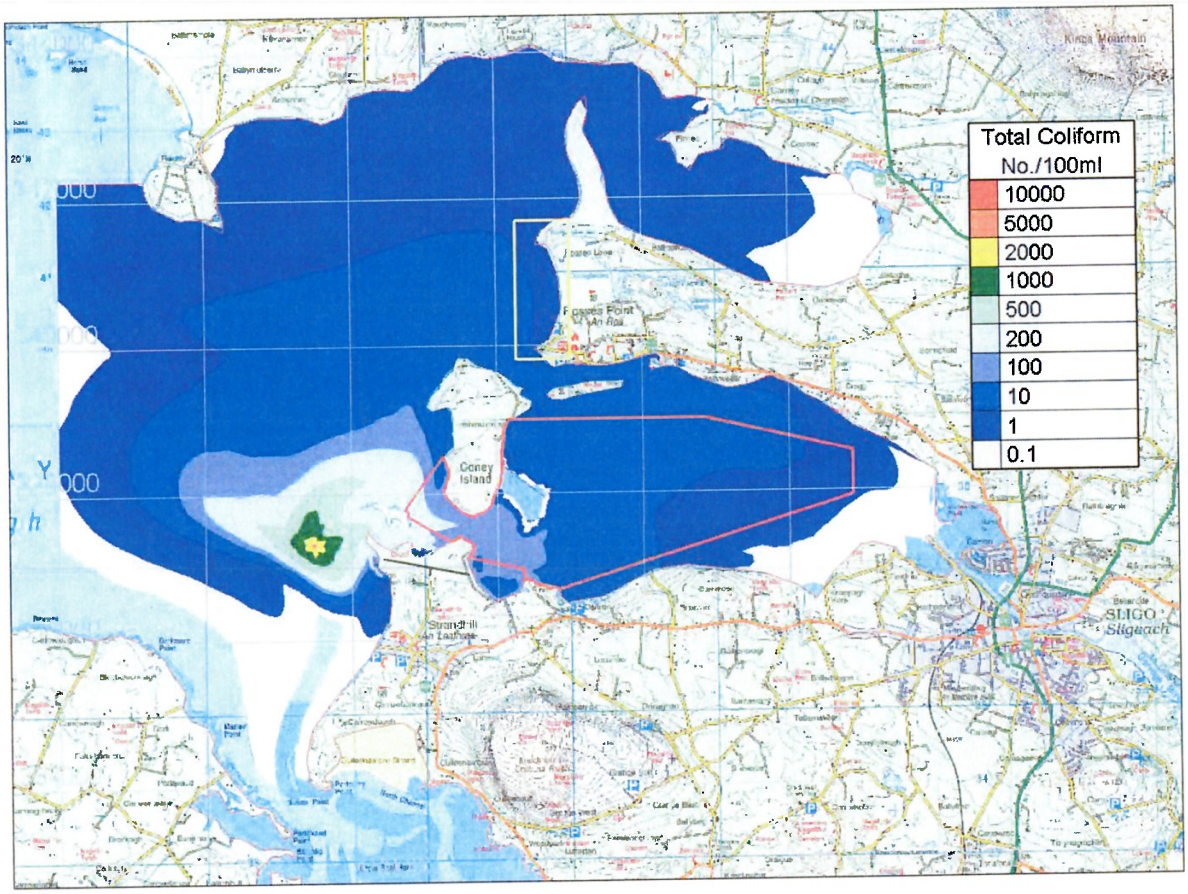


Figure 4.6: Total coliform concentrations for outfall option 2 and treated effluent of 1.0E+07 No./100ml

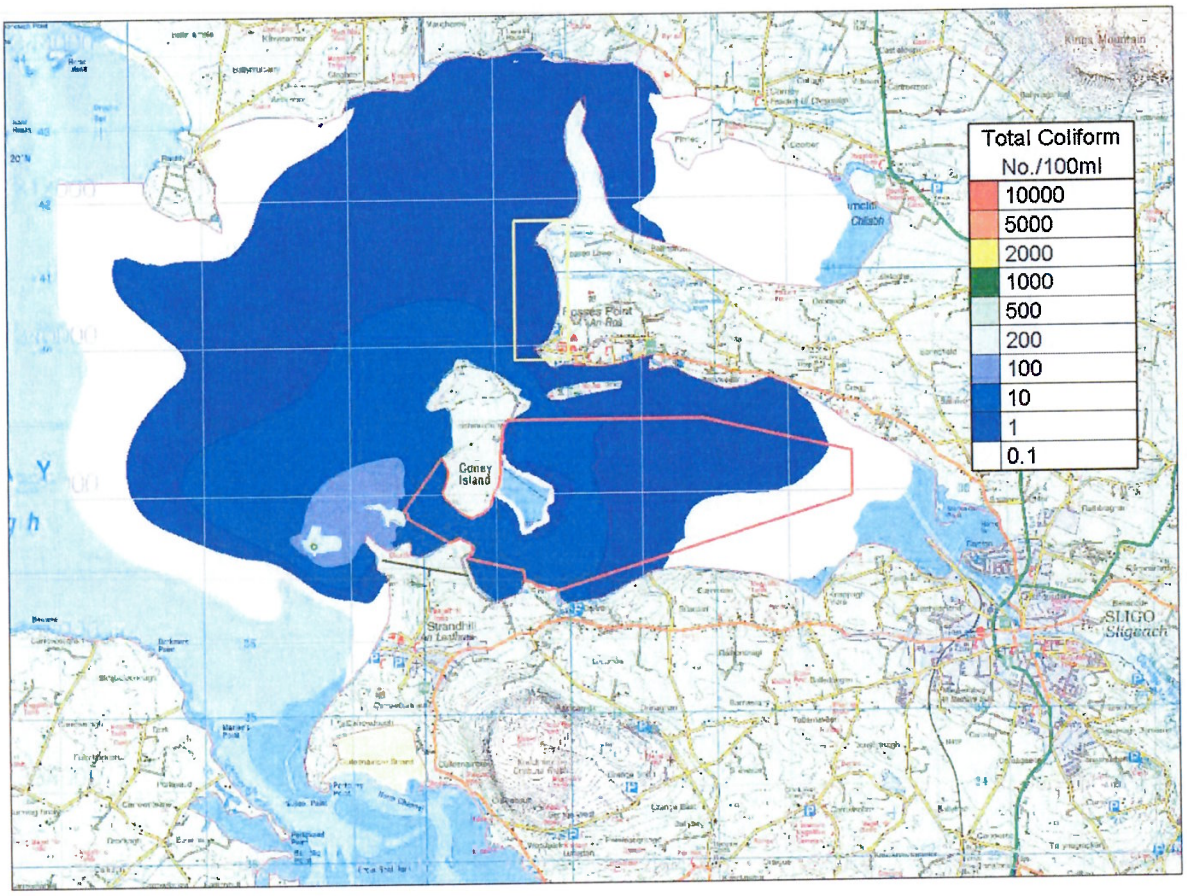


Figure 4.7: Tidal averaged total coliform concentrations for outfall option 2 and treated effluent of 1.0E+07 No./100ml

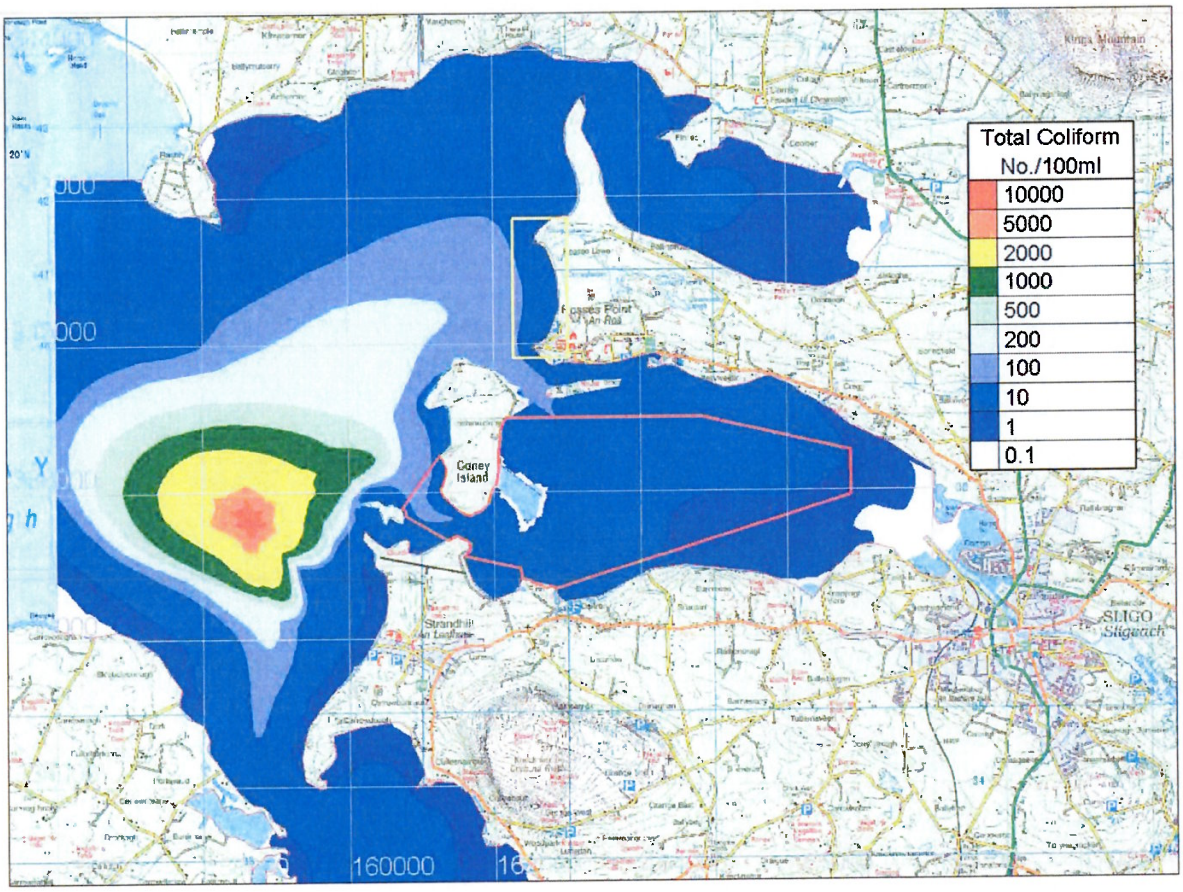


Figure 4.8: Maximum total coliform concentrations for outfall option 3 and treated effluent of 1.0E+08 No./100ml

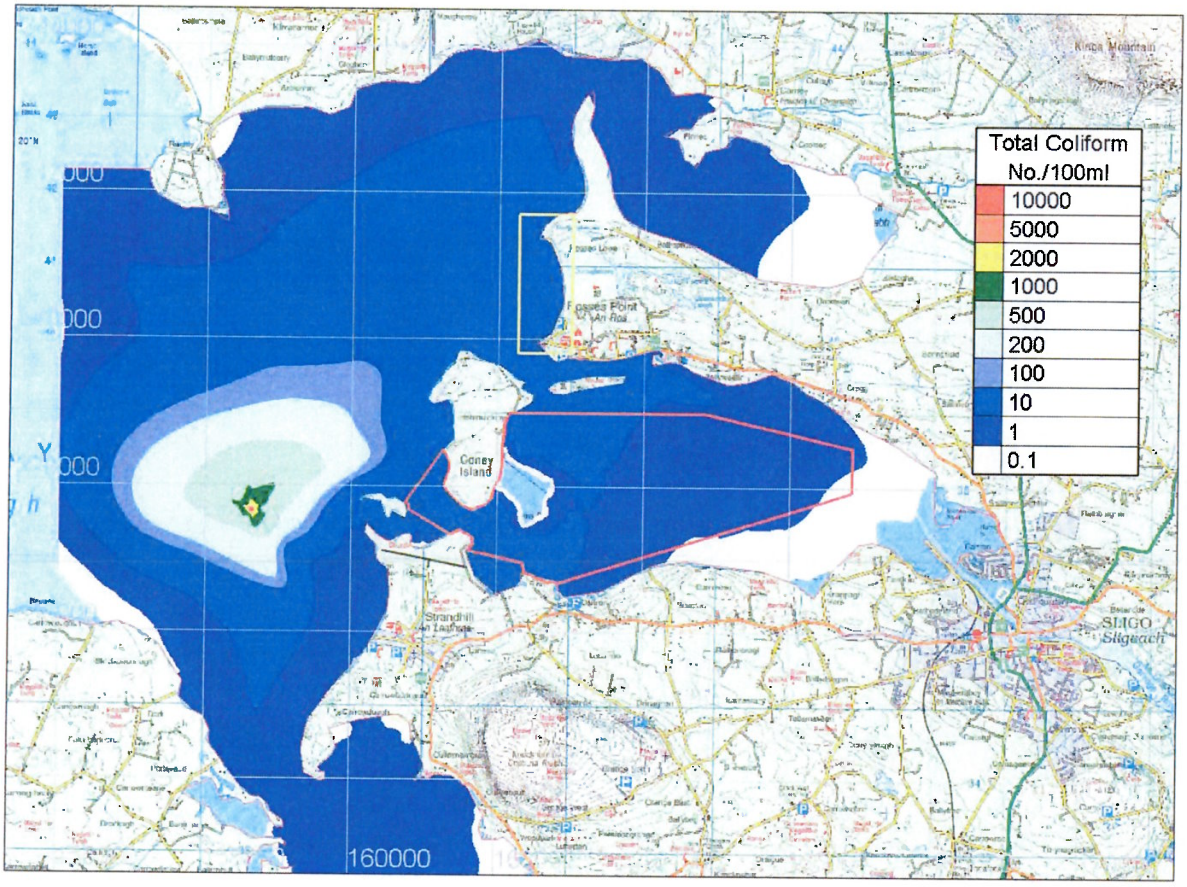


Figure 4.9: Tidal averaged total coliform concentrations for outfall option 3 and treated effluent of 1.0E+08 No./100ml

4.3. DIN Simulations

Four simulation runs for Dissolved Inorganic Nitrogen (DIN) were carried out for the three outfall option sites and varying levels of treatment (8.5 mgN/l outfall option 1, 40mgN/l outfall option 1 and 2 and 50 mgN/l outfall option 3).

The simulations were run for a lunar month which provided sufficient time for equilibrium concentrations to build up within the inner bay areas. The simulations were carried out independent of ambient background concentrations. Tables 4.6 to 4.9 present summary statistics of predicted DIN concentrations over the spring-neap cycle and Figures 4.10 to 4.17 present maximum and mean DIN concentration contour plots within the study area for the four model runs.

The model results clearly show that DIN concentrations for all four options will not affect the EQS status of the receiving water body with concentrations extremely low even in the vicinity of the outfalls themselves. Only trace levels of DIN are predicted within the inner bay areas of Ballysadare, Sligo Harbour and Drumcliff.

APPENDIX VII: DR. EVELYN MOORKENS REPORT ON IMPACT OF PROPOSED UPGRADE WORKS ON *Vertigo angustior*

SURVEY AND ASSESSMENT OF PROPOSED WASTE WATER TREATMENT WORKS UPGRADE AT STRANDHILL, COUNTY SLIGO ON *VERTIGO ANGUSTIOR*

August 2013

Evelyn A. Moorkens

Contact Address:

53, Charleville Square,
Rathfarnham,
Dublin 14, Ireland.

Tel: 353 1 4948500 Mob: 353 86 8211385

e-mail: emoorkens@eircom.net

1.0 Introduction

A molluscan survey was undertaken in the area both inside and outside the fence surrounding Strandhill Sewage Treatment Works and Strandhill Caravan Park Pumping Station. The sewage treatment works area is an exclusion from within the Cummeen Strand / Drumcliff Bay SAC (00627) (revised drawing), and the Strandhill caravan park area is to the south of the same SAC, and to the north of the Ballysadare Bay SAC (00622) which are both designated for the Annex II snail species *Vertigo angustior* as well as a variety of Annex I habitats.

The aim of the survey is to look for the presence or absence of the snail in the immediate area around and in front of the current fenced works area and the pumping station area, and to consider the results with respect to the potential impact of the upgrade works proposed in these works areas.

The survey was carried out on 12th August 2013.

2.0 Methodology

The area within and around the Strandhill WWTP works compound was walked and visually assessed for quality of fixed and semi-fixed dune habitat with respect to its value for *Vertigo angustior*. The assessment was made with comparison to a baseline survey undertaken in 2009 for the coastal protection project undertaken in the area (Moorkens, 2009). The presence of *V. angustior* was checked by banging living vegetation and litter onto a white tray, removing the vegetation and looking at the residue remaining in the tray under a 10X and 20X magnifying lens and noting the presence or absence of the species. The potential habitat around the pumping station area was checked in the same manner.

3.0 Results

3.1 Strandhill WWTP works surroundings

Figure 1 shows 8 polygon areas of habitat importance, which were determined for the 2009 survey (Moorkens, 2009). Polygons 3, 5 and 6 were found to be of the highest quality optimum habitat for *Vertigo angustior* in 2009, and they remain so in 2013 as found in the present survey. The 8th polygon is a dune slack habitat where *V. angustior* was not found, but has a very high botanical quality. The survey found that polygon 7 is recovering following its use as a track during the coastal protection project (Photo1), with *V. angustior* present where habitat was least disturbed. Polygon 4 is of lower value for the snail, although it is present in places. The vegetation is somewhat rank and disturbed which lowers its value compared with the other polygons. Polygon 5 adjacent to it is of high value for the snail (Photo 2).

In all, 23 samples out of 27 were positive for *V. angustior*.



Figure 1. Area showing areas of *V. angustior* habitat present



Photo 1 Polygon 7 recovering habitat



Photo 2. Polygon 5 looking back to Polygon 4

3.2 Strandhill WWTP works area

Within the Strandhill WWTP fenced area there is a grassed area of approximately 70m long and 22m wide, within which the new waste water treatment system is planned and needs to be commissioned in advance of the existing area being decommissioned.

This grassed area has been managed by mowing and does not constitute habitat for *V. angustior*, and no specimens of the species were found there (Photos 3 and 4).



Photo 3 Grass in Strandhill WWTP compound



Photo 4 Grass in Strandhill WWTP compound

3.3 Strandhill caravan park pumping station area

This area consisted of the current pumping station works, and was bounded to the west by a short strip of semi-fixed dune and beach (Photo 5), to the south by a built and disturbed environment (Photo 6) and to the east and north by disturbed and mown grass for caravans interspersed by more natural dune mounds (Photos 7 and 8). *Vertigo angustior* was not found in the 8 samples assessed in the field, and potential habitat was sparse.



Photo 5 Pumping station area looking west



Photo 6 Built environment to the south



Photo 7 Disturbed environment to the north



Photo 8 Disturbed environment to the east

4.0 Discussion

The rare narrow-mouthed whorl snail *Vertigo angustior* grows to less than 2mm in height. Sites where the species is widespread, especially those where a variety of suitable habitats and wetness conditions occur within the one general site, such as at the Cummeen Strand / Drumcliff Bay SAC (00627) and at the Ballysadare Bay SAC (00622) are of high international importance. The snail remains threatened internationally and in Ireland (Moorkens, 2006; Byrne *et al.*, 2009). Both SAC populations were assessed for status as part of a national monitoring scheme in 2010 and were found to be in favourable condition (Moorkens & Killeen, 2011).

The area between the fenced sewage treatment works and the sea remains of the highest quality optimum habitat for *Vertigo angustior*, within a wider SAC that is of high international importance for this species.

Strandhill sewage treatment works require upgrade. Strandhill is currently served by a 1,500 PE extended aeration WWTW which was constructed in 1992. The current plant is overloaded and not providing full secondary treatment of the influent wastewater. The plant discharges to the sea at Killaspug via an outfall pipe. The primary discharge from the existing WWTW is located outside but near to the Cummeen Strand/Drumcliff Bay SAC/SPA boundary. It is an objective in the Sligo County Development Plan 2011-2017 to carry out measures to address deficiencies in the existing water and wastewater infrastructure, so as to ensure compliance with regulatory requirements and the objectives of the Water Framework Directive.

The improvements will require a new facility at Strandhill, to be procured under a design/build/operate (DBO) procedure. This form of procurement will allow the Contractor to propose any design which will treat the wastewater to the required performance standards. The works shall be designed to treat wastewater from Strandhill to a PE equivalent of 3,000.

The exact size and position of the units, and the exact process is to be decided by the contractor at the design stage. The contractor will be obliged to stay within the site boundary and its height restrictions and comply with the requirements of Part 8 Planning. Once the new works are operational, unused parts of the existing plant are to be demolished and removed from the site for disposal.

As part of the scheme, the pumping stations will require maintenance works within their site boundaries (e.g. pump replacement, electrical system upgrade). The West End (Caravan Park) pumping station, located along the coast west of Strandhill village, will require general maintenance works and the addition of a new storm tank with a capacity of 20 m^3 to provide storage for peak flows, a control kiosk and the mechanical upgrade of the current pumping station.

An assessment of the potential impact of the proposed works at the two sites can be divided into two aspects, 1) the direct impact on the areas where the works are proposed, and 2) the indirect impacts on habitats occurring outside the footprint of the proposed works.

1) Assessment of the direct impact on the areas where the works are proposed

As no habitat was found for *Vertigo angustior* at either inside the Strandhill WWTP compound, or within the footprint of the West End (Caravan Park) pumping station, no direct impacts on *V. angustior* are possible from the proposed works.

2) Assessment of the indirect impacts on habitats occurring outside the footprint of the proposed works.

Potential negative impacts from works on areas of habitat nearby could be caused by:

a) Drainage of an area nearby, resulting in a loss of water through overland or subsurface flow to the habitat outside the works.
b) Disturbance of topography or subsurface flow of an area nearby, causing a change of direction or quantity of subsurface water to the habitat outside the works.
c) Any in-combination or cumulative effect that could lead to disturbance of the hydrogeology of the habitat outside the works.

At the West End (Caravan Park) pumping station area, the surrounding habitat is fragmented and marginal, and the area within the zone of hydrogeological influence of the proposed works is outside any designated area. The potential adverse indirect effects from the proposed works to the pumping station influence are considered to be negligible.

The area surrounding the Strandhill WWTP compound is, by contrast, of very high conservation value and within the Cummeen Strand / Drumcliff Bay SAC (00627). The hydrogeology regime of the fixed dune and dune slack areas of the cSAC are maintained through surface and sub-surface flow through the porous sands and soils laid down over the Carboniferous limestone bedrock of the area. The area of the Strandhill WWTP compound is relatively flat and therefore the sands and soils are considered to be evenly distributed across the area, thus are likely to supply an even quantity of subsurface water to the surrounding area from the part of the site that is not currently built on.

The current operational area of the site is to be decommissioned after the proposed upgraded treatment plant is complete. In order to supply an equal amount of porous sand and subsoil to that which is present within the compound, all excavated material should be stockpiled within the compound, with care being taken to keep the sand and soil components separate, clean and covered during the period of construction. When the new works area is operational, the old machinery and tanks should be carefully removed, and the stockpiled sand and soil carefully placed in the cleared area, with the same soil and sand horizon profile as that which was removed for the construction. As modern treatment plant is generally smaller and more efficient than older plant, the full quantity of excavated matter should be available for use. No additional external fill should be allowed in this area.

It should be a condition of the contract to ensure that any design of the new system should be no bigger or deeper than the existing plant. The design, construction and operation of the new systems should be done in full knowledge of the sensitive cSAC that the compound sits within, and all aspects of the project need to document how they will be carried out with the protection of the structure and function of the surrounding habitats and species.

Where the above are conditions attached to the contract, it can be concluded that the hydrogeological system will have no net loss in the long term, that the temporary disturbance to the hydrogeological regime during construction will be minimal. The operational phase compound will be equal to the old one in terms of drainage and hydrogeological support, and thus will not contribute any in-combination or cumulative effects. Therefore the long term effect on the Vertigo angustior population of the proposed works can be considered to be negligible.

5.0 References

Byrne, A., Moorkens, E.A., Anderson, R., Killeen, I.J. & Regan, E.C. (2009) *Ireland Red List No. 2 – Non-Marine Molluscs.* National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Moorkens, E. A. (2006). Irish non-marine molluscs – an evaluation of species threat status. *Bull. Ir. biogeog. Soc.* 30, 348-371.

Moorkens, E. A. (2009). *A non-marine molluscan survey of dune habitat in the vicinity of Strandhill sewage treatment works, County Sligo.* Report for Sligo County Council.

Moorkens, E.A. & Killeen, I.J. (2011) Monitoring and Condition Assessment of Populations of *Vertigo geyeri*, *Vertigo angustior* and *Vertigo moulinsiana* in Ireland. *Irish Wildlife Manuals*, No. 55. National Parks and Wildlife Service, Department of Arts, Heritage and Gaeltacht, Dublin, Ireland.

APPENDIX VIII: HYDRODYNAMIC MODEL

Table 4.6: Predicted DIN concentrations at reference sites for outfall option 1 (Site A) with final DIN effluent concentration of 8.5mg/l

Sites	A	1	2	3	4	5	6
Average	1.769E-02	6.431E-04	4.544E-04	2.978E-04	2.687E-04	2.481E-04	8.904E-06
Median	1.286E-02	6.418E-04	4.271E-04	2.856E-04	2.561E-04	2.377E-04	8.484E-06
Maximum	5.073E-02	1.108E-03	7.658E-04	5.037E-04	4.013E-04	3.776E-04	2.012E-05
Minimum	3.181E-03	2.340E-04	2.675E-04	1.744E-04	1.998E-04	1.519E-04	3.481E-06
Sites	7	8	9	10	11	12	
Average	5.575E-06	2.492E-04	2.073E-04	1.736E-04	2.199E-04	2.201E-04	
Median	5.502E-06	2.451E-04	2.107E-04	1.715E-04	2.145E-04	2.129E-04	
Maximum	4.112E-04	4.112E-04	3.441E-04	2.803E-04	2.822E-04	2.822E-04	
Minimum	3.854E-08	1.133E-04	8.962E-05	9.475E-05	1.779E-04	1.842E-04	

Table 4.7: Predicted DIN concentrations at reference sites for outfall option 1 (Site A) with final DIN effluent concentration of 40.0mg/l

Sites	A	1	2	3	4	5	6
Average	8.32E-02	3.03E-03	2.14E-03	1.40E-03	1.26E-03	1.17E-03	4.19E-05
Median	6.05E-02	3.02E-03	2.01E-03	1.34E-03	1.21E-03	1.12E-03	3.99E-05
Maximum	2.39E-01	5.21E-03	3.60E-03	2.37E-03	1.89E-03	1.78E-03	9.47E-05
Minimum	1.50E-02	1.10E-03	1.26E-03	8.21E-04	9.40E-04	7.15E-04	1.64E-05
Sites	7	8	9	10	11	12	
Average	2.62E-05	1.17E-03	9.76E-04	8.17E-04	1.03E-03	1.04E-03	
Median	2.59E-05	1.15E-03	9.92E-04	8.07E-04	1.01E-03	1.00E-03	
Maximum	1.94E-03	1.94E-03	1.62E-03	1.32E-03	1.33E-03	1.33E-03	
Minimum	1.81E-07	5.33E-04	4.22E-04	4.46E-04	8.37E-04	8.67E-04	

Table 4.8: Predicted DIN concentrations at reference sites for outfall option 2 (Site B) with final DIN effluent concentration of 40.0mg/l

Sites	B	1	2	3	4	5	6
Average	1.253E-02	1.421E-03	1.345E-03	1.020E-03	9.539E-04	8.972E-04	2.581E-06
Median	1.161E-02	1.263E-03	1.194E-03	9.534E-04	9.068E-04	8.328E-04	2.255E-06
Maximum	2.952E-02	2.732E-03	2.419E-03	1.864E-03	1.600E-03	1.484E-03	5.761E-06
Minimum	4.846E-03	5.911E-04	6.918E-04	6.466E-04	6.703E-04	5.411E-04	1.155E-06
Sites	7	8	9	10	11	12	
Average	1.971E-06	9.182E-04	8.086E-04	6.943E-04	8.412E-04	8.430E-04	
Median	1.977E-06	8.765E-04	7.611E-04	6.522E-04	8.239E-04	8.177E-04	
Maximum	1.604E-03	1.604E-03	1.363E-03	1.112E-03	1.126E-03	1.126E-03	
Minimum	2.349E-07	5.553E-04	4.944E-04	4.187E-04	6.667E-04	6.965E-04	

Table 4.9: Predicted DIN concentrations at reference sites for outfall option 3 (Site C) with final DIN effluent concentration of 50.0mg/l

Sites	C	1	2	3	4	5	6
Average	9.233E-03	1.874E-04	2.313E-04	3.974E-04	4.261E-04	4.088E-04	6.311E-05
Median	8.580E-03	1.798E-04	2.288E-04	3.920E-04	4.123E-04	3.974E-04	5.814E-05
Maximum	2.708E-02	3.146E-04	6.480E-04	6.480E-04	6.400E-04	5.263E-04	1.469E-04
Minimum	3.882E-03	1.132E-04	1.632E-04	2.944E-04	3.465E-04	2.398E-04	2.730E-05
Sites	7	8	9	10	11	12	
Average	4.889E-05	4.661E-04	5.231E-04	5.005E-04	4.898E-04	4.815E-04	
Median	4.840E-05	4.475E-04	4.906E-04	4.854E-04	4.765E-04	4.704E-04	
Maximum	8.780E-04	9.078E-04	9.078E-04	6.712E-04	6.304E-04	5.950E-04	
Minimum	5.463E-06	3.451E-04	3.813E-04	3.860E-04	4.174E-04	3.682E-04	

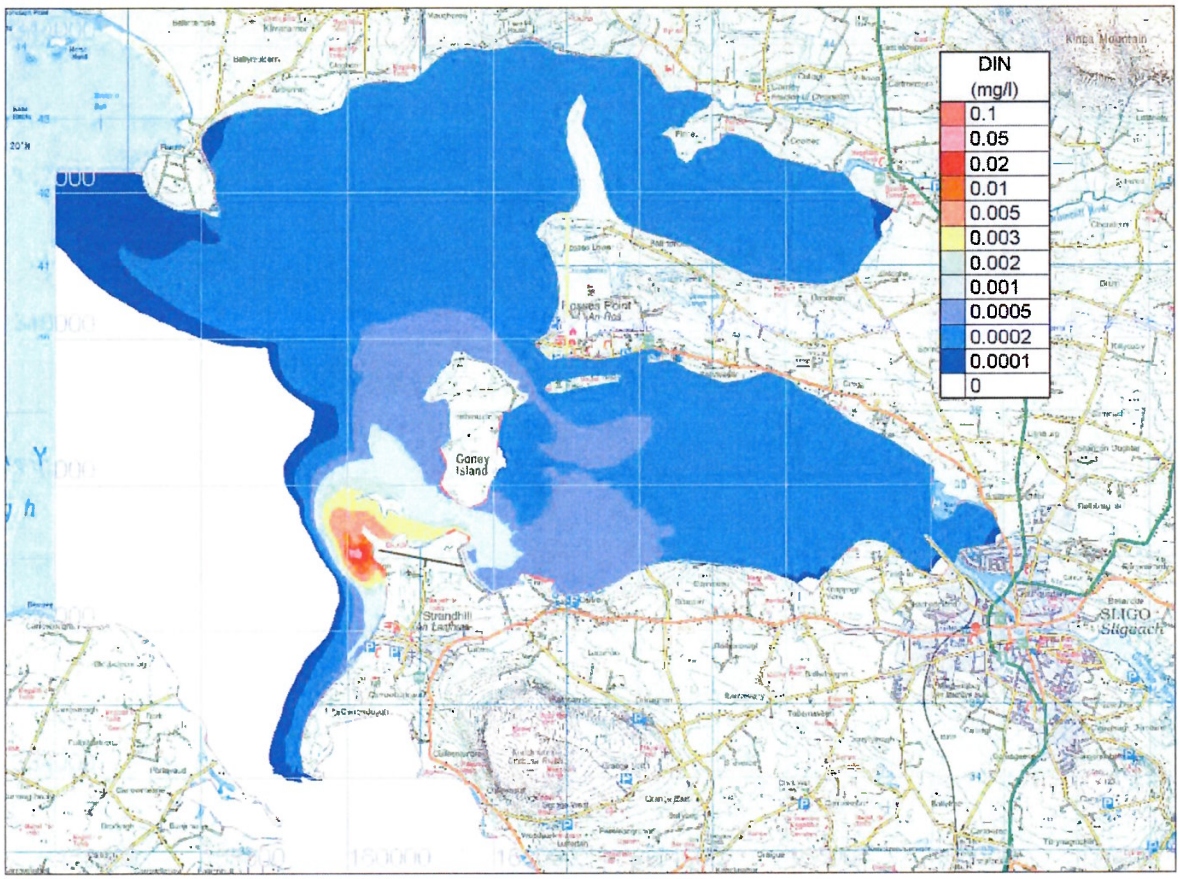


Figure 4.10: Maximum DIN concentrations for outfall option 1 and treated effluent of 8.5 mg/l DIN as N

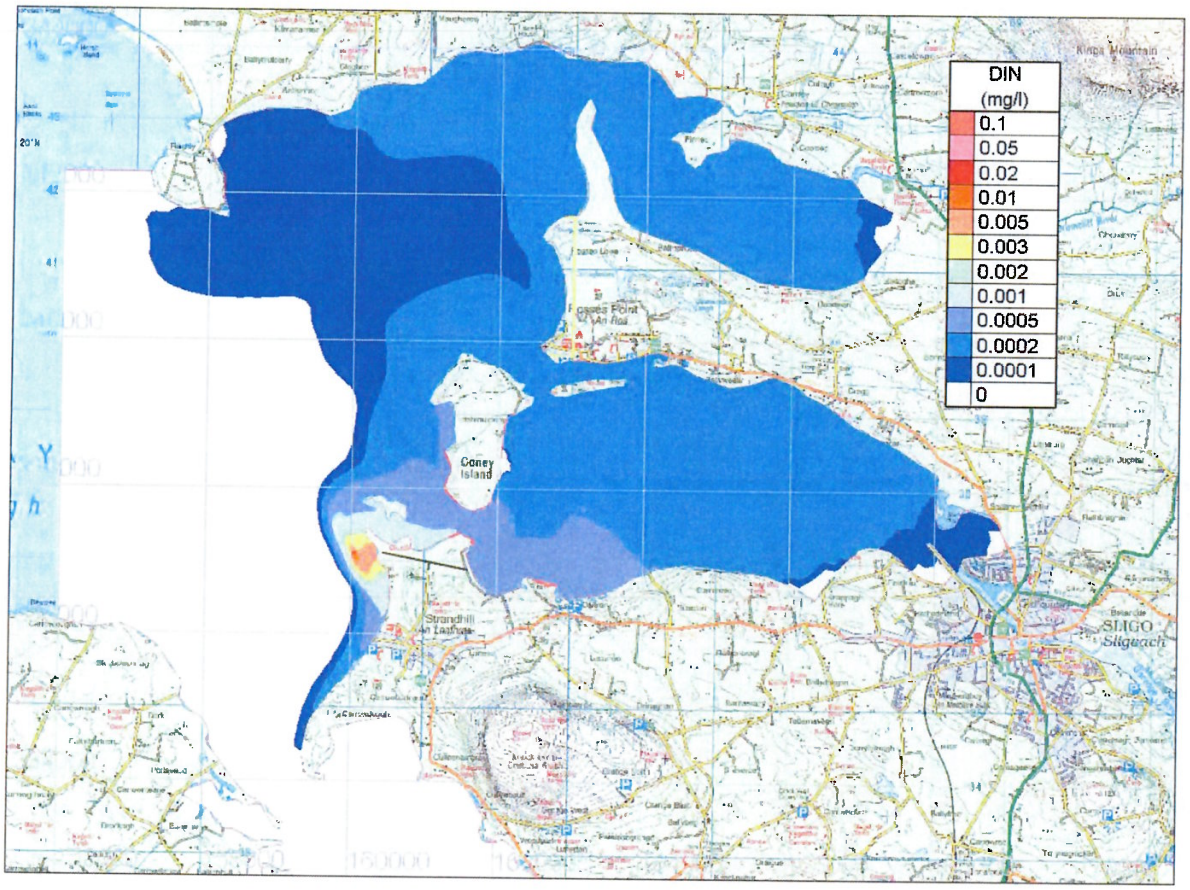


Figure 4.11: Tidal averaged DIN concentrations for outfall option 1 and treated effluent of 8.5 mg/l DIN as N

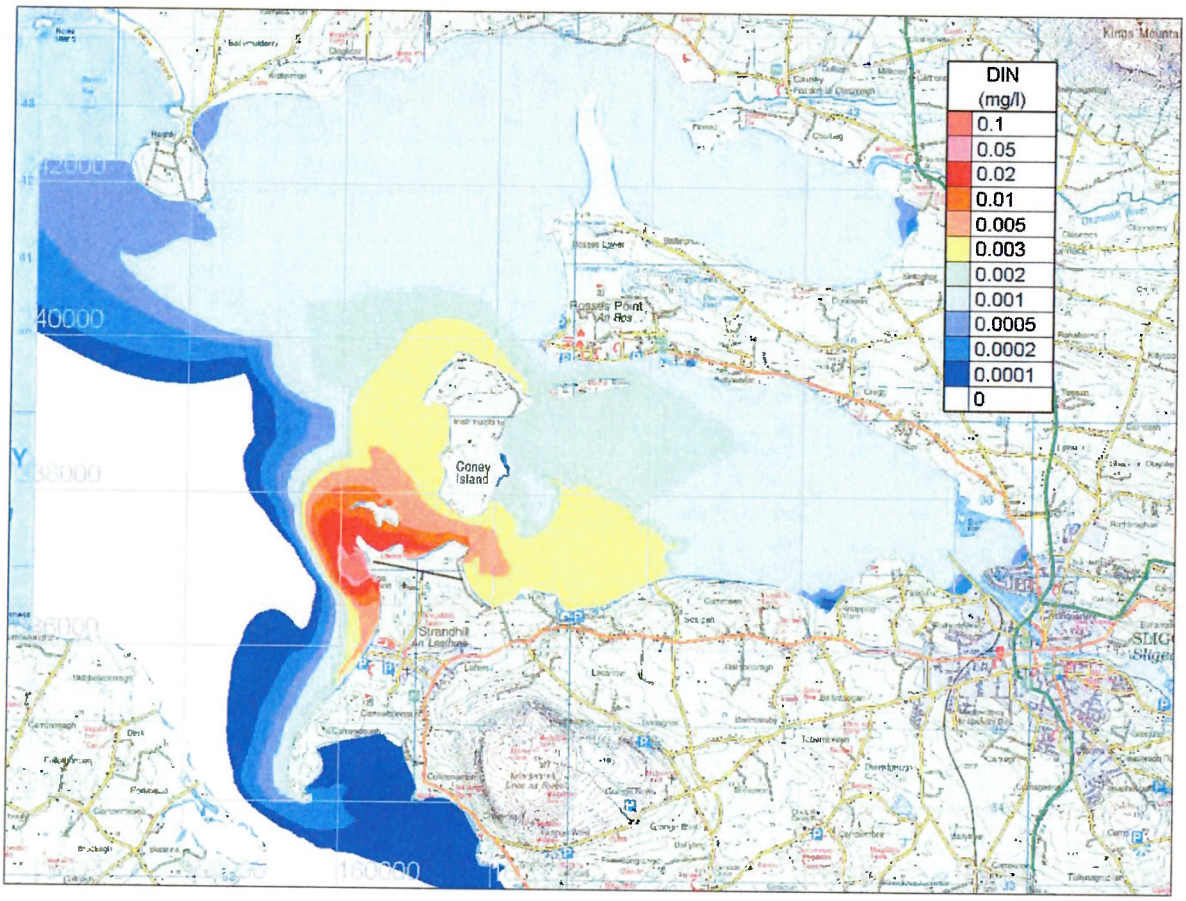


Figure 4.12: Maximum DIN concentrations for outfall option 1 and treated effluent of 40mg/l DIN as N

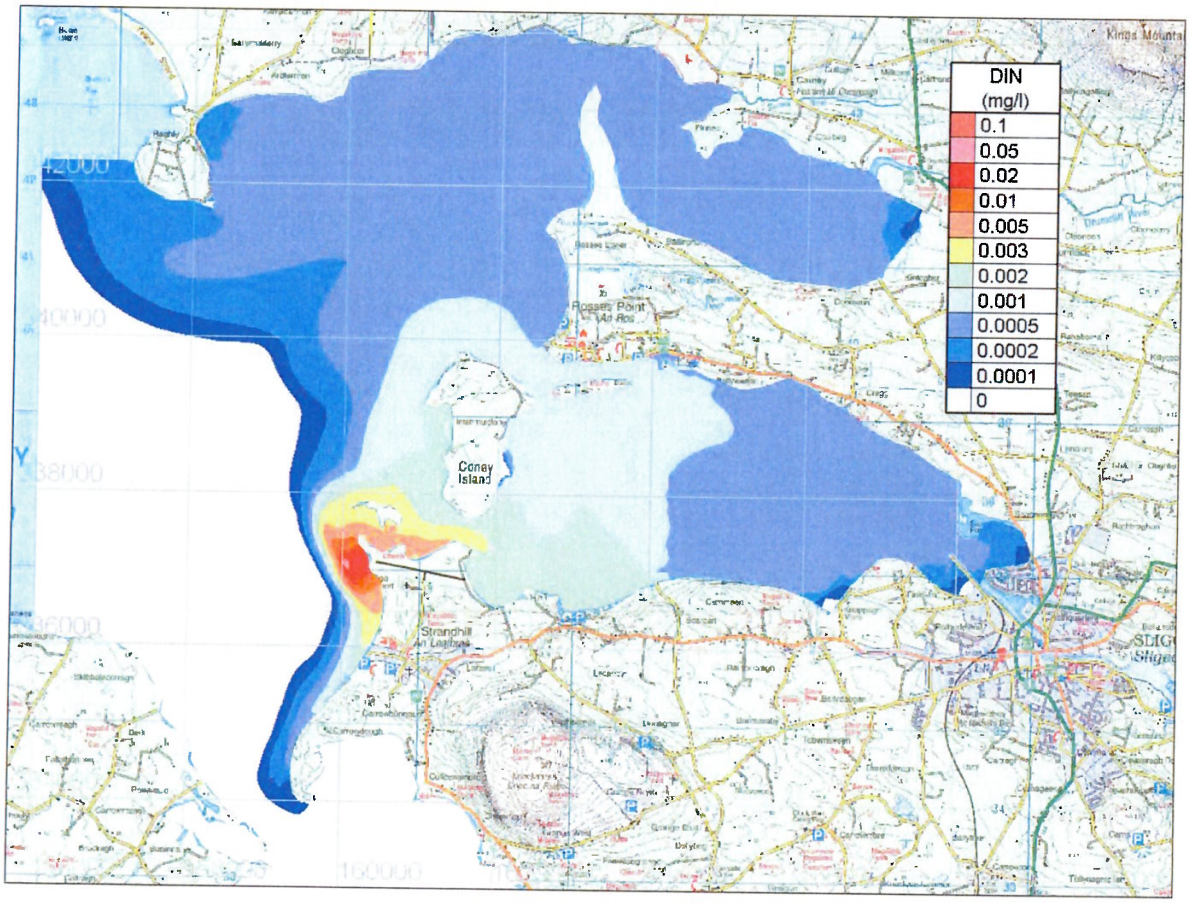


Figure 4.13: Tidal averaged DIN concentrations for outfall option 1 and treated effluent of 40mg /l DIN as N