

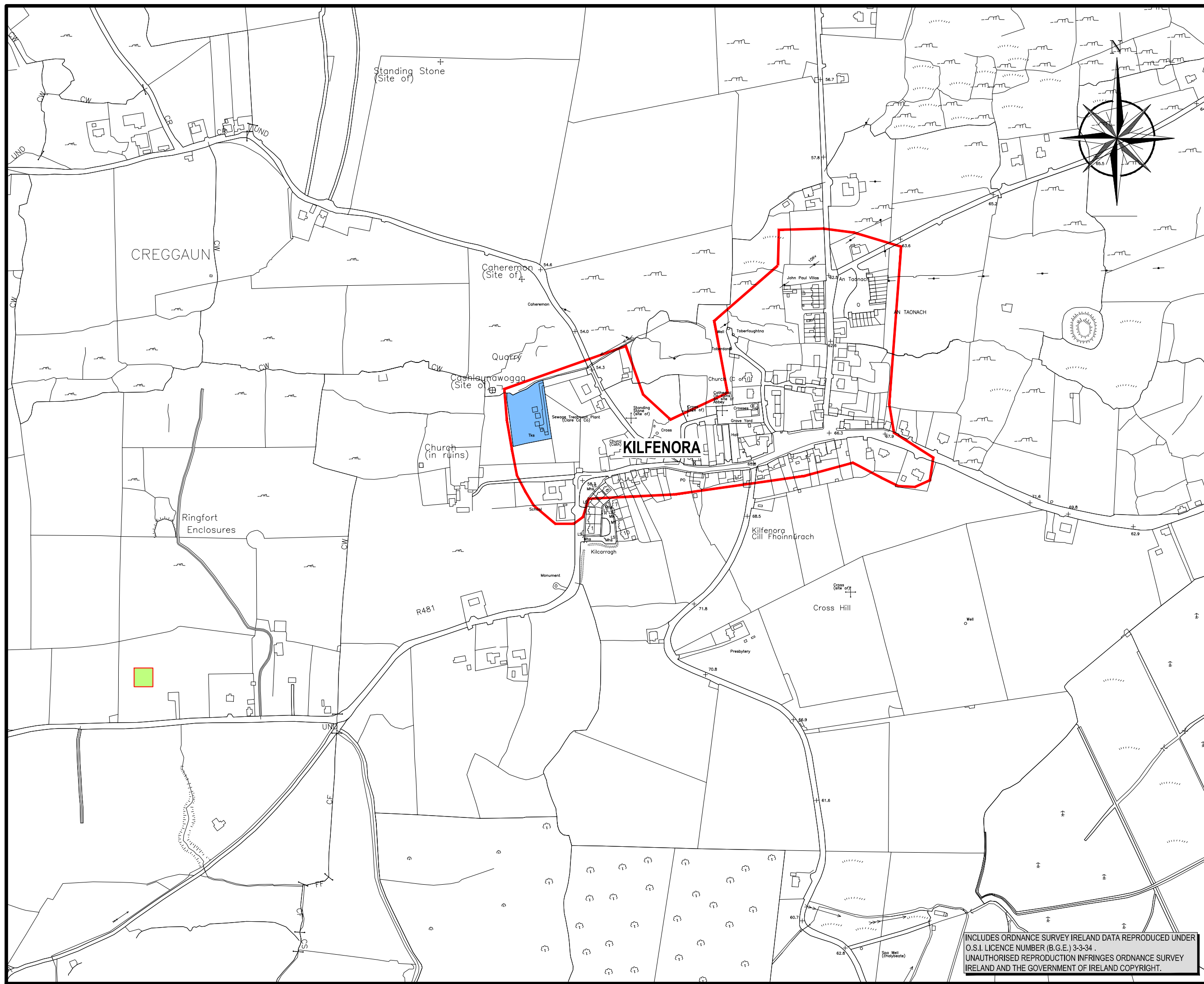
## **SECTION B – GENERAL**

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**Attachment B1: Agglomeration Plan (Drawing No.1)**

### LEGEND

- AGGLOMERATION BOUNDARY
- EXISTING WASTEWATER TREATMENT PLANT
- PROPOSED PERCOLATION AREA



SIGNED : \_\_\_\_\_

PRINT NAME : \_\_\_\_\_

POSITION : \_\_\_\_\_

DATE : \_\_\_\_\_

FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |

### CERTIFICATE OF AUTHORISATION

CLIENT  
**IRISH WATER**

PROJECT  
**KILFENORA  
WASTE WATER TREATMENT  
PLANT UPGRADE**

TITLE  
**AGGLOMERATION PLAN**

|                                     |                       |                          |
|-------------------------------------|-----------------------|--------------------------|
| SCALE<br>1:5000                     | DRAWN<br>J. McShane   | DATE<br>05.02.2018       |
| CAD REFERENCE<br>B.1 20624-DL-KA-01 | SECTION<br><b>B.1</b> | DRAWING No.<br><b>01</b> |
|                                     | REV<br><b>1</b>       |                          |

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## **SECTION B – GENERAL**

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**Attachment B2: WWTP Overall Site Plan & Site Boundary  
(Drawing No.2)**

**LEGEND**

- SITE BOUNDARY OF WWTP
- ✕ GW001 PROPOSED PRIMARY DISCHARGE POINT
- ✕ GW002 STORM WATER OVERFLOW

| POINT | EASTING | NORTHING |
|-------|---------|----------|
| GW001 | 117440  | 193593   |
| GW002 | 118018  | 194027   |

SIGNED: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

POSITION: \_\_\_\_\_

DATE: \_\_\_\_\_

FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |

**CERTIFICATE OF AUTHORISATION**

CLIENT  
**IRISH WATER**

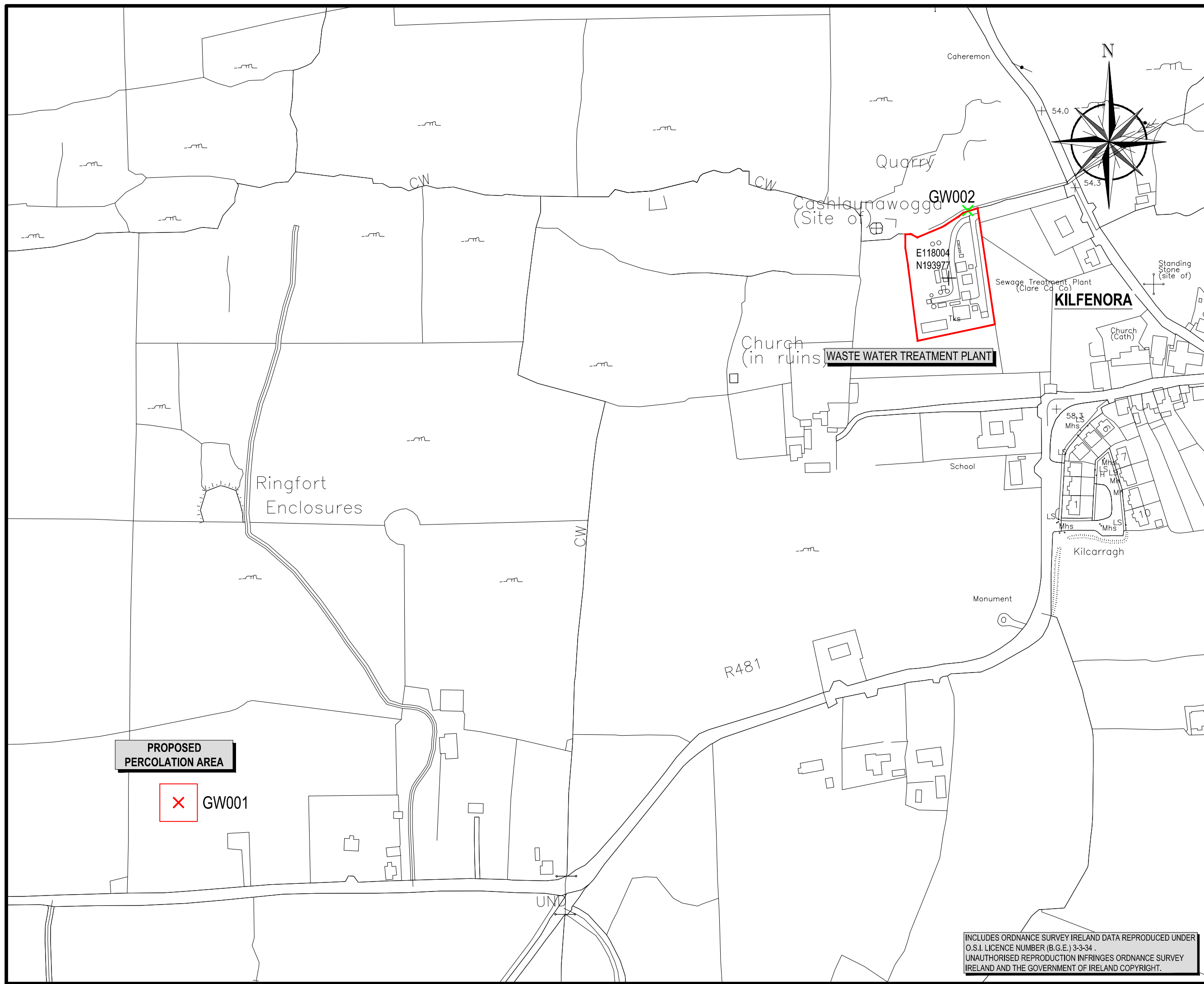
PROJECT  
**KILFENORA WASTE WATER TREATMENT PLANT UPGRADE**

TITLE  
**WWTP OVERALL SITE PLAN & SITE BOUNDARY**

|                                     |                     |
|-------------------------------------|---------------------|
| SCALES<br>1:2500                    | DRAWN<br>J. McShane |
| CAD REFERENCE<br>B.2 20624-DL-KA-02 | DATE<br>05.02.2018  |

|                       |                          |                 |
|-----------------------|--------------------------|-----------------|
| SECTION<br><b>B.2</b> | DRAWING No.<br><b>02</b> | REV<br><b>1</b> |
|-----------------------|--------------------------|-----------------|

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## **SECTION B – GENERAL**

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### **Attachment B3:**

- **Attachment B.3 (a): Primary Discharge Point location (Drawing No.3)**
- **Attachment B.3 (b): Monitoring & Sampling Points (Drawing No.4)**

### LEGEND

- SITE BOUNDARY OF WWTP
- INDICATIVE SITE LAYOUT
- EXISTING STRUCTURE TO BE RETAINED
- X PROPOSED PRIMARY DISCHARGE POINT  
GW001

| POINT | EASTING | NORTHING |
|-------|---------|----------|
| GW001 | 117440  | 193593   |

SIGNED: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

POSITION: \_\_\_\_\_

DATE: \_\_\_\_\_

FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |

#### CERTIFICATE OF AUTHORISATION

CLIENT  
**IRISH WATER**

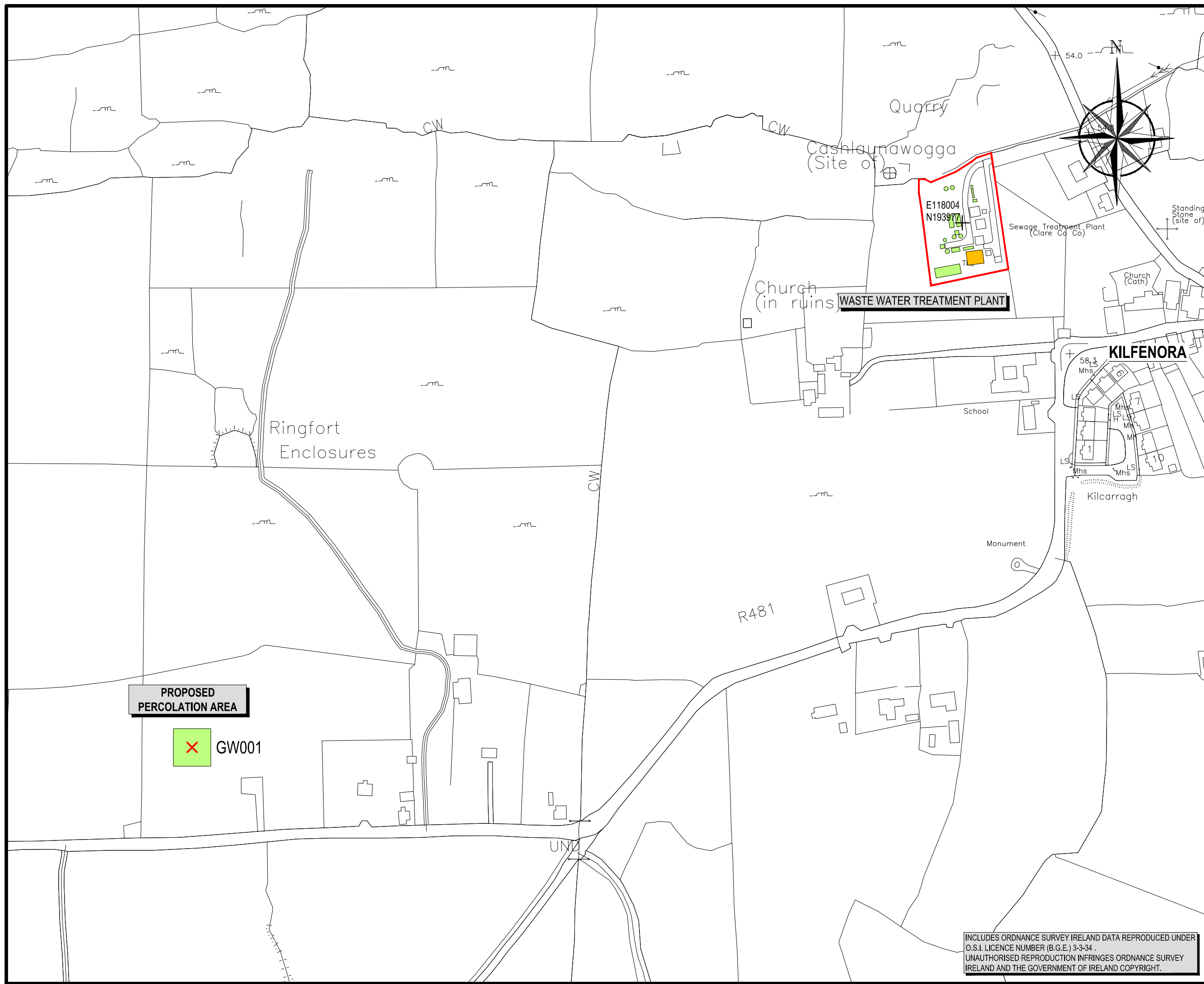
PROJECT  
**KILFENORA  
WASTE WATER TREATMENT  
PLANT UPGRADE**

TITLE  
**PRIMARY DISCHARGE POINT  
LOCATION**

|                                     |                     |
|-------------------------------------|---------------------|
| SCALES<br>1:2500                    | DRAWN<br>J. McShane |
| CAD REFERENCE<br>B.3 20624-DL-KA-03 | DATE<br>05.02.2018  |

|                       |                          |                 |
|-----------------------|--------------------------|-----------------|
| SECTION<br><b>B.3</b> | DRAWING No.<br><b>03</b> | REV<br><b>1</b> |
|-----------------------|--------------------------|-----------------|

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**LEGEND**

- SITE BOUNDARY OF WWTP
- + iGW001 PROPOSED WWTP SAMPLING POINT INLET
- + eGW001 PROPOSED WWTP SAMPLING POINT EFFLUENT
- X PROPOSED PRIMARY DISCHARGE POINT  
GW001

| POINT  | EASTING | NORTHING |
|--------|---------|----------|
| GW001  | 117440  | 193993   |
| iGW001 | 118004  | 193958   |
| eGW001 | 118013  | 193993   |

SIGNED: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

POSITION: \_\_\_\_\_

DATE: \_\_\_\_\_

FOR IRISH WATER

**CERTIFICATE OF AUTHORISATION**

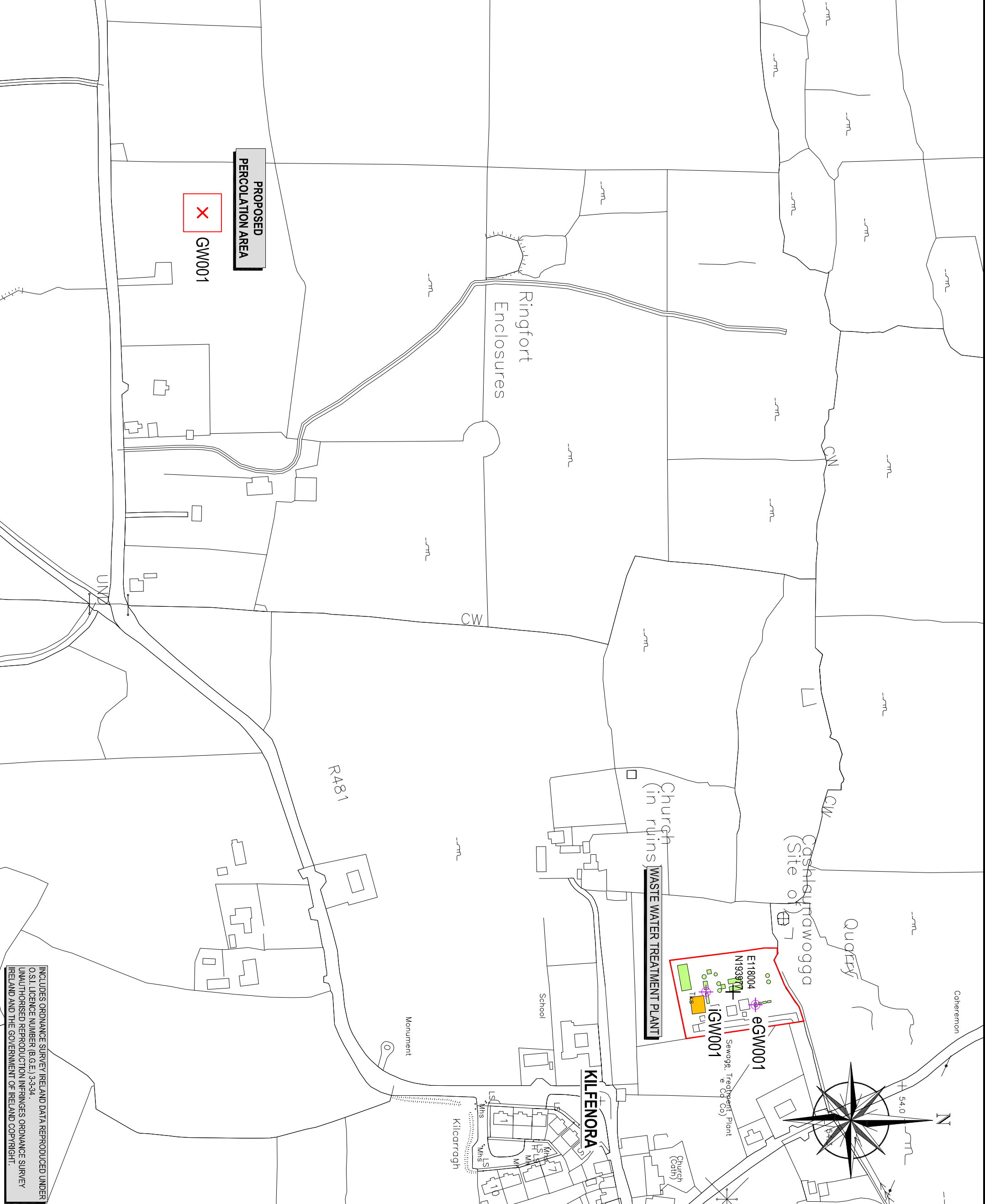
IRISH WATER

PROJECT: **KILFENORA WASTE WATER TREATMENT PLANT UPGRADE**

**MONITORING & SAMPLING POINTS**

|              |                   |             |            |
|--------------|-------------------|-------------|------------|
| SCALE        | 1:2500            | DRAWN       | J. McShane |
| DATE         | 14.03.2018        | SECTION     | B.3        |
| CD REFERENCE | B.3.20024.DL.A.04 | DRAWING No. | 04         |
|              |                   | REV         | 2          |

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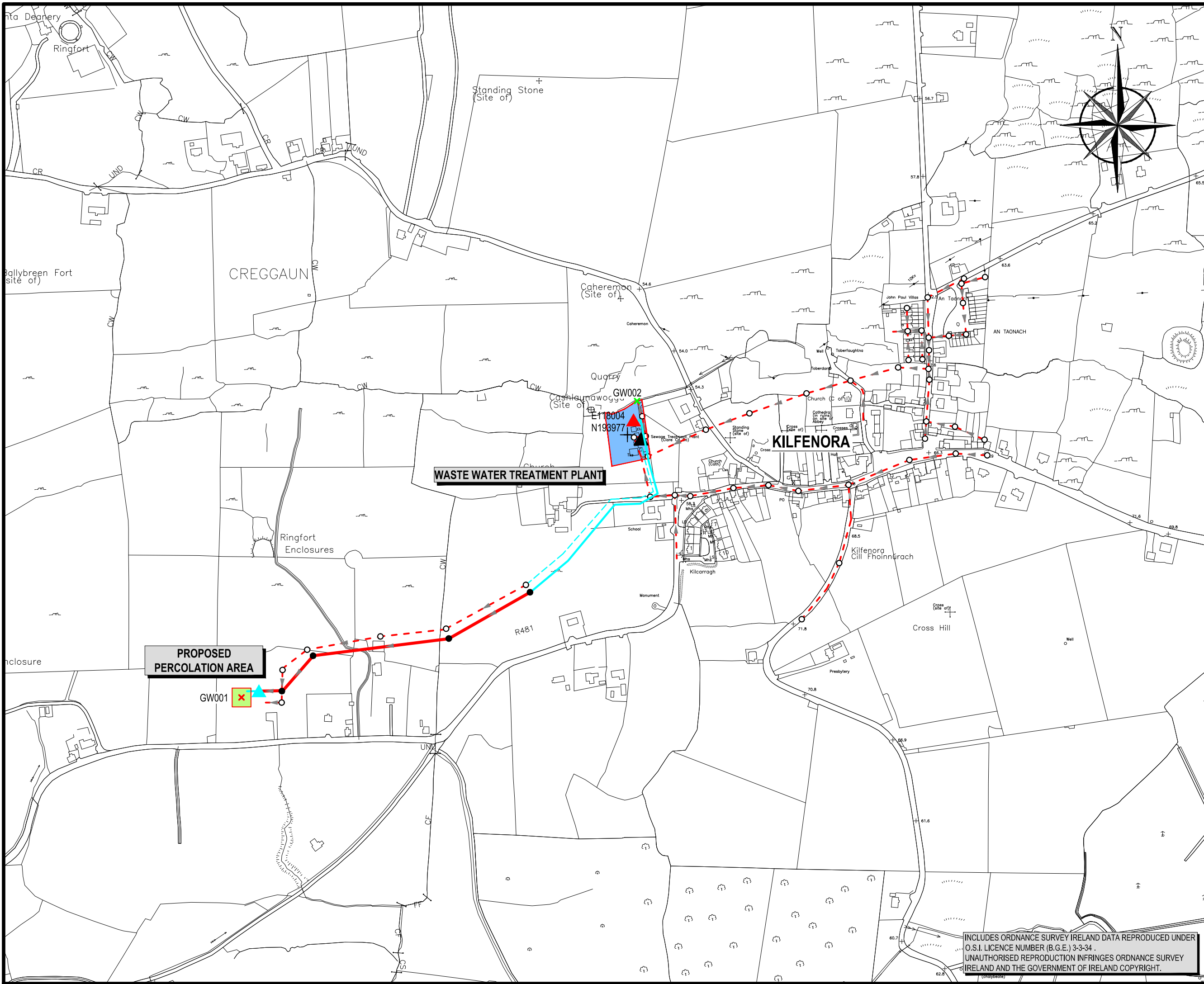
**PROPOSED PERCOLATION AREA**

X GW001

## **SECTION B – GENERAL**

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**Attachment B5: Location of Pumping Station & Stormwater  
Overflow Point (Drawing No.5)**



NOTES

**LEGEND**

- EXISTING WASTEWATER TREATMENT PLANT
- PROPOSED PERCOLATION AREA (LAYOUT & DIMENSIONS ARE INDICATIVE)
- SITE BOUNDARY OF WWTP
- EXISTING SEWER NETWORK
- EXISTING RISING MAIN
- PROPOSED RISING MAIN
- PROPOSED GRAVITY SEWER
- EXISTING PUMPING STATION
- PROPOSED PUMPING STATION AT WASTEWATER TREATMENT WORKS
- PROPOSED LIFT PUMPING STATION TO PERCOLATION AREA
- PROPOSED PRIMARY DISCHARGE POINT GW001
- STORM WATER DISCHARGE POINT GW002

| POINT | EASTING | NORTHING |
|-------|---------|----------|
| GW001 | 117440  | 193593   |
| GW002 | 118018  | 194027   |

| PUMPING STATION             | EASTING | NORTHING |
|-----------------------------|---------|----------|
| EXISTING                    | 118024  | 193971   |
| PROPOSED (PERCOLATION AREA) | 117466  | 193602   |
| PROPOSED (WWTP)             | 118013  | 193996   |

SIGNED: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

POSITION: \_\_\_\_\_

DATE: \_\_\_\_\_

FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |

**CERTIFICATE OF AUTHORISATION**

CLIENT  
**IRISH WATER**

PROJECT  
**KILFENORA WASTE WATER TREATMENT PLANT UPGRADE**

TITLE  
**LOCATION OF PUMPING STATION & STORM WATER OVERFLOW**

|                                     |                          |
|-------------------------------------|--------------------------|
| SCALES<br>1:5000                    | DRAWN<br>J. McShane      |
| CAD REFERENCE<br>B.5 20624-DL-KA-05 | DATE<br>05.02.2018       |
| SECTION<br><b>B.5</b>               | DRAWING No.<br><b>05</b> |
| REV<br><b>1</b>                     |                          |

INCLUDES ORDNANCE SURVEY IRELAND DATA REPRODUCED UNDER O.S.I. LICENCE NUMBER (B.G.E.) 3-3-34. UNAUTHORISED REPRODUCTION INFRINGES ORDNANCE SURVEY IRELAND AND THE GOVERNMENT OF IRELAND COPYRIGHT.

## **SECTION C – INFRASTRUCTURE AND OPERATION**

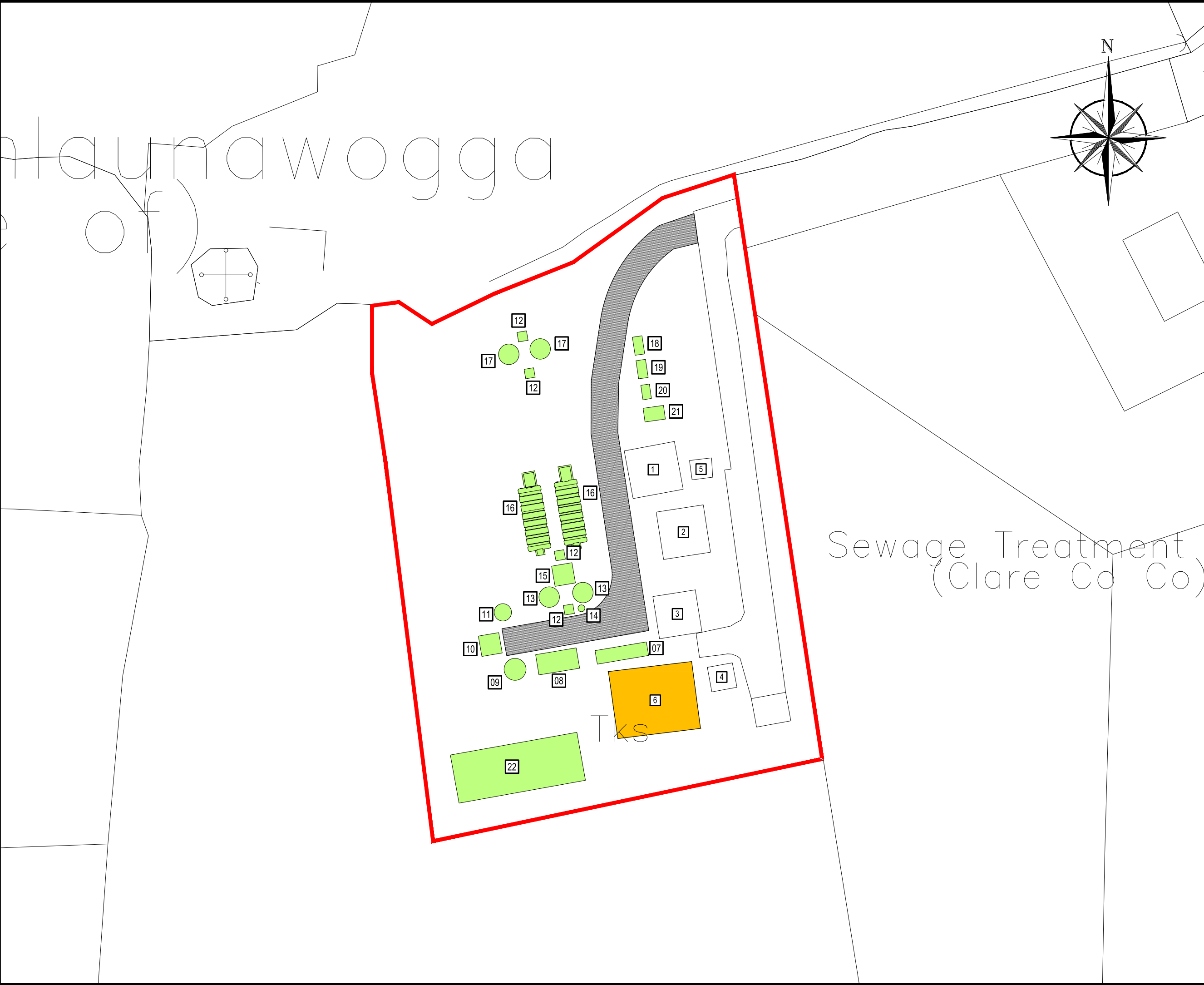
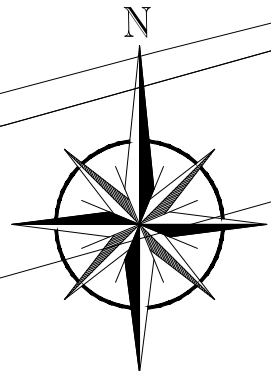
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### **Attachment C1: Operational Information Requirements**

- **Attachment C.1(a): WWTP Layout Plan (Drawing No.6)**
- **Attachment C.1(b): WWTP Layout Plan Proposed Percolation Area (Drawing No.7)**
- **Attachment C.1(c): Process Flow Diagram (Drawing No.8)**

### LEGEND

- SITE BOUNDARY OF WWTP
- INDICATIVE SITE LAYOUT
- EXISTING STRUCTURE TO BE RETAINED
- 1 EXISTING CLARIFIER TO BE DEMOLISHED
- 2 EXISTING AERATION TO BE DEMOLISHED
- 3 EXISTING SLUDGE DRYING BEDS TO BE DEMOLISHED
- 4 EXISTING BALANCE TANK AND INLET WORKS TO BE DEMOLISHED
- 5 EXISTING FINAL EFFLUENT PUMPING STATION TO BE DEMOLISHED
- 6 EXISTING STORM TANK TO BE RETAINED
- 07 PROPOSED INLET WORKS
- 08 PROPOSED CONTROL KIOSK
- 09 PROPOSED GRAVITY THICKENING TANK
- 10 PROPOSED CHEMICAL DOSING
- 11 PROPOSED SUPERNATANT P.S.
- 12 PROPOSED FLOW DISTRIBUTION CHAMBER
- 13 PROPOSED PRIMARY SETTLEMENT TANK
- 14 PROPOSED PRIMARY SLUDGE PUMP STATION
- 15 PROPOSED ANOXIC TANK
- 16 PROPOSED ROTATING BIOLOGICAL CONTACTOR
- 17 PROPOSED FINAL SETTLEMENT TANK
- 18 PROPOSED TERTIARY FILTER
- 19 PROPOSED UV DISINFECTION
- 20 PROPOSED FLOWMETER CHAMBER
- 21 PROPOSED FINAL EFFLUENT PUMP STATION
- 22 PROPOSED STORM TANK



Sewage Treatment  
(Clare Co Co)

SIGNED: \_\_\_\_\_

PRINT NAME: \_\_\_\_\_

POSITION: \_\_\_\_\_

DATE: \_\_\_\_\_

FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |

**CERTIFICATE OF AUTHORISATION**

CLIENT  
**IRISH WATER**

PROJECT  
**KILFENORA WASTE WATER TREATMENT PLANT UPGRADE**

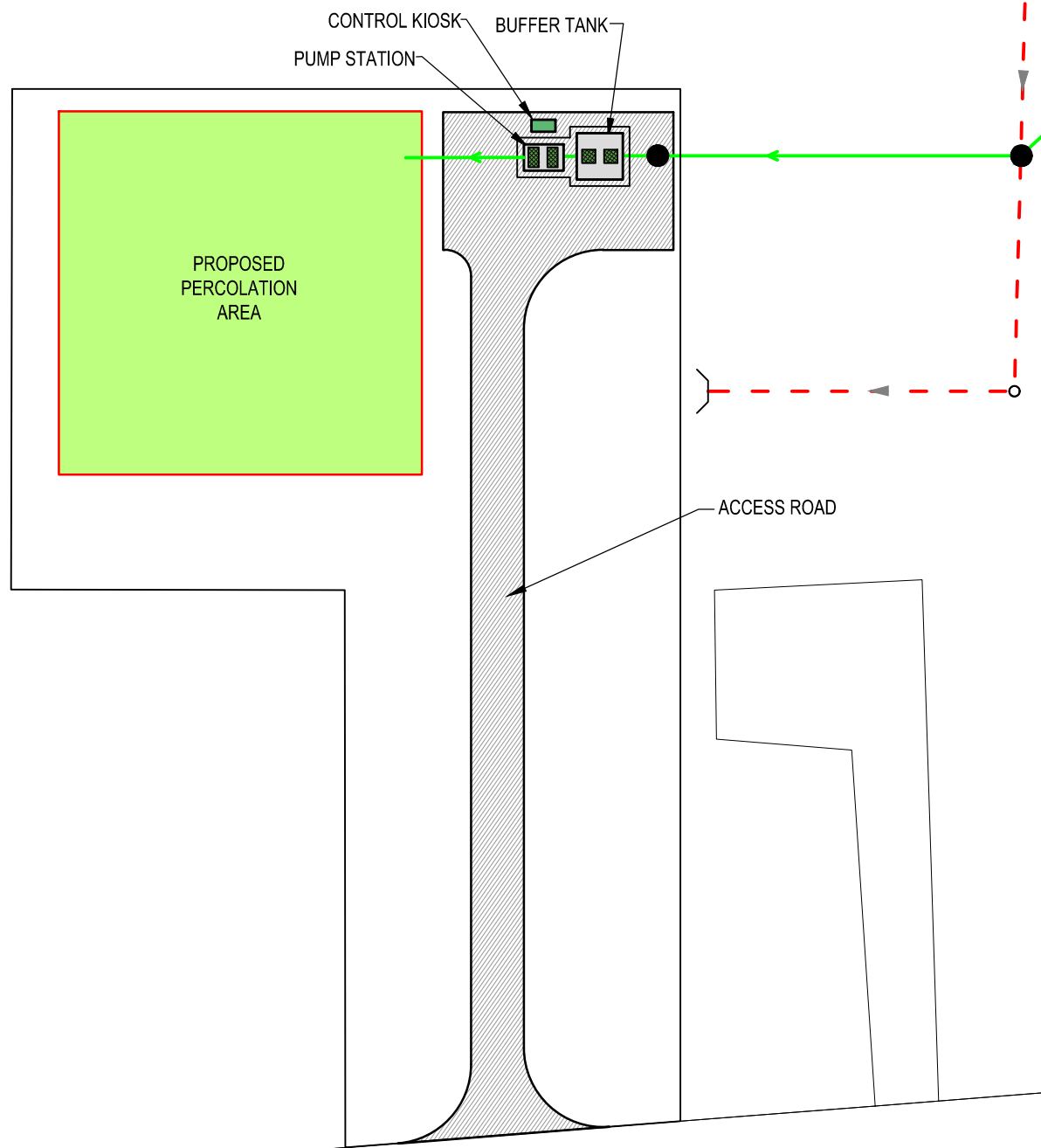
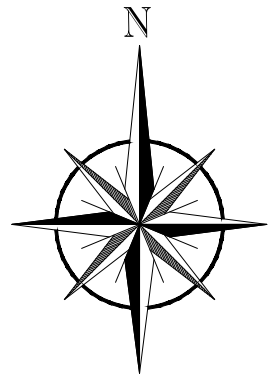
TITLE  
**WWTP LAYOUT PLAN**

|                                     |                       |                          |                 |
|-------------------------------------|-----------------------|--------------------------|-----------------|
| SCALES<br>1:500                     | DRAWN<br>J. McShane   | DATE<br>05.02.2018       |                 |
| CAD REFERENCE<br>C.1 20624-DL-KA-06 | SECTION<br><b>C.1</b> | DRAWING No.<br><b>06</b> | REV<br><b>1</b> |

LEGEND

INDICATIVE SITE LAYOUT

NOTE - PROPOSED PERCOLATION AREA  
FINAL DIMENSIONS TO BE CONFIRMED  
FOLLOWING COMPLETION OF DETAILED DESIGN.



SIGNED : \_\_\_\_\_  
 PRINT NAME : \_\_\_\_\_  
 POSITION : \_\_\_\_\_  
 DATE : \_\_\_\_\_  
 FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |

CERTIFICATE OF AUTHORISATION

CLIENT  
**IRISH WATER**

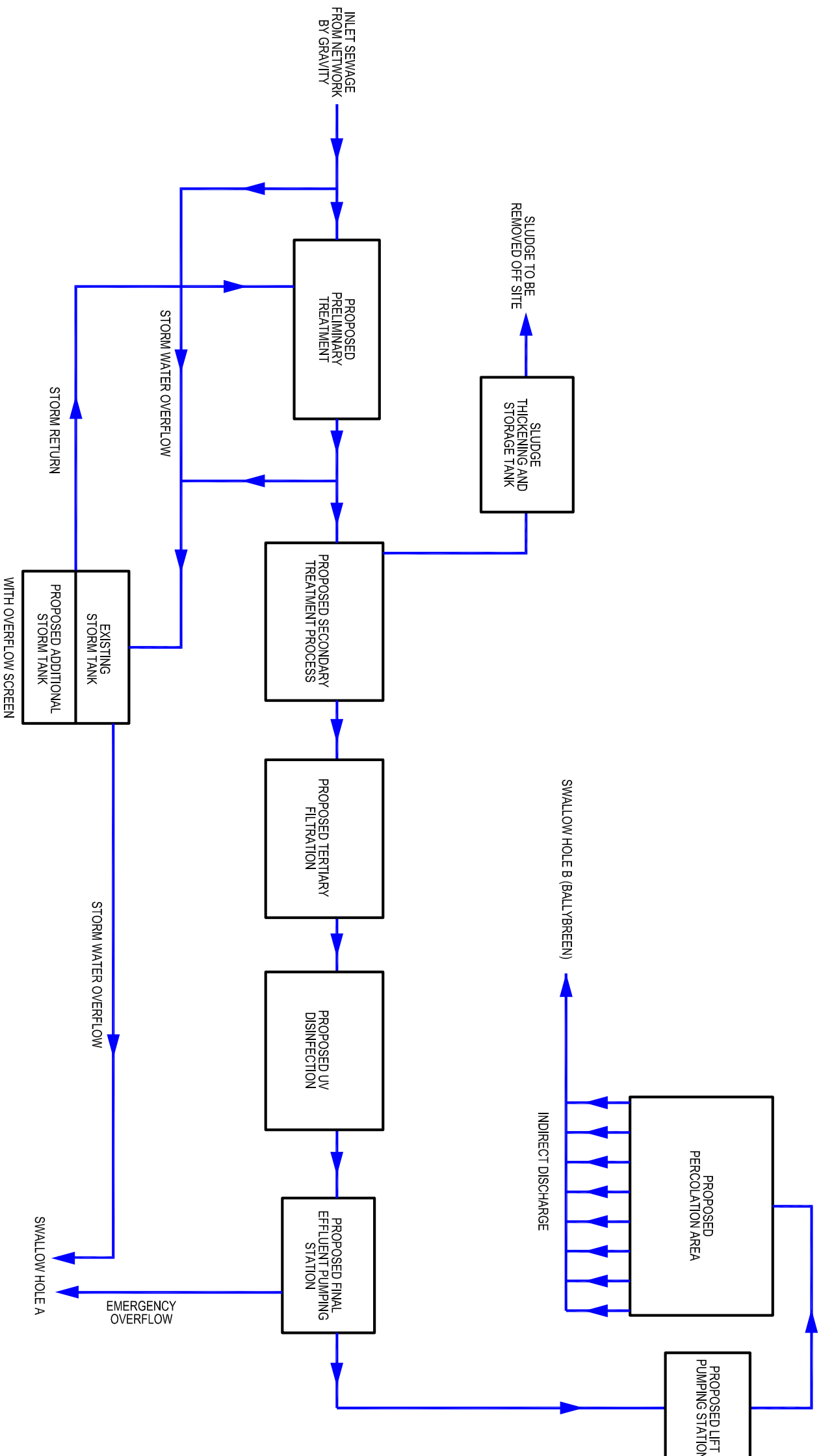
PROJECT  
**KILFENORA  
WASTE WATER TREATMENT  
PLANT UPGRADE**

TITLE  
**WWTP LAYOUT PLAN  
PROPOSED PERCOLATION AREA**

|                                     |                     |
|-------------------------------------|---------------------|
| SCALES<br>1:500                     | DRAWN<br>J. McShane |
| CAD REFERENCE<br>C.1 20624-DL-KA-06 | DATE<br>05.02.2018  |

|                       |                          |                 |
|-----------------------|--------------------------|-----------------|
| SECTION<br><b>C.1</b> | DRAWING No.<br><b>07</b> | REV<br><b>1</b> |
|-----------------------|--------------------------|-----------------|

R481



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 POSITION : \_\_\_\_\_  
 DATE : \_\_\_\_\_

FOR IRISH WATER

| REV | DATE | DESCRIPTION | D | C | A |
|-----|------|-------------|---|---|---|
|     |      |             |   |   |   |
|     |      |             |   |   |   |
|     |      |             |   |   |   |

**CERTIFICATE OF AUTHORISATION**

CLIENT  
**IRISH WATER**

PROJECT  
**KILFENORA  
 WASTE WATER TREATMENT  
 PLANT UPGRADE**

**PROCESS FLOW DIAGRAM**

|               |                   |            |         |             |     |
|---------------|-------------------|------------|---------|-------------|-----|
| SCALES        | DRAWN             | DATE       | SECTION | DRAWING No. | REV |
| N.T.S.        | J. McShane        | 14.03.2018 | C.1     | 08          | 2   |
| CAO REFERENCE | C.1 20694-DL44-07 |            |         |             |     |

## **SECTION D – DISCHARGES TO THE AQUATIC ENVIRONMENT**

---

### **Attachment D1: Discharges to Surface Waters**

- **Table D.1(i)(a): Emissions to Surface/Ground Waters (Primary Discharge Point)**
- **Table D.1(i)(b): Emissions to Surface/Ground Waters – Characteristics of the Emission (Primary Discharge Point)**

**WWD Certificate Application Annex I**

**Table D.1(i)(a): EMISSIONS TO SURFACE/GROUND WATERS (Primary Discharge Point)**

|   |        |                          |        |        |          |
|---|--------|--------------------------|--------|--------|----------|
| <b>Volume emitted m<sup>3</sup> (i)</b> |        |                          |        |        |          |
| Normal/day                              | 61.88  | Maximum/day              | 197.10 |        |          |
| Maximum rate/hour                       | 8.21   |                          | min/hr | hr/day | day/year |
| Dry Weather Flow/sec                    | 0.0007 | Period of emission (avg) | 60.00  | 24.00  | 365.00   |

|                 |     |
|-----------------|-----|
| Current 2018 PE | 275 |
| Future 2024 PE  | 292 |

**Table D.1(i)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of The Emission (Primary Discharge Point)**

|    |                                   |               |               |
|----|-----------------------------------|---------------|---------------|
| 1  | pH                                | NT            |               |
| 2  | Temperature                       | NT            |               |
| 3  | Electrical Conductivity (@ 25 'C) | NT            |               |
|    | <b>Max. daily average per day</b> | <b>(mg/l)</b> | <b>kg/day</b> |
| 4  | Suspended Solids                  | 19            | 1.176         |
| 5  | Ammonia as (N)                    | NT            | NT            |
| 6  | Biochemical Oxygen Demand         | 19            | 1.176         |
| 7  | Chemical Oxygen Demand            | 64            | 3.960         |
| 8  | Total Nitrogen (as N)             | NT            | NT            |
| 9  | Nitrite (as N)                    | NT            | NT            |
| 10 | Nitrate (as N)                    | NT            | NT            |
| 11 | Total Phosphorus (as P)           | NT            | NT            |
| 12 | Orthophosphate (as P)             | NT            | NT            |
| 13 | Sulphate (SO4)                    | NT            |               |
|    |                                   | <b>(ug/l)</b> |               |
| 14 | Phenols                           | NT            |               |
|    | Normal Flow rate=                 | 61.88         |               |

The maximum daily average is determined based on the raw sampling data for the effluent which is included in Attachment E.4 of this application.

Note: Date Range 25/01/2017 - 28/11/2017

## **SECTION E – MONITORING**

---

### **Attachment E1: Wastewater Discharge Frequency & Quantities – Existing**

- **Table E.1(i): Waste Water Frequency and Quantity of Discharge Primary Discharge Points**
- **Table E.1(ii): Waste Water Frequency and Quantity of Discharge Stormwater Overflows**

**TABLE E.1(i): WASTE WATER FREQUENCY AND QUANTITY OF DISCHARGE – Primary Discharge Point**

**Existing**

| Identification code for discharge point | Frequency of discharge (days/annum) | Quantity of Waste Water Discharged (m <sup>3</sup> /annum) |
|---|-------------------------------------|--|
| GW001                                   | 365                                 | 22,584   |

**TABLE E.1(ii): WASTE WATER FREQUENCY AND QUANTITY OF DISCHARGE – Storm Water Overflows**

| Identification code for discharge point | Frequency of discharge (days/annum) | Quantity of Waste Water Discharged (m <sup>3</sup> /annum) | Complies with Definition of Storm Water Overflow |
|---|-------------------------------------|--|--|
| GW002                                   | Unknown                             | Unknown  | Yes  |

## **SECTION E – MONITORING**

---

### **Attachment E2: Laboratory Sampling & Analysis Methodology**

|                                       |                     |             |
|---------------------------------------|---------------------|-------------|
| Clare Co.Co. Environmental Laboratory | Author:MMcN.        |             |
| Test Methods Manual                   | Issued By: MMcN     |             |
| pH                                    | Issue Date: 2/04/09 |             |
| Method No. 1                          | Issue No: 1         | Page 1 of 3 |

## 1. METHOD PRINCIPLE

The pH is the negative logarithm of the hydrogen ion concentration of a solution and is thus a measure of whether the liquid is acid or alkaline. The basic principle of electrometric pH measurement is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.

## 2. SAMPLING AND SAMPLE PRESERVATION

Samples should be taken in accordance with the procedures set out in the *Laboratory Sampling Manual*.

Analyse samples within 2 hours after receiving to the lab.

## 3. SAFETY PRECAUTIONS

Good safety habits and laboratory techniques should be used throughout the procedure; these are outlined in the *Laboratory Safety Manual*. Consult the Material Safety Data Sheets for information specific to the reagents used.

## 4. INTERFERENCES

Greasy or oily samples may cause blockage of the electrode.

## 5. REAGENTS

|                             |   |
|-----------------------------|---|
| pH 4 Buffer:                | pH 4 @ 25°C ( Reagecon , Product No. 104025C)     |
| pH 7 Buffer:                | pH 7 @ 25°C ( Reagecon , Product No. 107025C)     |
| pH 10 Buffer:               | pH 10 @ 25°C ( Reagecon , Product No. 110025)     |
| Quality Control Solution    | pH 6.865 @ 25°C (Reagecon Buffer Standard 106881) |
| Electrode filling solution: | 3M KCL (Reagecon, Product No. ESS5)               |

## 6. APPARATUS

- WTW pH meter 330
- WTW pH electrode SenTix 41
- Water bath , thermostatically controlled at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$

## 7. PROCEDURE

### (a) Preparation of Quality Control Sample:

- This is bought in from Reagecon and is logged in the QC logbook where it gets a sequential number, this is written on the bottle.

|                                       |                      |             |
|---------------------------------------|----------------------|-------------|
| Clare Co.Co. Environmental laboratory | Issue Date: 02/04/09 | Issue No: 1 |
| pH                                    | Method No: 1         | Page 2 of 3 |

**(b) Calibration:**

- Switch meter on and wait until display test is finished.
- **The temperature of both the samples and the buffers should be  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$  to minimize temperature correction errors. If necessary samples are placed in a  $25^{\circ}\text{C}$  waterbath to ensure that the correct temperature is achieved prior to measurement.**
- Press **CAL**, immerse electrode in pH 7 Buffer stirring sample in beaker to ensure homogeneity, press **RUN/ENTER**, AR flashes, wait until display shows C2.
- Rinse pH electrode with purified water, blot dry and immerse into the second buffer solution, pH 4. Press **RUN/ENTER**. Wait until AR extinguishes. Slope of electrode is given. (Admissible range Slope = **-50 to -62 mv/pH**).
- Record the slope value in the instrument logbook and on worksheet.

**(c) Measurement:**

- The meter is ready for measurement. Rinse the pH electrode with purified water, blot dry and immerse into the first sample. Press pH/MV, AR then **RUN/ENTER**. When AR stops flashing take reading. Record reading in pH worksheet along with temperature of sample. Press **RUN/ENTER** between all samples.
- A quality control sample must be run with each batch of analysis. (Reagecon Buffer Standard  $6.865 @ 25^{\circ}\text{C}$ ) Record value of QC sample in worksheet and on QC chart and also record the temperature of QC sample.
- When measurement of samples is complete, rinse electrode in purified water, blot dry and store in 3 molar KCL solution.

**8. METHOD DETECTION LIMIT/QUALITY CONTROL**

The method has no quantifiable detection limit however pH values of  $<2$  and  $>12$  units cannot be relied due to the nature of the sample matrix/electrode response.

The Quality Control Limits are shown below:

| Quality Control Target | Lower Control Limit (LCL) | Lower Warning limit (LWL) | Upper Warning limit (UWL) | Upper Control Limit (UCL) |
|------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| 6.88                   | 6.81                      | 6.84                      | 6.92                      | 6.95                      |

**9. EXPRESSION OF RESULTS**

Report pH values to the nearest 0.1 pH unit, except the QC sample which must be reported to 2 decimal places.

|  |                             |                    |
|--|-----------------------------|--------------------|
| <b>Clare Co.Co. Environmental laboratory</b> | <b>Issue Date: 02/04/09</b> | <b>Issue No: 1</b> |
| <b>pH</b>                                    | <b>Method No: 1</b>         | <b>Page 3 of 3</b> |

## 10. REFERERENCES

- *Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> edition, 2005*
- *Clare Co .Co. Laboratory Sampling Manual*
- *Clare Co .Co. Laboratory Safety Manual*
- *Clare Co.Co. Quality Manual*
- *NS 30 A Manual for Analytical Quality Control for the Water Industry, Water Research Centre 1987*

|  |                            |             |
|--|----------------------------|-------------|
| Clare Co.Co. Environmental Laboratory                              | Author: M.M <sup>c</sup> N |             |
| Test Method Manual   | Issued By: MMcN            |             |
| Chemical Oxygen Demand. High Range ( 20-1500 mg/L O <sub>2</sub> ) | Issue Date: 17/02/09       |             |
| Low Range (10- 150 mg/l O <sub>2</sub> )                           |                            |             |
| Method No. 2   | Issue No:1                 | Page 1 of 4 |

## 1. METHOD PRINCIPLE

The mg/L COD results are defined as the mg of O<sub>2</sub> consumed per litre of sample under conditions of this procedure. In this procedure the sample is heated for 2hrs with a strong oxidising reagent, potassium dichromate. Oxidisable organic compounds react, reducing the dichromate ion to green chromic ion ( Cr<sup>3+</sup>). When the 10-150 mg/L method is used the amount of Cr<sup>6+</sup> remaining is determined. When the 20-1500 mg/L is used the amount of Cr<sup>3+</sup> produced is determined. The COD reagent also contains silver and mercury ions. Silver is a catalyst and mercury is used to complex chloride interference's.

## 2. SAMPLING AND SAMPLE PRESERVATION

Samples should be taken in accordance with the procedures set out in the *Laboratory Sampling Manual*.

Analyse samples as soon as possible after receipt to the lab, otherwise refrigerate and analyse within 48 hours. If this cannot be achieved preserve samples by acidification to pH < 2 with H<sub>2</sub>SO<sub>4</sub> (2mls per litre), refrigerate and analyse within 28 days.

## 3. SAFETY PRECAUTIONS

Good safety habits and laboratory techniques should be used throughout the procedure; these are outlined in the *Laboratory Safety Manual*.

Vials contain sulphuric acid (86%), potassium dichromate silver and mercury. Consult Material Safety Data Sheet for information specific to the reagents used.

Wear appropriate skin and eye protection.

Vials are heated to 150<sup>0</sup>C so vials and digestion rack is very hot, take suitable precautions.

## 4. WASTE DISPOSAL

Final samples contain mercury, silver and chromium at concentrations which are hazardous so all COD vials must be disposed of by sending to Shannon Environmental Services. The used vials are stored in the used delivery containers marked "waste" pending collection.

## 5 INTERFERENCES

Chloride is the primary interference when determining COD concentration. Each COD vial contains mercuric sulphate which will eliminate chloride interference up to 2000 mg/L in the sample, if the sample contains greater than this it must be diluted.

|  |             |                     |
|--|-------------|---------------------|
| Clare Co. Council Environmental Laboratory | Method No.2 | Page 2 of 4         |
| COD (High /Low Range) Test                 | Issue No. 1 | Issue Date 17/02/09 |

## 6 REAGENTS

- COD Digestion Reagent Vials, 0 – 150 mg/L ( Hach Cat No. 21259-51)
- COD Digestion Reagent Vials, 0 – 1500mg/L ( Hach Cat No. 21258-51)
- **Stock Quality Control (High Range Test), Potassium Hydrogen Phthalate (500 mg/L O<sub>2</sub>) (BDH Analar 102075K ):**  
Dry Potassium Hydrogen Phthalate for 1 hour at 103 °C. Dissolve 0.425g in purified water and dilute to 1 litre. Record details in the QC logbook and assign a QC number to the solution. This solution is stable when refrigerated for up to three months in the absence of visible biological growth.
- **Stock Quality Control (Low Range Test) Potassium Hydrogen Phthalate (100mg/L O<sub>2</sub>):**  
Measure 200mls of the 500mg/l Stock Quality Control solution into a 1 litre volumetric flask and make up to the mark with purified water. Record details in the QC logbook and assign a number. This solution is also stable for three months if kept refrigerated.

## 7 APPARATUS

- Hach COD Reactor,
- Hach DR4000 Spectrophotometer

## 8 PROCEDURE

### (1) Sample preparation:

- Turn on the COD reactor and allow to heat to 150<sup>0</sup>C. When hot check thermometer in heating block and record temperature in the instrument log book.
- Choose COD vials to be used i.e. 0-150 and/or 0-1500 mg/L, put sample numbers on vials.
- Shake sample bottle vigorously to mix.
- Carefully remove the cap from vial and slowly pipette 2 mls of mixed sample into the vial. To avoid splashing pipette 2mls of diluted sample if dilutions are required. Put on the cap and mix by gentle inversion a few times.
- A blank of purified water and a Quality Control sample must be run with each test. If doing a high range test use the 500mg/L Quality Control Solution; if doing the low range test use the 100mg/L Quality Control solution.
- Place the vials in the COD reactor and set timer for 2 hours.
- Following 2 hours digestion, the reactor switches off automatically, wait approx. 20 minutes before removing the vials from the reactor. Carefully remove the vials, invert a few times and place on metal rack for cooling. Allow to cool to room temperature and measure.

### (2) Sample measurement:

- Switch on the spectrophotometer and press the soft key under HACH PROGRAM. Select the stored programme number, **2710 for low range test, 2720 for high range test**

|   |                    |                            |
|---|--------------------|----------------------------|
| <b>Clare Co. Council Environmental Laboratory</b> | <b>Method No.2</b> | <b>Page 3 of 4</b>         |
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- Press {ENTER}. The wavelength is automatically selected.
- Insert the test tube adapter into the sample cell module by sliding it under the thumbscrew and into the alignment grooves. Fasten with the thumbscrew.
- Clean the outside of the blank with a soft tissue.
- Place the blank into the adapter with the Hach logo facing the front of the instrument. Close the light shield.
- Press the soft key under ZERO, the display will show: 0 mg/L COD.
- Clean the outside of the sample vial with a soft tissue. Place the vial in the adapter with the Hach logo facing the front of the instrument. Close the light shield. Results in mg/L COD will be displayed. Record results on the COD worksheet and record QC on worksheet and on relevant QC chart.

## 9 METHOD DETECTION LIMIT ( M.D.L.) & QUALITY CONTROL

Low Range Test.

| <b>Method Detection limit.</b>   | <b>Quality Control Low Range test</b> | <b>Lower Control Limit</b>      | <b>Lower Warning limit</b>      | <b>Upper Warning limit</b>      | <b>Upper Control Limit</b>      |
|----------------------------------|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <b>M.D.L. mg/L O<sub>2</sub></b> | <b>mg/L O<sub>2</sub></b>             | <b>(LCL) mg/L O<sub>2</sub></b> | <b>(LWL) mg/L O<sub>2</sub></b> | <b>(UWL) mg/L O<sub>2</sub></b> | <b>(UCL) mg/L O<sub>2</sub></b> |
| <b>10</b>                        | <b>100</b>                            | <b>85</b>                       | <b>90</b>                       | <b>110</b>                      | <b>115</b>                      |

High Range Test:

| <b>Method Detection limit.</b>   | <b>Quality Control High Range test</b> | <b>Lower Control Limit</b>      | <b>Lower Warning limit</b>      | <b>Upper Warning limit</b>      | <b>Upper Control Limit</b>      |
|----------------------------------|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <b>M.D.L. Mg/L O<sub>2</sub></b> | <b>mg/L O<sub>2</sub></b>              | <b>(LCL) mg/L O<sub>2</sub></b> | <b>(LWL) mg/L O<sub>2</sub></b> | <b>(UWL) mg/L O<sub>2</sub></b> | <b>(UCL) mg/L O<sub>2</sub></b> |
| <b>20</b>                        | <b>500</b>                             | <b>460</b>                      | <b>475</b>                      | <b>525</b>                      | <b>540</b>                      |

## 10. EXPRESSION OF RESULTS

- Results are reported as mg/L O<sub>2</sub>. For the low range test results are reported to 1 decimal place, for the high range test results that are in the range 20 – 1000 are reported to two significant figures and results > 1000 mg/L O<sub>2</sub> are reported to three significant figures.

|   |                    |                            |
|---|--------------------|----------------------------|
| <b>Clare Co. Council Environmental Laboratory</b> | <b>Method No.2</b> | <b>Page 4 of 4</b>         |
| <b>COD (High /Low Range) Test</b>                 | <b>Issue No. 1</b> | <b>Issue Date 17/02/09</b> |

## **11. REFERENCES**

- *Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> edition.*
- *Clare Co .Co. Laboratory Sampling Manual*
- *Clare Co .Co. Laboratory Safety Manual*
- *Clare Co.Co. Quality Manual*
- *NS 30 A Manual for Analytical Quality Control for the Water Industry, Water Research Centre 1987*

|   |                      |             |
|---|----------------------|-------------|
| Clare Co.Council Environmental Laboratory | Author:MMcN          |             |
| <b>Test Method Manual</b>                 | Issued By: MMcN      |             |
| 5 day Biochemical Oxygen Demand Test      | Issue Date: 17/02/09 |             |
| Method No. 3                              | Issue No: 1          | Page 1 of 6 |

## 1. METHOD PRINCIPLE

The method consists of filling with diluted and seeded sample, to overflowing , an airtight bottle of specified size and incubating it at 20<sup>0</sup>C for 5 days. Dissolved oxygen is measured initially and after incubation and the BOD is computed from the difference between initial and final DO.

A factor which must be borne in mind in obtaining and assessing B.O.D. results is nitrification. This is the oxidation of ammonia to nitrate by nitrifying bacteria and if the process is occurring under test conditions high oxygen uptake values will be recorded. For normal river waters the onset of nitrification conditions does not occur within the 5 day period but in the case of wastewaters containing nitrifying organisms this phenomenon will take place much more promptly and unless nitrification is inhibited the result is an apparently very high B.O.D. level.

## 2. SAMPLING AND SAMPLE PRESERVATION

Samples should be taken in accordance with the procedures set out in the *Laboratory Sampling Manual*.

If analysis is begun within 2 hrs of collection cold storage is unnecessary if not, keep sample refrigerated before analysis. Analyse sample within 24h of collection. Warm chilled samples to 20<sup>0</sup>C ± 3<sup>0</sup>C .

## 3. SAFETY PRECAUTIONS

Good safety habits and laboratory techniques should be used throughout the procedure; these are outlined in the *Laboratory Safety Manual*.

## 4. INTERFERENCES

Samples containing caustic alkalinity or acidity must be neutralised to pH 6.5 to 7.5 with a solution of Sulphuric acid or Sodium hydroxide to pH 6.5 to 7.5 of such strength that the that the quantity of reagent does not dilute the sample by more than 0.5%.

## 5. REAGENTS

- **B.O.D. nutrient powder pillows** ( Hach Prod.Code:14861-98)
- **Quality Control Solution** : Glucose Glutamic Acid Standard Soln
- **Allythiourea (BDH analar,104622A)**
- **TCMP ?**
- **Seed ( diluted mixed liquor)**

|  |             |                     |
|--|-------------|---------------------|
| Clare Co. Council Environmental Laboratory | Method No.3 | Page 2 of 6         |
| BOD Test                                   | Issue No. 1 | Issue Date 17/02/09 |

## 6. APPARATUS

- Incubator @  $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$
- Incubation bottles, 250 to 300 mls capacity
- Water bath , thermostatically controlled at  $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$
- Dissolved Oxygen Meter

## 7. PROCEDURE

### (A) Preparation of Quality Control solution:

- Dry Glucose (BDH, Analar grade 10117Y) and reagent grade Glutamic acid (BDH Biochemical 371064E) at  $103^{\circ}\text{C}$  for 1 hr. Allow to cool in a dessicator.
- Dissolve 0.15g Glucose and 0.15g Glutamic acid distilled water and dilute to 1litre in a volumetric flask. Mix well. Prepare fresh immediately before use. Store all Glucose/Glutamic mixtures at  $4^{\circ}\text{C}$  or lower. Record in the QC log book and assign a QC number

### (B) Preparation of Reagents.

- **Source Water for Sample Dilution :** A quantity of distilled water is aerated overnight, on the day of the test 1 BOD nutrient powder pillow is added to 3 litres water.
- **Allythiourea** (Nitrification Inhibitor): This is used if analysing samples that require nitrification inhibition e.g. Wastewater Treatment Plant samples. Dissolve 0.2g of Allythiourea (BDH analar,104622A) in 150 mls purified water and make up to 200mls in a volumetric flask. This solution is stable for up to two weeks if kept refrigerated. Record preparation in the back QC logbook.
- **SEED**

### (C)Preparation of Blanks, Samples & Quality Control:

Samples both diluted and undiluted , dilution water blanks and Quality Control Samples should be treated in the same way. All samples must be brought to  $20^{\circ}\text{C} \pm 3^{\circ}\text{C}$  before D.O. measurement.

### Preparation of Dilution Water Quality Check Blanks:

- Two blanks must be run with each set of analysis, which contain nutrient, mineral and buffer solution but no seed or nitrification inhibitor , this serves as a check on quality of unseeded dilution water and cleanliness of incubation bottles. The DO uptake should should not exceed 0.2mg/L.
- for blank determination the prepared dilution water is treated as a sample. Place prepared dilution water into pre - labeled BOD bottles. Fill the BOD bottle to overflowing with sample. Remove any entrapped air bubbles by gently tapping the bottle.
- If using a nitrification inhibitor, add 1ml of Allythiourea solution per 500 mls sample, two ATU blanks must be prepared and treated in the same way as the samples.
- Place the BOD bottles in the water-bath until ready for D.O. measurement.

|  |             |                     |
|--|-------------|---------------------|
| Clare Co. Council Environmental Laboratory | Method No.3 | Page 3 of 6         |
| BOD Test                                   | Issue No. 1 | Issue Date 17/02/09 |

### Preparation of Quality Control Samples:

- At least two QC samples must be run with each set of analysis, this is prepared by diluting the Glucose/Glutamic Standard solution by 50 with the dilution water in a volumetric flask or graduated cylinder. Place prepared QC sample into pre - labeled BOD bottles. Fill the BOD bottle to overflowing with sample. Remove any entrapped air bubbles by gently tapping the bottle.
- If using a nitrification inhibitor, add 1ml of Allythioura solution per 500 mls QC sample.
- Place the BOD Bottle in the water- bath until ready for D.O. measurement.

### Preparation of Samples:

- Some samples may require dilution , if the BOD is expected to be greater than 7mg/l O<sub>2</sub> then the sample requires dilution . Make at least two dilutions of prepared sample estimated to produce a residual DO of at least 1.0 mg/L and a DO uptake of at least 2.0 mg/L.(Use dilution chart in Appendix 1 as reference).
  - Prepare dilution by adding desired amount of sample to a 500 mls Class A Graduated Cylinder ( For dilution greater than 1:100 make a primary dilution first.
  - Add X mls of seed and (nitrification inhibitor) solution per 500 mls diluted sample
  - Label BOD bottles with No. of sample, dilution and date.
- Shake vigorously and pour into BOD bottle (this is to ensure that sample is saturated with oxygen).
- Fill the BOD bottle to overflowing with sample. Remove any entrapped air bubbles by gently tapping the bottle.
  - Samples must be brought to 20<sup>0</sup>C in a water-bath before DO measurement, after preparing dilution measure initial DO within 30 min.

### **(D) Calibration of Dissolved Oxygen Meter.**

NEW SECTION

### **(E) Measurement of DO in Samples /Blanks and Quality Control Sample**

- Insert the funnel and stirrer into the BOD bottle to be measured, insert the electrode into the bottle. Ensure that there are no air bubbles trapped on the electrode head. Allow the DO reading to stabilise, the sample when fully saturated at 20<sup>0</sup>C should read between 8.8 to 9.2 mg/l. Record the DO<sub>1</sub> for the blanks, QC and samples on the worksheet. Rinse the probe between sample measurement.
- Put the glass top on the bottle, ensure that no air bubbles are trapped. Seal with parafilm to prevent evaporation. Place the BOD bottle in the incubator for 5 days.
- After 5 days remove the BOD bottle from the incubator and record the DO<sub>5</sub> remaining on the worksheet.
- Record samples with inhibition and without inhibition of separate worksheets. Samples with inhibitor added must be recorded as CBOD (Wastewater Treatment Plant Samples)

|   |                    |                            |
|---|--------------------|----------------------------|
| <b>Clare Co. Council Environmental Laboratory</b> | <b>Method No.3</b> | <b>Page 4 of 6</b>         |
| <b>BOD Test</b>                                   | <b>Issue No. 1</b> | <b>Issue Date 17/02/09</b> |

### 8. CALCULATIONS:

- The DO remaining in the bottle after 5 days should be greater than 2 mg/l and there should be a DO depletion of at least 2mg/l to accept results.
- If more than 1 sample dilution meets the above criteria average results in the acceptable range, this applies to the QC samples, blanks and diluted samples.
- The BOD of the blank should be < 1 mg/l O<sub>2</sub>, values of greater than this should be checked for possible sources of contamination. Protect water quality by using clean glassware, tubing and bottles.
- The calculations are done using an excel worksheet (BOD calculation worksheet) as follows:
  1. Always open the master worksheet blank to input data in the following filename/path:  
*T:\Environment\lab /lab/Excel Graphs Ammonia, BOD Calculations/BOD Calculations /Calculation Template.*
  2. Enter all sample values obtained for DO<sub>1</sub> and DO<sub>5</sub> and dilutions used. The calculations are automatically done. Remember not to accept results if there is < 2.0 mg/l O<sub>2</sub> left in the bottle or if there is an uptake of < 2mg/l O<sub>2</sub>. The results that are not acceptable will be highlighted. Results, which are highlighted, must be excluded from the final average value.
  3. Do not save onto this sheet. All data should be saved in Work in Progress file (WIP)/Year /Month of analysis/ and saved under test date and initials of analyst. Differentiate between the results for BOD & CBOD.
  4. Always open the master sheet. Never modify a previously used data sheet.
  5. Print the sheet and attach to the worksheet and place in results folder. Initial hand written raw data and computer print out.
  6. The calculation used in the excel sheet is as follows:

|  |  |
|--|--|
| <b>Undiluted Samples:</b>  | <b>Diluted Samples:</b>  |
| <b><u>DO<sub>1</sub> – DO<sub>5</sub> = BOD mg/l O<sub>2</sub></u></b>                                 | <b><math>F \times \{ ( DO_1 - DO_5 ) \} - \{ (F-1)/F \times ( B_1 - B_5 ) \} = BOD \text{ mg/L } O_2.</math></b>   |
| <i>DO<sub>1</sub> = Initial DO of sample<br/>DO<sub>5</sub> = DO of sample after 5 days incubation</i> | <i>F = Dilution Factor, DO<sub>1</sub> = Initial DO of diluted sample<br/>DO<sub>5</sub> = DO of diluted sample after 5 days incubation<br/>B<sub>1</sub> = Initial DO of blank, B<sub>5</sub> = DO of blank after 5 day incubation.</i> |

### 9. METHOD DETECTION LIMIT (M.D.L.) & QUALITY CONTROL

| <b>Method Detection limit.</b>   | <b>Quality Control</b> | <b>Lower Control Limit</b>      | <b>Lower Warning limit</b>      | <b>Upper Warning limit</b>      | <b>Upper Control Limit</b>      |
|----------------------------------|------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| <b>M.D.L. Mg/l O<sub>2</sub></b> |                        | <b>(LCL) mg/l O<sub>2</sub></b> | <b>(LWL) mg/l O<sub>2</sub></b> | <b>(UWL) mg/l O<sub>2</sub></b> | <b>(UCL) mg/l O<sub>2</sub></b> |
| <b>2</b>                         | <b>200</b>             | <b>150</b>                      | <b>165</b>                      | <b>235</b>                      | <b>250</b>                      |

|   |                    |                            |
|---|--------------------|----------------------------|
| <b>Clare Co. Council Environmental Laboratory</b> | <b>Method No.3</b> | <b>Page 5 of 6</b>         |
| <b>BOD Test</b>                                   | <b>Issue No. 1</b> | <b>Issue Date 17/02/09</b> |

## 10. EXPRESSION OF RESULTS

Results should be reported in accordance with the following table:

| <b>Concentration</b>          | <b>Method of Reporting</b>             | <b>Example</b>                |
|-------------------------------|--|-------------------------------|
| < 10 mg/l O <sub>2</sub>      | Report to nearest integer              | 8.3 measured report as 8      |
| 10 – 1000 mg/l O <sub>2</sub> | Report to 2 significant figures        | 106.3 measured report as 110  |
| > 1000 mg/l O <sub>2</sub>    | <u>Report to 3 significant figures</u> | 1244 measured, report as 1240 |

Note: If Nitrification is inhibited results should be reported as CBOD mg/l O<sub>2</sub> otherwise report as BODmg/l O<sub>2</sub>

## 11. REFERERENCES

- *Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition, 2005*  
APHA, AWWA, WEF
- *Clare Co .Co. Laboratory Sampling Manual*
- *Clare Co .Co. Laboratory Safety Manual*
- *Clare Co.Co. Quality Manual*

|  |             |                     |
|--|-------------|---------------------|
| Clare Co. Council Environmental Laboratory | Method No.3 | Page 6 of 6         |
| BOD Test                                   | Issue No. 1 | Issue Date 17/02/09 |

### Appendix 1 : Dilution Table

| Diln Factor | BOD Range    | Dilution 1       |                  | Dilution 2        |                 | Dilution 3         |                  |
|-------------|--------------|------------------|------------------|-------------------|-----------------|--------------------|------------------|
|             |              | Sample Vol (mls) | Make up to (mls) | Vol of Dil 1(mls) | Make up to(mls) | Vol of Dil 2 (mls) | Make up to (mls) |
| 1:2         | 4 – 14       | 200              | 400              |                   |                 |                    |                  |
| 1:3         | 6 – 21       | 150              | 450              |                   |                 |                    |                  |
| 1:4         | 8 – 28       | 100              | 400              |                   |                 |                    |                  |
| 1:5         | 10 – 35      | 80               | 400              |                   |                 |                    |                  |
| 1:10        | 20 – 70      | 40               | 400              |                   |                 |                    |                  |
| 1:15        | 30 – 100     | 30               | 450              |                   |                 |                    |                  |
| 1:20        | 40 – 140     | 20               | 400              |                   |                 |                    |                  |
| 1:30        | 60 – 200     | 15               | 450              |                   |                 |                    |                  |
| 1:40        | 80 – 280     | 10               | 400              |                   |                 |                    |                  |
| 1:50        | 100 – 350    | 10               | 500              |                   |                 |                    |                  |
| 1: 100      | 200 –700     | 10               | 100              | 40                | 400             |                    |                  |
| 1: 200      | 400 – 1400   | 10               | 100              | 20                | 400             |                    |                  |
| 1 :400      | 800 – 2800   | 10               | 100              | 10                | 400             |                    |                  |
| 1: 500      | 1000 – 3500  | 10               | 100              | 10                | 500             |                    |                  |
| 1 : 800     | 1600 – 5600  | 10               | 200              | 10                | 400             |                    |                  |
| 1 : 1000    | 2000 – 7000  | 10               | 500              | 20                | 400             |                    |                  |
| 1 : 2000    | 4000 – 14000 | 10               | 500              | 10                | 400             |                    |                  |
| 1 : 4000    | 8000 – 28000 | 25               | 500              | 10                | 500             | 100                | 400              |

#### NOTE:

- From dilutions 1:2 to 1:50 dilutions are made up in 500 mls graduated cylinder
- From dilutions 1:100 to 1:4000 a serial dilution is done where first dilution is made in volumetric flask and second dilution is made in graduated cylinder
- The table above is an aid to estimate the dilutions to use. As a general guideline use the following dilutions:  
1/100 to 1/20 for raw and settled wastewater and 1/5 for biologically treated effluent. If the biologically treated effluent is of bad quality use the dilutions that are generally used for raw wastewater.

|   |                       |            |
|---|-----------------------|------------|
| <b>10 Clare Co.Co. Environmental Laboratory</b> | Author: MMcN          |            |
| Test Methods Manual                             | Issued By: MMcN       |            |
| Total Suspended Solids                          | Issue Date : 17/02/09 |            |
| Method No. 4                                    | Page 1 of 3           | Issue No 1 |

## 1. METHOD PRINCIPLE

The procedure consists of filtering a well mixed sample through a weighed glass–fibre paper (grade GF/C with particle retention of 1.2µm) and the residue on the filter is dried at 103 to 105°C. The increase in the weight of the filter represents the total suspended solids.

## 2. SAMPLING AND SAMPLE PRESERVATION

Samples should be taken in accordance with the procedures set out in the *Laboratory Sampling Manual*.

Samples must be refrigerated to minimize microbiological decomposition of solids and analyzed within 7 days.

## 3. SAFETY PRECAUTIONS

Good safety habits and laboratory techniques should be used throughout the procedure; these are outlined in the *Laboratory Safety Manual*.

## 4. INTERFERENCES

Exclude large floating particles if it is determined that their inclusion is not representative. For samples high in dissolved solids e.g. chloride, thoroughly wash the filter to ensure removal of the dissolved material.

## 5. REAGENTS

**Kaolin Quality Control Sample (200mg/L):** Weigh 0.200g of Kaolin (Aldrich 22,883-4) dilute to 1litre in a volumetric flask with purified water. Mix well. Record in QC log book and assign number.

## 6. APPARATUS

- 1 litre Buchner flask
- **GF/C Whatman filter papers (90mm)**
- Oven for operation at 103 to 105 °C
- Analytical Balance
- Dessicator

|  |             |                     |
|--|-------------|---------------------|
| Clare Co. Council Environmental Laboratory | Method No.4 | Page 2 of 3         |
| Total Suspended Solids.                    | Issue No. 1 | Issue Date 17/02/09 |

## 7. PROCEDURE

### (a) Preparation of GF/C Filter Papers

- Insert numbered GF/C filter paper with wrinkled side up into filtration apparatus.
- Apply vacuum and wash filter paper with 3 successive 20 mls portions of purified water. Continue suction to remove all traces of water and discard washings.
- Remove filter and dry in an oven at 103 to 105<sup>0</sup>C for 1 hour.
- Cool in a dessicator to balance temperature and weigh, record of the worksheet. Store in dessicator until needed.
- A pre-weighed, numbered filter paper is required for each sample and QC sample.

### (b) Sample Analysis

- Prepare Quality Control Sample as above. At least one Quality Control sample must be run with each batch of samples. Use 250mls of Quality Control sample per determination.
- Place numbered pre-weighed filter paper on filter apparatus, wash with a small volume of purified water to seat it.
- Ensure sample is well mixed, pour a volume of the well-mixed sample onto the filter paper (the volume chosen depends on the concentration of solids in the sample e.g. up to 500 mls can be filtered for samples of low suspended solids content and less than 100 mls samples are used if there is a high suspended solids content).
- Wash with three successive 10 ml volume of purified water and allow complete drainage between washings. Samples with high dissolved solids may require additional washings. Continue suction for about 5 minutes after filtration is complete.
- Record the volume filtered on the worksheet.
- Carefully remove the filter from the apparatus place in the oven for 1 hour at 103 to 105<sup>0</sup>C.
- Remove from oven, cool in dessicator and weigh, record final weight on worksheet and do calculations below. Record value of QC sample on QC chart.

## 8. CALCULATIONS/RESULTS

- The Total Suspended Solids is calculated as follows:

$$\text{mg/L: Total Suspended Solids} = \frac{(A - B) \times 1,000,000}{\text{Sample Volume (ml)}}$$

*A: Weight of filter plus dried residue (g)*

*B: Weight of filter (g)*

- Report results as mg/L SS to three significant figures.

|   |                    |                            |
|---|--------------------|----------------------------|
| <b>Clare Co. Council Environmental Laboratory</b> | <b>Method No.4</b> | <b>Page 3 of 3</b>         |
| <b>Total Suspended Solids.</b>                    | <b>Issue No. 1</b> | <b>Issue Date 17/02/09</b> |

### 9. METHOD DETECTION LIMIT (M.D.L.)/ QUALITY CONTROL

| Method<br>Detection<br>limit.<br>M.D.L<br>mg/l SS | Quality<br>Control<br>Target<br>mg/l<br>SS | Lower<br>Control Limit<br>(LCL)<br>mg/l SS | Lower<br>Warning<br>limit<br>(LWL)<br>mg/l SS | Upper<br>Warning<br>limit<br>(UWL)<br>mg/l SS | Upper<br>Control<br>Limit<br>(UCL)<br>mg/l SS |
|---|--|--|---|---|---|
|   |  | 2  | 175   | 180   | 200   |
|   | 190  |  |   |   |   |

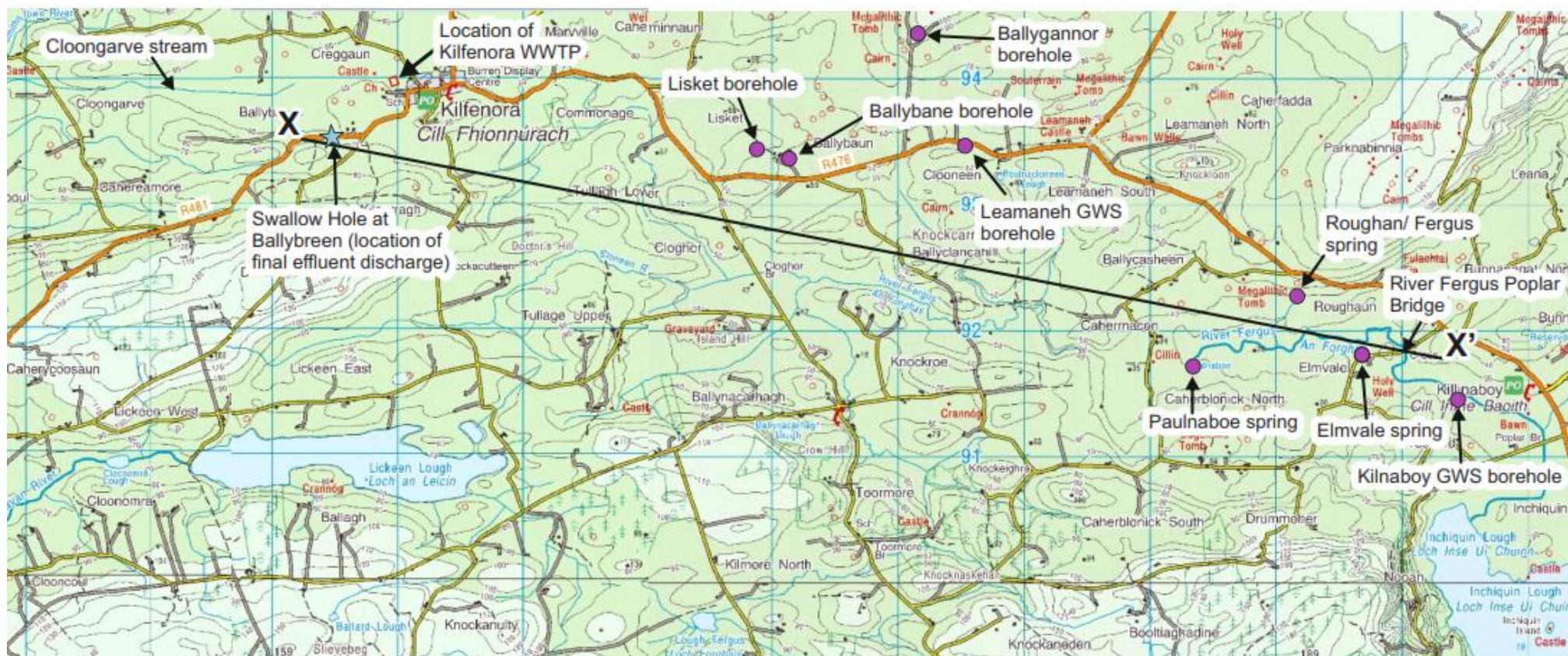
### 10. REFERENCES

- *Standard Methods for the Examination of Water and Wastewater, 21st edition.*
- *Clare Co .Co. Laboratory Sampling Manual*
- *Clare Co .Co. Laboratory Safety Manual*
- *Clare Co.Co. Quality Manual*
- *NS 30 A Manual for Analytical Quality Control for the Water Industry, Water Research Centre 1987*

## **SECTION E – MONITORING**

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### **Attachment E3: Tracer Studies of the Ballybreen Swallow Hole**



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Scale 1:25000

| Location of Former Tracer Sampling Sites & Line of Cross-Section (X - X') |                        |        |
|---|------------------------|--------|
| Kilfenora WWTP  | Tier 3 Risk Assessment |        |
| Geosyntec<br>consultants  | Irish Water            | Figure |
|   |                        | 1      |
| Dublin, Ireland   | July 2014              |        |

● Tracer sampling point selected and utilised by Mr D Drew in report for Clare County Council, 2012, entitled 'Water Trace from Ballybreen Swallowhole'.

## **SECTION E – MONITORING**

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- **Attachment E.4(a): Influent Sampling Data**
- **Attachment E.4(b): Effluent Sampling Data**
- **Attachment E.4(c): Downstream Surface Water Monitoring Data**
-

## Attachment E.4(a): Influent Sampling Data

| Sample Date | BOD, 5 days with Inhibition (mg/l) | COD Chemical Oxygen Demand (mg/l) | Suspended Solids (mg/l) | Flow m <sup>3</sup> /24hrs |
|-------------|------------------------------------|-----------------------------------|-------------------------|----------------------------|
| 27/01/2015  | 20                                 | 13                                | 18                      | 294                        |
| 18/03/2015  | 124                                | 164                               | 54                      |                            |
| 27/05/2015  | 114                                | 298                               | 115                     |                            |
| 25/06/2015  | 286                                | 469                               | 150                     |                            |
| 11/08/2015  | 62                                 | 142                               | 96                      |                            |
| 03/09/2015  | 48                                 | 174                               | 117                     |                            |
| 18/11/2015  | 30                                 | 122                               | 148                     |                            |
| 08/12/2015  | 12                                 | 125                               | 36                      |                            |
| 17/02/2016  | 21                                 | 59                                | 54                      |                            |
| 30/03/2016  | 15                                 | 61                                | 38                      |                            |
| 30/06/2016  | 34                                 | 62                                | 36                      |                            |
| 28/09/2016  | 114                                | 220                               | 107                     |                            |
| 1/12/2016   | 82                                 | 366                               | 25                      |                            |
| 25/01/2017  | 120                                | 208                               | 69                      |                            |
| 7/02/2017   | 7                                  | 38                                | 8                       | 381                        |
| 5/03/2017   | 39                                 | 218                               | 60                      |                            |
| 7/06/2017   | 81                                 | 164                               | 59                      | 202                        |
| 29/08/2017  | 54                                 | 149                               | 74                      |                            |
| 25/10/2017  | 76                                 | 187                               | 108                     |                            |
| 28/11/2017  | 22                                 | 59                                | 19                      | 343                        |
| <b>Min</b>  | 7                                  | 13                                | 8                       | 202                        |
| <b>Max</b>  | 286                                | 469                               | 150                     | 381                        |
| <b>Mean</b> | 68.05                              | 164.90                            | 69.55                   | 305.00                     |

## Attachment E.4(b): Effluent Sampling Data

| Sample Date      | BOD, 5 days with Inhibition (mg/l) | COD Chemical Oxygen Demand (mg/l) | pH   | Suspended Solids (mg/l) |
|------------------|------------------------------------|-----------------------------------|------|-------------------------|
| 27/01/2015       | 2                                  | 10                                | 8.15 | 4                       |
| 18/03/2015       | 3                                  | 15                                | 7.96 | <2                      |
| 27/05/2015       | 6                                  | 13                                | 6.66 | 2                       |
| 25/06/2015       | 7                                  | 33                                |      | 2                       |
| 12/08/2015       | 4                                  | 15                                |      | 2                       |
| 03/09/2015       | 2                                  | 16                                |      | 10                      |
| 18/11/2015       | 3                                  | 10                                |      | 5                       |
| 08/12/2015       | 2                                  | 10                                |      | 3                       |
| 17/02/2016       | 2                                  | <10                               | 7.4  | 2                       |
| 30/03/2016       | 2                                  | 14                                | 7.4  | 4                       |
| 30/06/2016       | 23                                 | 41                                | 7.4  | 8                       |
| 28/09/2016       | 33                                 | 82                                | 7.4  | 46                      |
| 16/11/2016       | 10                                 | 51                                | 7.4  | 5                       |
| 1/12/2016        | 3                                  | 20                                | 7.4  | <2                      |
| 25/01/2017       | 3                                  | <10                               |      | 9                       |
| 7/02/2017        | 2                                  | <10                               |      | 3                       |
| 5/03/2017        | 3                                  | 38                                |      | 2                       |
| 7/06/2017        | 19                                 | 64                                |      | 19                      |
| 29/08/2017       | 5                                  | 30                                |      | 5                       |
| 25/10/2017       | 2                                  | 14                                |      | 2                       |
| 28/11/2017       | 2                                  | 47                                |      | 2                       |
| <b>Min</b>       | 2                                  | 10                                | 6.66 | 2                       |
| <b>Max</b>       | 33                                 | 82                                | 8.15 | 46                      |
| <b>Mean</b>      | 6.57                               | 29.06                             | 7.46 | 7.11                    |
| <b>UWWT Stds</b> | 25                                 | 125                               |      | 35                      |



## **SECTION F – EXISTING ENVIRONMENT & IMPACT OF THE DISCHARGE(S)**

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- **Attachment F.1 (a):**      **Kilfenora WWTP Natura Impact Statement**
- **Attachment F.1 (b):**      **West Coast Clare WMU Action Plan**

# Irish Water Report

Natura Impact Statement as part of the Kilfenora Wastewater Treatment Plant Certificate of Authorisation – A0079-01



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# Introduction

This Natura Impact Statement (NIS) provides an Appropriate Assessment (AA) of the proposed Waste Water Treatment Plant (WWTP), located at Kilfenora, Co. Clare, for the purposes of the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007), as amended. It assesses whether the proposed upgrade of the plant, alone or in combination with other plans and projects, is likely to have significant effects on a European Site(s) in view of best scientific knowledge and the conservation objectives of the site(s). European Sites are those identified as sites of European Community Importance designated as Special Areas of Conservation under the Habitats Directive or as Special Protection Areas under the Birds Directive.

This report follows the guidance for AA published by the Environmental Protection Agency's (EPA) 'Note on Appropriate Assessments for the purposes of the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007)' (EPA, 2009); and takes account of the Department of the Environment, Heritage and Local Government's guidelines 'Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities' (DoEHLG, 2010) and Circular L8/08 'Water Services Investment and Rural Water Programmes - Protection of Natural Heritage and National Monuments' (DoEHLG, 2008).

This NIS has been completed by Hibernica Ecology Ltd. on behalf of Irish Water in the context of a review of the existing Certificate of Authorisation (COA) (EPA Inspector's Report: 04/03/2015) and taking cognisance of the findings of that CoA with regard to the initial NIS prepared to inform the AA process (Ryan Hanley, 2014).

On the basis of the NIS prepared in 2014, the EPA Inspector's Report concluded the following:

*"...based on best scientific knowledge in the field and in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 and 2013, pursuant to Article 6(3) of the Habitats Directive, that the activity, individually or in combination with other plans or projects, will not adversely affect the integrity of a European Site(s), in particular the East Burren Complex SAC, Site Code: 001926, Corofin Wetlands SPA, Site Code: 004220 and Inagh River Estuary SAC, Site Code: 000036, having regard to their conservation objectives and will not affect the preservation of these sites at favourable conservation status if carried out in accordance with this RCoA and the conditions attached hereto for the following reasons: the RCoA requires the direct discharge to groundwater to cease by 31<sup>st</sup> December 2016, a technical assessment is required for the proposed indirect discharge to groundwater and the Certificate holder is required to operate the waste water works in accordance with best practice to ensure that discharges from the works do not cause environmental pollution or a deterioration in the receiving water status.*

*In light of the foregoing reasons, no reasonable scientific doubt remains as to the absence of adverse effects on the integrity of the European sites at East Burren Complex SAC, Site Code: 001926, Corofin Wetlands SPA, Site Code: 004220 and Inagh River Estuary SAC, Site Code: 000036."*

## Legislative Context

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, better known as “*The Habitats Directive*”, provides legal protection for habitats and species of European importance. Articles 3 to 9 provide the legislative means to protect habitats and species of Community interest through the establishment and conservation of an EU-wide network of sites known as Natura 2000. These are Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) designated under the Conservation of Wild Birds Directive (79/409/ECC) as codified by Directive 2009/147/EC.

Articles 6(3) and 6(4) of the Habitats Directive set out the decision-making tests for plans and projects likely to affect Natura 2000 sites (Annex 1.1). Article 6(3) establishes the requirement for Appropriate Assessment (AA):

*Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site’s conservation objectives. In light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.*

Article 6(4) states:

*If, in spite of a negative assessment of the implications for the [Natura 2000] site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, Member States shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.*

# Methodology

## Guidance Followed

Both EU and national guidance exists in relation to Member States fulfilling their requirements under the EU Habitats Directive, with particular reference to Article 6(3) and 6(4) of that Directive. The methodology followed in relation to this AA has had regard to the following guidance:

- Note on Appropriate Assessments for the purposes of the Waste Water Discharge (Authorisation) Regulations, 2007 (S.I. No. 684 of 2007). Environmental Protection Agency, (EPA, 2009).
- Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Department of Environment, Heritage and Local Government, (DoEHLG, 2010).
- Circular L8/08 – Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments. Department of Environment, Heritage and Local Government, (DoEHLG, 2008).
- Communication from the Commission on the Precautionary Principle. Office for Official Publications of the European Communities, Luxembourg, (EC, 2000a).
- Managing Natura 2000 Sites: the provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg, (EC, 2000b).
- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Brussels (EC, 2001).
- Guidance document on Article 6(4) of the ‘Habitats Directive’ 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission. Office for Official Publications of the European Communities, Luxembourg, (EC, 2007).
- Nature and biodiversity cases: Ruling of the European Court of Justice. Office for Official Publications of the European Communities, Luxembourg (EC, 2006).
- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No.477 of 2011).
- Interpretation Manual of European Union Habitats. Version EUR 28. European Commission (EC, 2013).

## Stages Involved in the Appropriate Assessment Process

### Stage 1: Screening/Test of Significance

This process identifies whether the upgrade of the Kilfenora WWTP is directly connected to or necessary for the management of a European Site(s); and identifies whether the upgrade of the WWTP is likely to have significant adverse effects upon a European Site(s) either alone or in combination with other projects or plans.

The output from this stage is a determination for each European Site of not significant, significant, potentially significant, or uncertain effects. The latter three determinations at Screening stage, will identify that an Appropriate Assessment is required for the project.

### **Stage 2: Appropriate Assessment**

This stage considers the impact of the upgrade of the plant on the integrity of a European Site(s), either alone or in combination with other projects or plans, with respect to (1) the site's conservation objectives; and (2) the site's structure and function and its overall integrity. Where adverse impacts are identified, mitigation measures to negate those impacts are determined.

The output from this stage is a Natura Impact Statement (NIS). This document must include sufficient information for the EPA, as the Competent Authority, to carry out the Appropriate Assessment. If the assessment is negative, *i.e.* adverse effects on the integrity of a site cannot be excluded, then the process must consider alternatives (Stage 3) or proceed to Stage 4.

### **Stage 3: Assessment of Alternatives**

This process examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the European Site. This assessment may be carried out concurrently with Stage 2 in order to find the most appropriate solution. If no alternatives exist or all alternatives would result in negative impacts to the integrity of the European sites then the process either moves to Stage 4 or the project is abandoned.

### **Stage 4: Assessment Where Adverse Impacts Remain**

This process is an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

## **Desk-study and Field Surveys**

The current NIS has been informed by a review of existing project information including a previous NIS to inform the CoA application, prepared by Ryan Hanley (2014) and the Hydrogeological Risk Assessment prepared by Geosyntec (2014).

NPWS mapping, records and conservation data relating to designated European Sites (SAC and SPAs) were accessed online (January 2018) at [www.npws.ie](http://www.npws.ie) and utilised the online mapviewer [www.webgis.npws.ie/npwsviewer/](http://www.webgis.npws.ie/npwsviewer/). EPA data, including WFD biological water quality data was accessed (January 2018) using the online GIS tool: [www.gis.epa.ie/EPAMaps/](http://www.gis.epa.ie/EPAMaps/).

This NIS was informed by field walkover surveys completed by qualified ecologists. The initial survey was undertaken in May 2014 to inform the Ryan Hanley NIS report (2014), these surveys identified the potential for Annex I habitats and Annex II species occurring within the surrounding environs of the Kilfenora WWTP and discharge point. An invasive species survey was completed on the 19<sup>th</sup> August 2016 (Nicholas O'Dwyer, 2016), with a follow-up ecological field survey completed on 20<sup>th</sup> March 2018 on behalf of Nicholas O'Dwyer (EirEco, 2018). The habitats and fauna recorded from within the survey area are described as per standard guidelines (Fossitt, 2000; CIEEM, 2016).

## **Consultation**

The EPA, as the competent authority, will seek NPWS advice as may be required in concluding their Appropriate Assessment; the NPWS can only communicate with the applicant (*i.e.* Irish Water) on request from the competent authority (*i.e.* the EPA), when the formal application review process to the competent authority has already commenced.

## **Screening for Appropriate Assessment**

The EPA Inspector's Report (2015) identified that the initial Screening and Appropriate Assessment reporting (Ryan Hanley, 2014) had closed out the potential for adverse effects on the designated European Sites within the zone of influence of the proposed Kilfenora WWTP upgrade, with regard to the works proposed within that project proposal. However, the Inspector's Report for the CoA requested that Irish Water review and update, as appropriate, the Natura Impact Statement prepared to inform the Appropriate Assessment in view of the detailed design, construction, and operation of the proposed treatment solution for the WWTP upgrade. This current Screening assessment has been undertaken with cognisance of the previous Appropriate Assessment reporting submitted to the EPA on the 14<sup>th</sup> November 2011 and 3<sup>rd</sup> November 2014.

The updated screening process for the proposed CoA review is described below in terms of source-pathway-receptor chains and the various pathways by which impacts can occur *i.e.* groundwater, surface water and land & air pathways in accordance with the relevant guidance documents for Appropriate Assessment.

### **Description of the Project**

Kilfenora village is located close to the southern edge of the Burren National Park, approximately 27 km north-west of Ennis, 8 km north-east of Ennistymon and 9 km south-east of Lisdoonvarna. The WWTP is located to the west of Kilfenora Village immediately surrounded by agricultural land with a school close by to the south. A private dwelling is located to the east of the WWTP in relatively proximity to the site boundary.

The existing Kilfenora WWTP in Co. Clare serves an estimated existing (2018) population equivalent (p.e.) of approximately 275 (based on 2016 Census data). The existing sewerage scheme consists of a network of foul and combined sewers which discharge to the WWTP. The treated effluent from the WWTP discharges directly to groundwater *via* a swallow hole at Ballybreen. The existing WWTP consists of screening, secondary treatment (aeration basin followed by clarification) and a stormwater storage tank (approx. 200 m<sup>3</sup>). There is also an existing overflow from the stormwater storage tank which discharges directly to groundwater *via* a swallow hole located adjacent to the WWTP.

Condition 3.13.1 of the current Certificate of Discharge states that "*The existing discharges from the agglomeration, directly to groundwater, must cease by 31<sup>st</sup> December 2016*".

Nicholas O'Dwyer (NOD) were appointed by Irish Water (IW) to act as Consultants for the Kilfenora WWTP Upgrade project.

A Design Review Report was prepared by NOD which examined a number of options for the discharge of the treated effluent from the WWTP in accordance with the Assessment Process recommended in Section 4.1 of the *Guidance on the Authorisation of Direct Discharges to Groundwater (2014)* by the EPA. The Design Review Report proposed:

- an **indirect discharge to groundwater via a percolation area** installed adjacent to swallow hole in Ballybreen. Deemed as technically and economically feasible and the preferred option for the discharge of the treated effluent;
- to **retain the existing WWTP storm water overflow direct discharge to groundwater** at the existing swallow hole located adjacent to the WWTP through an exemption under Regulation 14(b) of the European Communities (EC) Environmental Objectives (Groundwater) Regulations;
- to **upgrade the WWTP with a more efficient and robust treatment process** to achieve for more stringent treated effluent standards.

In accordance with the *Guidance on the Authorisation of Discharges to Groundwater (2011)* by the EPA, it is required to demonstrate that “a site for the discharge has sufficient infiltration capacity to physically accept the effluent, thereby avoiding surface ponding and effluent run-off”. Intrusive site investigation works were completed (by Irish Drilling Ltd.) in November 2017 at the site location proposed for the indirect discharge (adjacent to existing Ballybreen swallow hole). The works included boreholes, trial pits and percolation tests (P and T-values). According to EPA Code of Practice *Wastewater Treatment and Disposal Systems Serving Single Houses (EPA Code of Practice, 2014)*, the subsoil is considered acceptable for percolation of secondary (or tertiary) treated effluent if the respective T-values fall in the range between 3 to 75. The T-value tests performed at the site reported values between 1.75 and 41.25 (min/25 mm). The boreholes and trial pits reported limestone at 2.9-4.0 m below ground level and a layer of gravel above the limestone. Standpipes indicated groundwater at 3.6 m deep below ground level. The results of the intrusive site investigation work confirmed that the site proposed for indirect discharge (adjacent to existing Ballybreen swallow hole) is acceptable for percolating secondary or tertiary treated effluent discharged from the Kilfenora WWTP.

The upgrade to the Kilfenora WWTP comprises the following:

- Preliminary treatment (screenings and grit removal);
- Anoxic tank for denitrification and reduce concentration of Nitrates discharged;
- Secondary treatment process;
- Secondary settlement Tanks;
- Chemical dosing for phosphorus removal;
- Tertiary filtration system, installed upstream the UV system, for effluent polishing;
- Disinfection by UV for pathogens removal;
- Sludge thickening and storage tank;
- New storm storage tank. This is in addition to the existing 200 m<sup>3</sup> storm tank being retained and will significantly reduce stormwater overflow frequency and volume;
- New final treated effluent pumping station;
- Percolation area for indirect discharge to swallow hole at Ballybreen, including ancillary infrastructure, i.e., lift pumping station and buffer tank (if required).

The existing WWTP structures, apart from the storm tank, will be decommissioned and demolished. The existing rising main and gravity pipeline currently discharging the treated effluent from the WWTP to the Ballybreen swallow hole will be decommissioned and replaced.

The percolation area may require the importation of soil and stone. For landscape and visual purposes, the percolation area will be seeded with grass mixes and screened with landscape planting of native species. There will also be a requirement for a site compound and temporary hauling/ access roads. The above will be determined at detailed design.

A summary of the proposed effluent quality standards for the Kilfenora WWTP upgrade are presented in Table 1. The design specification for the percolation area and WWTP are shown in Table 2. The design of the percolation area and WWTP utilise standard design parameters *i.e.* BOD loading of 60 g BOD/p.e/day and a flow of 180 l/p.e/day (Table 2).

*Table 1: Proposed effluent quality achieved at Kilfenora WWTP upgrade*

| Parameter            | Units | Proposed Final Effluent Standards at WWTP |
|----------------------|-------|---|
| BOD                  | mg/l  | 10  |
| COD                  | mg/l  | 40  |
| Ammonia              | mg/l  | 1.0                                       |
| Nitrates             | mg/l  | 50  |
| Ortho-Phosphate      | mg/l  | 0.5                                       |
| Suspended Solids     | mg/l  | 10  |
| Pathogenic Reduction | -     | Log 3 reduction                           |

*Table 2: Design Specification for Percolation Area and WWTP*

| Parameter                     | Units             | Load  |
|-------------------------------|-------------------|-------|
| Population Equivalent         | p.e               | 330   |
| BOD Loading                   | kg/d              | 19.8  |
| Dry Weather Flow              | m <sup>3</sup> /d | 59.4  |
| Full Flow to Treatment (4DWF) | m <sup>3</sup> /d | 237.6 |

## **Description of the Receiving Environment and Monitoring Results**

### ***Water Chemistry and Evaluation of Effluent Quality***

A Hydrogeological Assessment was completed in 2014 by Geosyntec Consultants and included a conceptual Site Model (CSM) for the site. A map figure from that report is presented as Figure 1. The report concluded that:

- *Tracer studies completed by Drew (2001, 2012)<sup>1,2</sup> identified a direct linkage between Ballybreen swallow hole B and springs to the southeast which feed the headwaters of the River Fergus. Further private wells in the catchment area were also shown to be hydraulically connected, albeit through a weaker connection than the main conduit connections with the spring system;*
- *The above wells were subsequently sampled for microbial pathogens in 2012 and found to be impacted. It was confirmed by Clare County Council that all the households using wells, identified as being at risk of contamination by the Kilfenora WWTP discharge in the 2012 tracer study, were offered a mains water connection;*

<sup>1</sup> Drew, D (2001) Tracing of the Water Sinking at the Swallow Hole at Ballybreen, Kilfenora, Co Clare (August 2001). Prepared for Clare County Council

<sup>2</sup> Drew, D (2012) Water Trace from Ballybreen Swallow hole (Kilfenora) April 2012. Prepared for Clare County Council

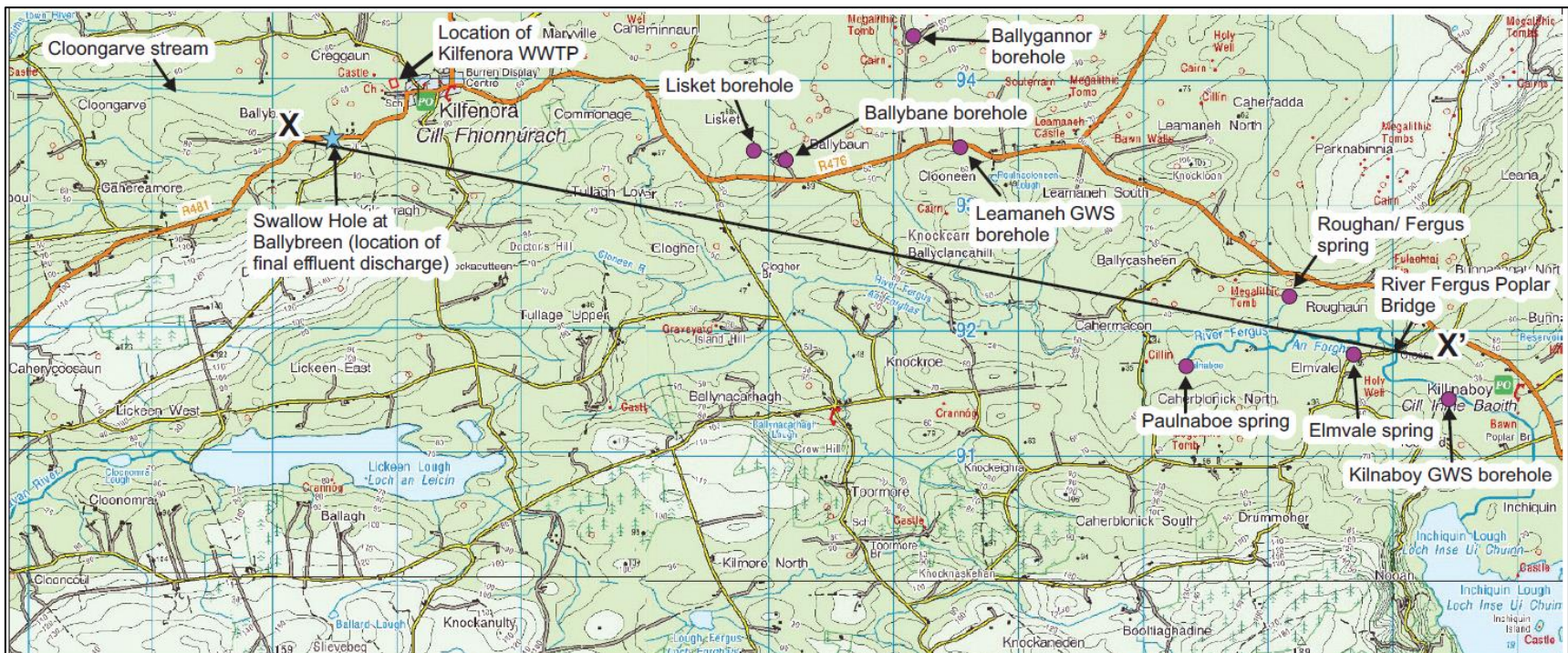
- *The main contaminants of potential concern (COPC) from the Kilfenora WWTP discharge are microbial pathogens and Nitrogen (N) and Phosphorous (P) species;*
- *Direct linkages between swallow hole B at Ballybreen and private wells in the study area represent the main risk driver for the study area. A pollutant linkage with the River Fergus is confirmed; however, surface water chemistry monitoring by Clare Co. Co. in the River Fergus downstream shows that it is currently not impacted from the discharge at Ballybreen;*
- *It is recognised that upgrades to the WWTP at Kilfenora will significantly reduce the potential human health risks by breaking the pollutant linkage at the source;*
- *It is recognised that due to the rural location other inputs into the system from disused sources such as agriculture and septic tank discharges may be impacting groundwater quality.*

Routine monitoring data by Clare County Council (2009-2013) on private wells downgradient of the Ballybreen discharge (Kilnaboy and Leamaneh/Roughan) indicated that, apart from microbial parameters, the parameters analysed were compliant with Drinking Water Regulations (2000) (S.I. 439 2000) and the Groundwater (Groundwater) Regulations 2010 (S.I. 9 of 2010). This suggests that the existing direct discharge from the WWTP to groundwater is not having a substantial impact on the overall chemical quality of the groundwater body. The fact that the groundwater body (Craggaunboy) is classified as having “Good” chemical status by the EPA (2010-2015) seems to support this view since Drinking Water Regulations standards and threshold values of the Groundwater Regulations are used for the assignment of this status.

It is proposed to nitrify Ammonia to a standard of 1.0 mg/l. Furthermore, to control the levels of Nitrates discharged to groundwater, a denitrification step is also proposed at the WWTP so that the concentration of Nitrates in the treated effluent is below 50 mg/l. This will contribute to significantly reduce any project related effect and will further improve the present chemical “Good” status of the overall groundwater body and at the receptor wells when compared to the concentrations of N-Species currently being discharged from the WWTP to groundwater.

The “Good” chemical status classification of the groundwater body indicates compliance with the relevant threshold values of the Groundwater Regulations for “Good” status (35 µg/ for Molybdate Reactive Phosphorus). In order to determine an acceptable standard for P-Species, it is proposed to use the River Fergus and its assimilation capacity as a surrogate. Tracer studies completed by Drew (2001, 2012) confirmed that the water discharging at Ballybreen is primarily connected to a series of springs that form the head waters of the River Fergus. This approach will result in stringent limits with regards to P-Species as the most onerous limits with respect to P-Species discharged to the receiving waters are the Surface Water Regulations (2009).

A Waste Assimilative Capacity (WAC) calculation was performed for the River Fergus in order to ascertain the loads that the river can assimilate while maintaining its current “Good Ecological Status”. Ambient water quality monitoring data was made available by Clare County Council. Based on the results of the WAC, a standard of 0.5 mg/l is proposed for Orthophosphate. This will contribute to significant improvements in discharge quality and further improve the present chemical “Good” status of the overall groundwater body and at the receptor wells when compared to the concentrations of P-Species currently being discharged from the WWTP to groundwater. A copy of the WAC calculation is included in **Appendix A**.



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| Location of Fomer Tracer Sampling Sites & Line of Cross-Section (X - X') |                        |           |
|--|------------------------|-----------|
| Kilfenora WWTP   | Tier 3 Risk Assessment |           |
| Geosyntec consultants  | Irish Water            | Figure 1  |
|  | Dublin, Ireland        | July 2014 |

● Tracer sampling point selected and utilised by Mr D Drew in report for Clare County Council, 2012, entitled 'Water Trace from Ballybreen Swallowhole'.

Swallow Hole at Ballybreen (location of final effluent discharge)

Figure 1 Map of hydrogeological connectivity within the study area, from Geosyntec Hydrogeological Report (2014).

An approach similar for deriving the standards for P-species was used for BOD, COD and SS, *i.e.*, the River Fergus and its assimilate capacity was used as a surrogate. A WAC calculation was performed for the River Fergus in order to ascertain the loads that the river can assimilate while maintaining its “*Good Ecological Status*”. Ambient water quality monitoring data was made available by Clare County Council. Based on the results of the WAC, a standard of 10/10/40 mg/l are proposed for BOD/SS/COD respectively. These standards are far superior to the ones prescribed in the Urban Wastewater Treatment Regulations and will contribute to significant improvements in discharge quality and further improve the present chemical “*Good*” status of the overall groundwater body and at the receptor wells when compared to the concentrations of BOD/SS/COD currently being discharged from the WWTP to groundwater. A copy of the WAC calculation is included in **Appendix A**.

In terms of the materials proposed for the percolation area, a single layer sand filter is proposed with a minimum depth of 650 mm. The sand filter will be either installed above existing ground level or partially buried and this will be confirmed at detail design stage. A small lift pumping station will be installed adjacent to the sand filter so that the incoming tertiary treated and disinfected effluent from the WWTP can be elevated to the top of the sand filter. A small buffering tank may be required adjacent to the sand filter so that a constant flowrate can be discharged to the sand filter and also for maintenance purposes. The need and size of the buffering tank will be confirmed at detail design stage.

A summary of the proposed effluent quality standards for the Kilfenora WWTP upgrade are presented in Table 1 in the Section *Description of the Project* above which will be used to evaluate compliance. The exact quality of the final effluent being discharged to groundwater *via* the proposed indirect discharge through the sand filter cannot be exactly determined. Notwithstanding this, it can be expected to be of a quality superior than that included in Table 1, since the effluent will undergo an additional level of treatment following percolation through the sand filter.

#### ***Description of the Hydrology and Hydrogeology of the Study Area***

The regional geology of the Kilfenora area is dominated by Dinantian Pure Bedded Limestones to the east (Lissylisheen and Ballyelly members) and Namurian Shales (Clare shale formation) to the west with the result that Ballybreen is surrounded on all sides by shale except to the east. Locally karst features dominate, similar to the adjacent Burren landscape. Drew (2012) describes the local geology of the area as having a series of swallow holes along the eastern boundary between the Carboniferous Limestone and the Namurian Shales including the Ballybreen swallow hole. As a result, both the surface hydrology and hydrogeology of the area is complex and surface water is closely interlinked with groundwater. Many of the surface water courses sink underground before rising to the surface further down-gradient and then sinking again. Depending on rainfall and water levels throughout the catchment, rivers also vary from being losing rivers (*i.e.* where river water flows to groundwater through the river bed), to gaining rivers where the rivers are fed by groundwater. There are also links between swallow holes and caves to surface water courses and springs *via* conduits and diffuse pathways. The large open conduits within limestone can transport groundwater great distances over relatively short periods of time. This rapid migration of groundwater (and dissolved or suspended contaminants) is such that beyond dilution and dispersion, little or no contaminant attenuation occurs within the groundwater system between a pollutant source and a receptor (Geosyntec Consultants, 2014).

Clare County Council commissioned Dr. David Drew to undertake a tracer test study at the Ballybreen swallow hole (*i.e.* the discharge point of the Kilfenora WWTP) in 2001 and 2012 (Drew, 2001; 2012). The main aim of the initial tracer study was to determine the location of the outlets from the swallow hole and comment on how this interacts with the local hydrology and hydrogeology of the area. The second study in 2012 aimed to better characterise the underground flow path(s) between the Ballybreen swallow hole and its known reappearance in springs feeding the River Fergus. The results of the 2001 and 2012 studies demonstrate that conduit flow is significant in the area. The following groundwater, surface water and land & air pathways have been identified from the Ballybreen swallow hole and Kilfenora WWTP:

1. The Ballybreen swallow hole is connected *via* a karstic conduit to a spring system located 6.5 km down gradient and to the southeast *i.e.* Roughan, Poul naboe and Elmvale Springs which in turn provide the head waters of the River Fergus (in townlands of the same name) upstream of Lough Inchiquinn. The River Fergus and Lough Inchiquinn are designated within the East Burren Complex SAC and Corofin Wetlands SPA; the designated site boundary is 1.85 km (approximately) downstream of the nearest surface water spring system/source (*i.e.* Elmvale Spring).
2. A component of groundwater flow from the Ballybreen swallow hole migrates (especially under high flow conditions) to feed the local surface water system at Cloongarve Stream 0.7 km west of the swallow hole (in a townland of the same name) which flows into the Smithstown River. The Smithstown River is a tributary of the Dealagh River (Henry, 2006). The estuaries of both the Inagh and Dealagh Rivers converge before O'Brien's Bridge (Clare County Council, 2011) and enter Inagh River estuary and ultimately Liscannor Bay. The Inagh River Estuary is designated as the Inagh River Estuary SAC 7.2 km (approximately) downstream of Cloongarve Stream.
3. During the construction stage of the proposed upgrade to Kilfenora WWTP there is a potential pathway for pollutants between the works area and the East Burren Complex SAC and Corofin Wetlands SPA and also to the Inagh River Estuary SAC *via* the Ballybreen swallow hole (and other karstified features in the immediate area) and/or percolation to groundwaters. Percolation is likely given that the subsoil is thin or absent based on the aquifer vulnerability of 'extreme with rock at surface/Karst features' for the Miltown Malbay\_2 GWB which underlies the swallow hole and the WWTP.

The GWB underlying the study area is Miltown Malbay\_2 and the adjacent Craggaunboy GWB. Miltown Malbay\_2 and Craggaunboy GWB are classified by the EPA as a poorly productive aquifer. However, the tracer studies have demonstrated that the limestone bedrock in the study catchment area exhibits karstic features which would suggest that a Karst Aquifer classification may be more accurate for these GWB. The classification for both the neighbouring Burren and Ennis GWBs is Karst.

Clare County Council provided Geosyntec Consultants with surface water quality monitoring (for the period 2009-2013) at Poplar Bridge and Riverstown monitoring locations on the River Fergus which is down stream of the main spring discharges which form the River Fergus and up stream of the East Burren Complex SAC and Corofin Wetlands SPA at Lough Inchiquinn. For both locations, chemical parameters were predominantly compliant with 'High' status requirements, with the majority of values for Orthophosphate achieving at least "Good" status. Biological water quality in the upper reaches of the River Fergus (Cloneen Stream) due east of Kilfenora is classified by the EPA under the Water Framework Directive as 'Poor' ecological status (Q3) following 2014 monitoring, and as 'Good' at the next downstream monitoring station in 2016. The

Fergus is evaluated as 'Good' status (2016) at Popular Bridge, Killinaboy, upstream of the East Burren Complex SAC and Corofin Wetlands SPA. These biological water quality evaluations align with the aforementioned chemical water quality status in the Fergus.

It is understood that no monitoring of surface water quality is undertaken for the Cloongarve Stream which periodically may receive water from the Ballybreen swallow hole under high flow conditions, as such it is not possible to evaluate the degree of impact, if any, resulting from this connection (Geosyntec Consultants, 2014) with the Inagh River Estuary SAC. The River Dealagh is currently classified as 'Good' ecological status at River Dealagh Bridge near Smithstown House upstream of the confluence with the Cloongarve Stream and downstream of the confluence at Aughvackeen Bridge.

### **Field Walkover Survey**

The Kilfenora WWTP is a fenced site situated to the west of Kilfenora village. It is accessed by a short lane from the nearby minor road. A stand of Japanese knotweed (*Fallopia japonica*) occurs on the southern side of this track at a distance of ca. 20 m from the boundary fence of the WWTP site. The presence of Japanese Knotweed at this location was identified in the 2014 Ryan Hanley reporting and was confirmed in the Nicholas O'Dwyer August 2016 Invasive Species Report and the EirEco 2018 Ecological Survey Report. It is located ca. 2m from the access track at its closest point.

The habitats within the site of the Kilfenora WWTP were evaluated by Ryan Hanley in May 2014 and were subject to a further ecological survey in March 2018 (EirEco, 2018); no ecologically significant change was noted in the intervening period. Within the WWTP, the ground consists of a mixture of buildings, structures and hard surface (ED2) with areas of neglected grassland (GS1). The grassland is dominated by cocksfoot (*Dactylis glomerata*) with small amounts of ribwort plantain (*Plantago lanceolata*) and patches of nettle (*Urtica dioica*). There are occasional small patches of developing briar (*Rubus fruticosus* aggr.) scrub (WS1). A low-lying area in the northwest of the site is subject to periodic flooding and is an extension of a small turlough lying in linear basin to the west of the site. It contains a limited flora however, dominated by creeping bent (*Agrostis stolonifera*), creeping buttercup (*Ranunculus repens*), dock (*Rumex obtusifolius*) and meadowsweet (*Filipendula ulmaria*). A patch of butterbur (*Petasites hybridus*) occurs alongside the trackway on the west of the site. A fragmented treeline (WS2) occurs on the eastern boundary of the site but outside of the fence line. This consists of a mixture of semi mature ash (*Fraxinus excelsior*), hawthorn (*Crataegus monogyna*) and sycamore (*Acer pseudoplatanus*) with ferns (*Dryopteris* spp.), briar (*Rubus fruticosus* aggr.) and ivy (*Hedera helix*) along its base. The remainder of the WWTP consists of habitat classified as buildings and artificial surfaces (BL3).

The rising main route crosses an area of open grassland which is characterised by shallow soils with frequent exposed limestone bedrock (ER2). The grassland is grazed and heavily poached, with some damp low-lying areas. The species composition appears limited but the seasonality of the survey precludes a detailed species assessment being carried out. It appears dominated by grasses with rushes (*Juncus effusus*) in damper areas. Shallow soiled areas overlying rock are characterised by abundant mosses. Stonewalls (BL1) subdivide fields. The percolation area lies to the north of the R481 road and has a gentle slope to the north. It is dominated by rushes, grasses, creeping buttercup and ribwort plantain. A stonewall occurs along the road side with patches of briar. The existing swallow hole to the east of the percolation area is in a fenced enclosure and is comprised of grazed grassland with briar and the black moss *Cinclidotus* on

exposed rock. A small stream feeds into the swallow hole which rises on elevated lands to the south of the R481.

## **Potential Impact Source**

### **Construction Impacts**

There is a potential source of indirect impacts arising from the construction stage of the proposed upgrade to the plant related to the accidental release of silt laden waters or hydrocarbons during works, with potential for impacts on European Sites *via* groundwater and associated surface water pathways. There is also potential for direct and indirect impacts to Qualifying Interests and Special Conservation Interests of European Sites (*ex situ*), were they to occur within or adjacent to the works area *via* land & air pathways.

During the construction stage of the proposed upgrade to Kilfenora WWTP there is potential for indirect impacts on Qualifying Interests and Special Conservation Interests of these European Site designations arising from the introduction, disturbance, or spread of non-native invasive species during works.

### **Operational Impacts**

The WWTP at Kilfenora currently (2018) provides secondary treatment for an estimated p.e. of 275 and discharges directly to a swallow hole in the townland of Ballybreen, referred to as the Ballybreen swallow hole, just south of Kilfenora village, Co. Clare. The monthly water quality monitoring results (2016 data available) for Kilfenora WWTP show that effluent water quality for BOD, COD and SS are below the appropriate treatment conditions placed on the WWTP. However, the direct discharge to groundwater at Kilfenora has been found not to meet with Regulation 8 and 14 of the Groundwater Regulations (S.I. No. 9 of 2010). The proposed upgrade includes the provision of tertiary treatment and disinfection with UV at the WWTP followed by indirect discharge to groundwater *via* a percolation area (sand filter). The percolation area will have the effect of ending the '*direct discharge*' from the WWTP to groundwater by achieving '*indirect discharge*' and further improve the final effluent quality included in Table 1. In addition, the provision of significant additional storm water storage capacity at the WWTP will significantly reduce stormwater overflow frequency and volume to the swallow hole adjacent to the WWTP.

## **Potential Impact Pathways**

Kilfenora bedrock geology is dominated by karst features, similar to the adjacent Burren landscape. A series of swallow holes are present including the Ballybreen swallow hole. As a result, the surface watercourses and springs are closely interlinked with groundwater through swallow holes and caves *via* conduits and diffuse pathways. Hydrogeological data was identified *via* EPA and WFD online mapping (<https://gis.epa.ie/EPAMaps/>; <https://www.catchments.ie/maps/>) and also with reference to the Geosyntec (2014) Hydrogeological Risk Assessment. The interconnectedness between surface water and groundwater within the study area comprise a vector for potential water quality impact sources to be transferred downstream or downgradient from the Kilfenora WWTP site, during both the construction and operational phase of the development.

Furthermore, construction phase works, requiring machinery on site undertaking construction-related activities have the potential to give rise to localised noise and visual disturbance effects. These pathways are evaluated with regard to the impact sources arising from construction

elements and with reference to the sensitivities of receptors identified within designated European Sites for which connectivity has been established.

## Identification of European Sites within the Zone of Influence

The designated European Sites within the zone of influence of the proposed WWTP upgrade have been evaluated based on connectivity to the proposed construction and operation phase of the project *via* surface water and groundwater flow connectivity as outlined above, with regard to the water-dependant and nutrient sensitive qualifying interests and special conservation interests of these designations. In addition, all European Sites within a 10 km and 15 km buffer have also been evaluated, as per the NPWS (2010) guidance. Figure 2 presents these sites within the wider study area. Table 3 presents an overview of the European Sites within the zone of influence, outlining the qualifying interests and special qualifying interests for the SAC and SPA designations, respectively. Potential downstream connectivity *via* surface water and groundwater pathways, with regard to water-dependant and nutrient sensitive receptors, is identified in relation to the potential for impact interactions from the proposed development.



Figure 2. Designated European Sites within a 10 km and 15 km buffer zone of the Kilfenora WWTP upgrade.

Note 1: SAC sites – yellow; SPA sites – pink.

Note 2: Data from Openstreetmap and NPWS online mapviewer.

Table 3. European Sites within the zone of influence of Kilfenora WWTP upgrade project.

| Site name               | Approx. Distance of Separation | Qualifying Interest / Special Conservation Interest  | Water-dependant features | Nutrient sensitive features | Pathways for potential adverse effects   |
|-------------------------|--------------------------------|--|--------------------------|-----------------------------|--|
| East Burren Complex SAC | 5.7 km E,<br>9.2 km SE         | Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. [3140]<br>Turloughs [3180]<br>Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]<br>Alpine and Boreal heaths [4060]<br><i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]<br>Calaminarian grasslands of the <i>Violetalia calaminariae</i> [6130]<br>Semi-natural dry grasslands and scrubland facies on calcareous substrates ( <i>Festuco-Brometalia</i> ) (* important orchid sites) [6210]<br>Lowland hay meadows ( <i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i> ) [6510]<br>Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]<br>Petrifying springs with tufa formation ( <i>Cratoneurion</i> ) [7220]<br>Alkaline fens [7230]<br>Limestone pavements [8240]<br>Caves not open to the public [8310]<br>Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> ( <i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i> ) [91E0]<br><i>Euphydryas aurinia</i> (Marsh Fritillary) [1065]<br><i>Rhinolophus hipposideros</i> (Lesser Horseshoe Bat) [1303]<br><i>Lutra lutra</i> (Otter) [1355] | Yes                      | Yes                         | Hydrological connectivity via groundwater pathways. Screened in for further evaluation of potential significant adverse effects. |
| Moneen Mountain SAC     | 2.7 km E                       | Turloughs [3180]<br>Alpine and Boreal heaths [4060]<br><i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]<br>Semi-natural dry grasslands and scrubland facies on calcareous substrates ( <i>Festuco-Brometalia</i> ) (* important orchid sites) [6210]<br>Petrifying springs with tufa formation ( <i>Cratoneurion</i> ) [7220]<br>Limestone pavements [8240]<br><i>Euphydryas aurinia</i> (Marsh Fritillary) [1065]<br><i>Rhinolophus hipposideros</i> (Lesser Horseshoe Bat) [1303]  | Yes                      | Yes                         | No hydrological pathways, separated by distance. Screened out  |
| Ballyteige              | 4.7 km NW                      | Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion  | Yes                      | Yes                         | No hydrological pathways,  |

| Site name                           | Approx. Distance of Separation | Qualifying Interest / Special Conservation Interest  | Water-dependant features | Nutrient sensitive features | Pathways for potential adverse effects   |
|-------------------------------------|--------------------------------|--|--------------------------|-----------------------------|--|
| (Clare) SAC                         |                                | caeruleae) [6410]  |                          |                             | separated by distance.<br><i>Screened out</i>  |
| Inagh Estuary SAC                   | 7.2 km SW                      | Salicornia and other annuals colonising mud and sand [1310]<br>Atlantic salt meadows ( <i>Glauco-Puccinellietalia maritimae</i> ) [1330]<br>Mediterranean salt meadows ( <i>Juncetalia maritimi</i> ) [1410]<br>Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2120]<br>Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]   | Yes                      | Yes                         | Hydrological connectivity via surface water pathways.<br><i>Screened in for further evaluation of potential significant adverse effects.</i> |
| Black Head – Pousallagh Complex SAC | 8.8 km N                       | Reefs [1170]<br>Perennial vegetation of stony banks [1220]<br>Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]<br>Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260]<br>Alpine and Boreal heaths [4060]<br><i>Juniperus communis</i> formations on heaths or calcareous grasslands [5130]<br>Semi-natural dry grasslands and scrubland facies on calcareous substrates ( <i>Festuco-Brometalia</i> ) (* important orchid sites) [6210]<br>Lowland hay meadows ( <i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i> ) [6510]<br>Petrifying springs with tufa formation ( <i>Cratoneurion</i> ) [7220]<br>Limestone pavements [8240]<br>Submerged or partially submerged sea caves [8330]<br><i>Petalophyllum ralfsii</i> (Petawort) [1395] | Yes                      | Yes                         | No hydrological pathways, separated by distance.<br><i>Screened out</i>  |
| Ballycullinan Lake SAC              | 12 km SE                       | Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]   | Yes                      | Yes                         | No hydrological pathways, separated by distance.<br><i>Screened out</i>  |
| Corofin Wetlands SPA                | 8.6 km SE                      | Little Grebe ( <i>Tachybaptus ruficollis</i> ) [A004]; Whooper Swan ( <i>Cygnus cygnus</i> ) [A038]<br>Wigeon ( <i>Anas penelope</i> ) [A050]; Teal ( <i>Anas crecca</i> ) [A052]<br>Black-tailed Godwit ( <i>Limosa limosa</i> ) [A156]; Wetland and Waterbirds [A999]  | Yes                      | Yes                         | Hydrological pathways via ground/surface water.<br><i>Screened in for further evaluation of potential significant adverse effects.</i>       |
| Cliffs of Moher SPA                 | 12 km W                        | Fulmar ( <i>Fulmarus glacialis</i> ) [A009]; Kittiwake ( <i>Rissa tridactyla</i> ) [A188]<br>Guillemot ( <i>Uria aalge</i> ) [A199]; Razorbill ( <i>Alca torda</i> ) [A200]<br>Puffin ( <i>Fratercula arctica</i> ) [A204]; Chough ( <i>Pyrrhocorax pyrrhocorax</i> ) [A346]   | Yes                      | Yes                         | No hydrological pathways, separated by distance.<br><i>Screened out</i>  |

## Evaluation of Potentially Significant Adverse Effects

Clare County Council provided Geosyntec Consultants with surface water quality monitoring (for 2009-2013) at Poplar Bridge monitoring location on the River Fergus (see Figure 1). This location is downstream of the main spring discharges which form the River Fergus and up stream of the East Burren Complex SAC (approx. 0.11 km) and Corofin Wetlands SPA (approx. 0.95 km) at Lough Inchiquin (see Figure 2). Updated chemical water quality data for 2013 to 2015 was provided by Clare County Council has been reviewed in the preparation of this report. The chemical data shows strong compliance with 'High' status and generally with 'Good' status limits for the Fergus at Riverstown and Popular Bridge sampling locations; therefore, it is evaluated that in the current situation, the existing discharges from the final effluent are not having a significant impact on the water quality of the River Fergus.

The surface water quality of the River Fergus at the Popular Bridge, upstream of the East Burren SAC, is classified by the EPA as 'Good' ecological status based on 2016 biological water quality sampling. The next monitoring station upstream on the Cloneen Stream also was evaluated as 'Good' status in 2016. This aligns with the water chemistry data from Clare Co. Co. The values recorded at Poplar Bridge account for the cumulative effects to the Fergus catchment from upstream, including the existing Kilfenora discharge, agricultural inputs and onsite septic tank inputs. The fact that the water chemistry results indicate a good water quality status it can be concluded that the current discharge is not having a significant impact on the downstream water quality which is a supporting feature of the East Burren Complex SAC and Corofin Wetlands SPA.

It is understood that no monitoring of water quality is undertaken for the Cloongarve Stream (see Figure 1), to the northwest, which periodically may receive water from the Ballybreen swallow hole under high flow conditions. As such it is not possible to evaluate the localised impact, if any, resulting from this connection; with reference to borehole and hydrogeological investigations undertaken by Geosyntec Consultants (2014). However, the distance and current status is evaluated with regard to the Inagh River Estuary SAC. The River Dealagh, downstream of the Cloongarve Stream, is currently classified as 'Good' ecological status at River Dealagh Bridge near Smithstown House upstream of the confluence with the Cloongarve Stream and downstream of the confluence at Aughvackeen Bridge. There has been a recent drop in water quality in the River Dealagh; agriculture is the main pressure and possibly localised impacts, e.g. cattle access in places as cited in the West Clare WMU Action Plan (2010); however, no specific pressures are noted in the online EPA water quality pressures dataset (<https://gis.epa.ie/EPAMaps/>). The current EPA WFD monitoring reporting identifies the Inagh River Estuary as being at Intermediate status (2010-2012 period)<sup>3</sup>. While there is no available monitoring data for the Cloongarve Stream the status of the River Dealagh upstream at Smithstown Bridge and downstream at Aughvackeen Bridge of the confluence with the Cloongarve Stream together with the status of the Inagh River Estuary indicates that the discharges from the final effluent are not having a significant impact on the water quality of the River Inagh Estuary. Given the distance (7.2 km) downstream, dilution and dispersion effects and considering the fact that the discharges from other sources such as agricultural inputs and OSWWTS could be contributing to Inagh River Estuary, it can be concluded that the current discharge is not having a significant impact on the water quality of the Inagh River Estuary SAC.

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<sup>3</sup> <https://gis.epa.ie/EPAMaps/>. Accessed April 2018

The proposed upgrade of Kilfenora WWTP will reduce the current pollutant loading from the existing discharge through provision of tertiary treated and UV disinfected effluent through a percolation area (sand filter), thus resulting in significantly improved final effluent quality over the existing discharge to groundwater at Ballybreen swallow hole. In addition, the provision of significant additional storm water storage capacity at the WWTP will significantly reduce stormwater overflow frequency and volume to the swallow hole adjacent to the WWTP.

Based on the above, it can be concluded that there is no significant impact on the WFD water quality status of the East Burren Complex SAC, Corofin Wetland SPA and Inagh River Estuary SAC arising from the current operational discharge scenario. This provides confidence in the evaluation of an improved effluent discharge loading to the hydrological and hydrogeological receiving waters, with consequent positive effects due to the proposed improved operational discharges from the proposed upgraded Kilfenora WWTP.

However, the potential for significant impacts must be assessed in relation to the potential for significant adverse effects on the qualifying interests and the Conservation Objectives of these European Sites, in the context of potential source-pathway-receptor chains in relation to the operation and construction stage of the proposed upgrade to Kilfenora WWTP as outlined above. The field walkover surveys of the proposed works footprint did not reveal the presence of any Annex I habitats, nor were any records identified for any of the qualifying interests of those European Sites potentially connected to the proposed *via* the zone of influence; *i.e.* the East Burren Complex SAC or Inagh River Estuary SAC. No suitable wetland habitat to support bird species listed as Special Conservation Interests of the Corofin Wetlands SPA was recorded.

In summary, the Screening for the Appropriate Assessment considers the following complete impact source-pathway-receptor chains:

- During the construction stage of the proposed upgrade to Kilfenora WWTP (within the WWTP site itself and the decommissioning and construction works at the Ballybreen swallow hole) there is a potential pathway for pollutants (*e.g.* the accidental release of silt-laden waters or hydrocarbon) to affect the East Burren Complex SAC, Corofin Wetlands SPA and Inagh River Estuary SAC *via* the Ballybreen swallow hole (and other karstified features *i.e.* the immediate area) and/or percolation to groundwaters. Potential for percolation is likely given that the subsoil is thin or absent based on the aquifer vulnerability of 'extreme with rock at surface/Karst features' for the Miltown Malbay\_2 (GWB) which underlies the WWTP and Ballybreen swallow hole.
- During the construction stage of the proposed upgrade to Kilfenora WWTP there is potential for indirect disturbance impacts on Qualifying Interests and Special Conservation Interests where they occur within the wider zone of influence of the proposed works *via* land and air pathways.
- There is also potential for the introduction, disturbance, or spread of non-native invasive species during construction works.
- There is potential for cumulative or in-combination impacts arising with regard to baseline or diffuse water quality impacts or pressures affecting the East Burren Complex SAC, Corofin Wetlands SPA and Inagh Estuary SAC arising from other sources, *e.g.* Ennistymon WWTP, agricultural inputs, cattle access, OSWWTS etc.
- During operation the proposed discharge *via* percolation has the potential to affect nutrient-sensitive, water-dependant qualifying interests of designated European Sites which are hydrologically / hydrogeologically connected to the proposal and located downstream.

Therefore, based on the above evaluations in terms of water quality effects, and applying the Precautionary Principle and in accordance with Article 6(3) of the Habitats Directive, the construction works and proposed operation of the Kilfenora WWTP upgrade are identified as having the potential for adverse effects on the above European Sites, in view of their qualifying interests and conservation objectives and are therefore brought forward for evaluation within the NIS to inform the Appropriate Assessment.

# Natura Impact Statement

The Screening evaluation identified impact source-receptor pathways with the potential for significant adverse effects during construction and operation, which may interact with the nutrient-sensitive water-dependant qualifying interests (QIs) and special conservation interests (SCIs) of the following European Sites: the East Burren Complex SAC (ca. 5.7 km due east but hydrologically disconnected; 9.2 km SE connected *via* the River Fergus downstream); the Inagh Estuary SAC (ca. 7.2 km due west and downstream); and the Corofin Wetlands SPA (ca. 8.6 km due southeast, connected *via* the River Fergus downstream). The following Assessment presents the potential impacts resulting from the proposed development in relation to the qualifying interests and their respective conservation status in view of the conservation objectives for these European Sites.

## Description of the Natura 2000 Site Affected

### East Burren Complex SAC

The East Burren Complex SAC encompasses all of the high ground in the east Burren in Counties Clare and Galway and extends south-eastwards to include a complex of calcareous wetlands. The area consists of a range of limestone habitats that include limestone pavement and associated calcareous grasslands and heath, scrub and woodland together with a network of calcareous lakes and turloughs. The River Fergus is the only major over ground river within the site. The Ballyeighter wetland complex represents an excellent example of a nutrient-poor calcareous lake and fen system, of European significance. This SAC has some of the best examples and most extensive areas of oligotrophic limestone wetlands in the Burren and in Europe.

#### Description of the Qualifying Interests of the East Burren Complex SAC: Annex I Habitats

The East Burren Complex SAC is designated for the presence of fourteen Annex I habitats. Of these habitats, the construction and operational stages of the proposed upgrade to the Kilfenora WWTP is assessed as having the potential to result in indirect impacts to water quality affecting groundwater and/or surface water dependent habitats within the zone of impact downstream. The Annex I habitats and their dependencies are listed in Table 4.

Of these habitats, the construction and operational stage of Kilfenora WWTP upgrade has the potential to impact on the following groundwater and surface water dependent habitats: hard water lakes, turloughs, floating river vegetation (Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation), *Cladium* and alkaline fens, tufa formations. These habitats are nutrient sensitive and are hydrologically connected to or downstream/down-gradient of the WWTP, at a distance of over 9 km downstream. Water quality does not threaten other habitats which are terrestrial in nature *i.e.* heaths, Juniper scrub, orchid-rich grasslands, lowland hay meadows and limestone pavement / caves for which the site has been selected. In this regard, there is little/no potential for adverse effects, and no changes to the conservation status of these habitats.

Table 4: East Burren Complex SAC Annex I habitat QIs.

| Code   | Habitat   | Dependency  | Connectivity via Zone of Impact |
|--|---|-------------|---------------------------------|
| [3140]   | Hard Water Lakes  | GWDSW       | Yes                             |
| [3180]   | Turloughs*  | GDWTE       | Yes                             |
| [3260]   | Floating River Vegetation                                     | GWDSW       | Yes                             |
| [4060]   | Alpine and Subalpine Heaths                                   | T           | No                              |
| [6130]   | Calaminarian grasslands of the <i>Violetalia calaminariae</i> | T           | No                              |
| [5130]   | Juniper Scrub   | T           | No                              |
| [6210]   | Orchid-rich Calcareous Grassland*                             | T           | No                              |
| [6510]   | Lowland Hay Meadows   | T           | No                              |
| [7210]   | Cladium Fens*   | GDWTE       | Yes                             |
| [7220]   | Petrifying Springs with Tufa Formation*                       | GDWTE/SW    | Yes                             |
| [7230]   | Alkaline Fens   | GDWTE       | Yes                             |
| [8240]   | Limestone Pavement*   | T           | No                              |
| [8310]   | Caves   | GDWTE       | No                              |
| [91E0]   | Alluvial Forests*   | GDWTE & SWD | No                              |
| Note: GDWTE - Ground Water Dependent Terrestrial Ecosystem / GWDSW - Surface water dependent habitats which have connectivity with GDWTEs / T – Terrestrial/ SW - Surface water dependent habitats<br>* denotes a priority habitat |   |             |                                 |

*[3140] Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.*

This habitat is strongly associated with lowland lakes over limestone bedrock and is also found on calcareous sand at the landward side of machair plains, along the north-western coast. It is dominated by algae, particularly *Chara* species and is of international conservation importance for its krustenstein, a cyanobacterial crust found on bedrock, stones and cobbles in shallow waters to 2 m depth. Charophyte diversity is high in Irish hard water lakes and includes a number of rare and threatened species. A characteristic depth related vegetation zonation has also been described from Irish hard water lakes, with up to six distinct zones. This type of vegetation is uncommon in the EU and some of the best European examples occur in Ireland. As a result, Ireland has a special responsibility with respect to this habitat. This habitat is under significant pressure from eutrophication. The primary sources of pollutants include agriculture and municipal and industrial wastewaters and pollutant pathways through groundwater are a significant concern; in particular, the high phosphate concentration recorded in karst aquifers (EPA, 2015). The overall conservation status of this habitat has been assessed as Bad (NPWS, 2013).

*[3180] Turloughs*

Turloughs are depressions in karst limestone that temporarily and/or seasonally flood from groundwater. There is usually winter flooding, and recession of flood water during summer but there can be considerable variation in flooding regime. Turloughs are restricted to well-bedded, relatively pure karst Carboniferous limestone and are largely restricted to Ireland. They typically contain wetland vegetation communities in their lower zones, and communities more characteristic of drier limestone soils in their upper zones. They contain numerous specialist aquatic invertebrates and are important winter feeding grounds for several species of waterfowl and wading birds, with some of these species utilising the habitat for breeding. Pressures facing turloughs include agricultural intensification leading to increased nutrient run-off and

contamination of groundwater as well as drainage and climate change. The overall conservation status of Turloughs has been assessed as Inadequate (NPWS, 2013).

*[3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation*

Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260) (floating river vegetation) is characterised by the abundance of Water-Crowfoots (*Ranunculus* spp). Floating mats of these white-flowered species are characteristic of river channels in early to mid-summer. They may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals. The main pressures affecting river habitats in Ireland are damage through eutrophication and other processes linked to water pollution. The overall conservation status of this habitat has been assessed as Inadequate (NPWS, 2013).

*[7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae**

This priority habitat typically occurs in lowland topogenous basins associated with limestone groundwater bodies with a karstic or poorly productive flow regime. The habitat can also occur in other calcareous wetland types such as upland and lowland base-rich flushes, along the fringes of calcareous lakes and within turloughs. It typically occurs where *C. mariscus* stands are in contact with *Caricion davallianae* or other *Phragmition* species but in Ireland can also occur where monodominant or species-poor stands of *C. mariscus* merge with *Schoenetum nigricans*. The main pressures to this habitat are groundwater abstraction and pollution to surface waters. The overall conservation status of this habitat has been assessed as Unfavourable-Bad due to impaired structure and function (NPWS, 2013).

*[7220] Petrifying Springs with Tufa Formation (*Cratoneurion*)*

This habitat has been defined as springs and seepages where tufa is actively deposited and where characteristic species of bryophytes are dominant or abundant. Characteristic bryophyte species include *Palustriella commutata*, *P. falcata*, *Eucladium verticillatum*, *Pellia endiviifolia*, *Cratoneuron filicinum*, *Bryum pseudotriquetrum* and *Didymodon tophaceus*. Red Fescue (*Festuca rubra*), Carnation Sedge (*Carex panicea*) and Great Horsetail (*Equisetum telmateia*) are also characteristic. Petrifying springs are vulnerable to alterations in water quality or flow and intensification of landuse practices. The overall conservation status of this habitat has been assessed as Inadequate (NPWS, 2013).

*[7230] Alkaline Fens*

Alkaline fens are base-rich basin or flush fen systems with extensive areas of species-rich small sedge communities. The most extensive areas of alkaline fens in Ireland are thought to occur in lowland basins associated with limestone groundwater bodies with a karstic or poorly productive flow regime. Alkaline fens are vulnerable to land drainage and water abstractions within the immediate locality and wider catchment areas as well as groundwater and surface water pollution. The overall conservation status of Alkaline Fens has been assessed as Unfavourable-Bad (NPWS, 2013).

*Description of the Qualifying Interests of the East Burren Complex SAC: Annex II Species*

The East Burren Complex SAC is also designated for the presence of three Annex II animal species, listed in Table 5. Of these species, the construction and operational stages of the

Kilfenora WWTP upgrade project is assessed as having the potential to result in indirect impacts on groundwater and surface water dependent species *i.e.* Otter *via* groundwater and surface water pathways and changes in water quality. Potential for impacts on Lesser Horseshoe Bat *via* changes in water quality are not identified, given the absence of a complete source-pathway-receptor chain (refer to Impacts Section). Water quality does not threaten species which are not dependent on surface water and groundwater *e.g.* Marsh Fritillary for which the site has been selected. There is however potential for direct and indirect impacts on Annex II species occurring *ex situ* the SAC boundary arising from habitat loss, mortalities and disturbance.

Table 5: Species of Qualifying Interest for the East Burren Complex SAC

| Code   | Species  | Dependency | Connectivity via ZOI |
|--|--|------------|----------------------|
| [1065]   | Marsh Fritillary ( <i>Euphydryas aurinia</i> )           | T          | No                   |
| [1303]   | Lesser Horseshoe Bat ( <i>Rhinolophus hipposideros</i> ) | T          | No                   |
| [1355]   | Otter ( <i>Lutra lutra</i> )                             | SWD        | Yes                  |
| Note:<br>GWD = Groundwater Dependent<br>SWD = Surface Water Dependent<br>T = Terrestrial |  |            |                      |

#### Marsh Fritillary [1065]

According to National Parks and Wildlife Service (NPWS, 2013), knowledge of the distribution of Marsh Fritillary in Ireland is incomplete. Colonies can be found on many types of site and the habitat it occupies can be difficult to define. The presence of Devil's Bit Scabious (*Succisa pratensis*) is essential for Marsh Fritillary and they require a moderate to high coverage of the plant species (more than 3 plants per m<sup>2</sup>) growing in a low-growing unintensified sward with a height range of 10-25 cm and low cover of invasive scrub. Structural variation in the form of tussocks or hummocks may also be important as it is considered to provide support for the webs and allows the species to deal with variation in water levels and exposure (Woodrow & Allen 2012). Suitable habitat for Marsh Fritillary was not recorded during the field walkover study at the proposed WWTP development site or at the Ballybreen swallow hole. According to the National Biodiversity Data Centre there are no records for Marsh Fritillary from the 10 km Grid Square R19 which overlaps with the footprint of the proposed works. The overall conservation status of Marsh Fritillary in Ireland is Inadequate (NPWS, 2013).

Suitable habitat for Marsh Fritillary was not recorded within the footprint of the Kilfenora WWTP upgrade site, at the outfall location or along the proposed rising main/gravity pipeline route. There are no records with the NBDC for this species within the 10 km grid square which overlaps with Kilfenora WWTP. This species is recognised as having a population range of approximately 10 km; where the proposed works site is located at a distance of > 5.7 km from the SAC boundary at its closest point. However, in the absence of any direct impact on important Marsh Fritillary habitat; the absence of records of this species in the works area; and the conservation status of this species within the SAC as a whole; it is evaluated that there is sufficient isolation of the proposed works from the SAC population. No pathways for potential adverse effects on the conservation objectives or *ex situ* effects on the conservation status of this species are identified.

#### Lesser Horseshoe Bat [1303]

Ireland represents the most northerly and westerly limits of the Lesser Horseshoe Bat's (*Rhinolophus hipposideros*) distribution; confined to six west coast counties: Mayo, Galway,

Clare, Limerick, Cork and Kerry. They often roost in the attics of old or derelict buildings and typically hibernate in caves, souterrains, cellars and icehouses. This species relies on linear landscape features (e.g. treelines, stonewalls and hedgerows) to navigate and commute from roosts to feeding sites (Schofield, 2008). The bats forage on flying insects predominantly in deciduous woodland and riparian vegetation (Bontadina *et al.*, 2002, Motte & Libois, 2002). The East Burren SAC complex supports an internationally important population of Lesser Horseshoe Bat, with an estimated 400 individuals. There are two known nursery roosts, a transition roost and four known winter sites. The winter sites are all in natural limestone caves. Suitable habitat for Lesser Horseshoe Bat was not recorded at the WWTP site or along the rising main/gravity pipeline to the percolation area and discharge location during the field walkover survey. According to the National Biodiversity Data Centre records there are no records for Lesser Horseshoe Bat from the 10 km Grid Square R19 which overlaps with the footprint of the proposed works. The overall conservation status of Lesser Horseshoe Bat has been assessed as Favourable (NPWS, 2013).

Connectivity giving rise to adverse effects on the designated SAC population of Lesser Horseshoe Bats *via* changes in water quality are considered unlikely given the absence of a complete source-pathway-receptor chain. While Lesser Horseshoe Bats utilise caves, impacts from Suspended Solids and hydrocarbons in underground river systems are unlikely to impact on roosting bats. Suitable habitat for this species was not recorded during the field walkover survey. Construction works are unlikely to impact on the commuting/foraging corridor of this species within or associated with the SAC. It should be noted that there are no records with the NBDC for this species within the 10 km grid square which overlaps with Kilfenora WWTP. Although the foraging range of this species is *ca.* 6 km, the proposed development site lies at a distance of 5.7 km from the SAC boundary and does not comprise a preferential foraging site for this species. It is evaluated that the potential scale and extent of the works preclude any potential *ex situ* indirect impacts. No pathways for potential adverse effects on the conservation objectives or on the conservation status of this species are identified.

#### *Otter [1355]*

Otters (*Lutra lutra*) have two basic requirements: aquatic prey and safe refuges where they can breed and rest. This species is dependent on fish stocks which are ultimately dependent on water quality. No suitable habitat for Otter was recorded during the field walkover survey at the WWTP or at the fenced off swallow hole at Ballybreen. Suitable habitat is likely to present upstream of the swallow hole. According to the National Biodiversity Data Centre there are 2 No. records (Atlas of Mammals in Ireland 2010-2015) for Otter from the 10 km Grid Square R19 which overlaps with the footprint of the proposed works. Otter have been recorded regularly in the East Burren Complex SAC. The overall conservation status of Otter has been assessed as Good (NPWS, 2013).

#### **Corofin Wetlands SPA**

Corofin Wetlands SPA incorporates Inchiquin Lough, Lough Atedaun, Lough Cullaun and their associated calcareous wetlands. The site extends south-westwards to include the floodplain of the River Fergus to the west of Corofin, Co. Clare. The site contains some of the best areas of oligotrophic limestone wetlands to be found in the Burren. The site is also of special conservation interest for Wetlands and Waterbirds. The E.U. Birds Directive pays particular attention to wetlands and wetlands form an important part of this SPA. Corofin Wetlands also supports

nationally important numbers of Whooper Swan (127) and Black-tailed Godwit (329) and nationally important populations of Little Grebe (87), Wigeon (2,828) and Teal (800). Other species that occur include Mute Swan (223), Mallard (270), Gadwall (47), Shoveler (35), Tufted Duck (111), Coot (59), Golden Plover (56) and Curlew (222). The regular presence of Whooper Swan and Golden Plover is of note as both species are listed on Annex I of the E.U. Birds Directive.

Description of the Special Conservation Interests of Corofin Wetland SPA

Corofin Wetlands SPA supports five bird species of Special Conservation Interest (SCI) and associated supporting wetland habitats (see Table 6). Of these species, the construction and operation of the proposed upgrade to Kilfenora WWTP are assessed as having the potential to result in indirect impacts on groundwater and/or surface water dependent supporting wetland habitats *via* groundwater and surface water pathways due to changes in water quality. There is also potential for direct or indirect impacts on the SCIs arising from *ex situ* disturbance outside of the SPA boundary. While wet grassland (GS4) habitats which support these bird species was recorded during the field walkover survey the overall suitability of the habitat is considered low, given the absence of suitable open water bodies; furthermore, the proposed development and construction elements are at a distance of 8.6 km from the SPA.

Table 6: Special Conservation Interests of Corofin Wetland SPA

| Code  | Species  | Dependency | Status    | Connectivity via ZOI |
|---|--|------------|-----------|----------------------|
| A004  | Little Grebe ( <i>Tachybaptus ruficollis</i> ) | GWD/SWD    | Wintering | Yes                  |
| A038  | Whooper Swan ( <i>Cygnus cygnus</i> )          | GWD/SWD    | Wintering | Yes                  |
| A050  | Wigeon ( <i>Anas penelope</i> )                | GWD/SWD    | Wintering | Yes                  |
| A052  | Teal ( <i>Anas crecca</i> )                    | GWD/SWD    | Wintering | Yes                  |
| A156  | Black-tailed Godwit ( <i>Limosa limosa</i> )   | GWD/SWD    | Wintering | Yes                  |
| A999  | Wetlands                                       | GWD/SWD    |           | Yes                  |
| Note:   |  |            |           |                      |
| 1. GWDTE - Ground Water Dependent Terrestrial Ecosystem 2. CT- Coastal/Transitional |  |            |           |                      |
| 3. SW - Surface water dependent 4. T - Terrestrial                                  |  |            |           |                      |

**Inagh River Estuary SAC**

The Inagh River Estuary SAC is an estuarine channel that flows westwards to the sea from Ennistimon, in the south-west of Co. Clare. The site includes the estuaries of both the Inagh and Dealagh Rivers. These channels meander through a wide, flat valley, which is sheltered from the sea by an extensive sand dune system to the west. Low undulating hills surround the valley, giving it a secluded nature. The soils vary from gleys to peats. This is a large site with a range of coastal, tidal and terrestrial habitats that are of considerable ecological interest, five of which are listed under Annex I of the E.U. Habitats Directive.

Description of the Qualifying Interests of Inagh River Estuary SAC Annex I Habitats

The Inagh River Estuary SAC is designated for the presence of five Annex I habitats (Table 7). Of these habitats, the construction and operation of the proposed upgrade to Kilfenora WWTP is assessed as having the potential to result in indirect impacts on groundwater and/or surface water dependent habitats *via* groundwater and surface water pathways due to changes in water quality *i.e.* Salicornia Mud, Atlantic Salt Meadows and Mediterranean Salt Meadows. These

coastal/transitional habitats are located a significant distance (approx. 7.2 km) downstream of the WWTP. In this regard, the potential for adverse effects are limited to pathways for water quality impacts which would be of such magnitude to result in changes to the conservation status of these habitats. Water quality does not threaten other habitats which are terrestrial in nature *i.e.* Marram dunes and fixed dunes.

Table 7: Habitats of Qualifying Interest of the Inagh River Estuary SAC

| Code   | Habitat  | Dependency | Connectivity via Zone of Impact |
|--------|--|------------|---------------------------------|
| [1310] | Salicornia and other annuals colonising mud and sand | CT/SW      | Yes                             |
| [1330] | Atlantic Salt Meadows                                | GWDTE      | Yes                             |
| [1410] | Mediterranean Salt Meadows                           | GWDTE      | Yes                             |
| [2120] | Marram Dunes (White Dunes)                           | T          | No                              |
| [2130] | Fixed Dunes (Grey Dunes)*                            | T          | No                              |

Note:  
1. GWDTE - Ground Water Dependent Terrestrial Ecosystem 2. CT- Coastal/Transitional  
3. SW - Surface water dependent 4. T - Terrestrial

*[1310] Salicornia and other annuals colonising mud and sand*

This is a pioneer saltmarsh community. It occurs on muddy sediment seaward of established saltmarsh, or can form patches within other saltmarsh communities where the elevation is suitable and there is regular tidal inundation. It is dominated by annuals and can therefore be ephemeral or transient in nature. The main pressures facing this habitat are the spread of *Spartina anglica*, which is an invasive species of saltmarsh and mudflats (McCorry 2007, McCorry & Ryle 2009) and erosion and accretion. Other impacts can include grazing and eutrophication from sewage discharges (NPWS, 2013). The overall conservation status of this habitat has been assessed as Unfavourable-Inadequate (declining) In view of the on-going threat posed by the invasion and spread of *Spartina* (NPWS 2013).

*[1330] Atlantic Salt Meadows (Glauco-Puccinellietalia maritima)*

Atlantic salt meadows are distributed around most of the coastline of Ireland. They generally occupy the widest part of the saltmarsh gradient and have a distinctive topography formed by an intricate network of creeks and salt pans. Atlantic salt meadows are characterised by distinct zonation of vegetation as a result of elevation and submergence frequency. The three distinct zones are the lower marsh, dominated by common saltmarsh-grass (*Puccinellia maritima*) with species such as glasswort (*Salicornia* spp.) and annual sea-blite (*Suaeda maritima*) also present, mid marsh characterised by Thrift (*Armeria maritima*) and or Sea Plantain (*Plantago maritima*) and upper marsh characterised by red fescue (*Festuca rubra*), saltmarsh rush (*Juncus gerardi*) and creeping bent (*Agrostis stolonifera*). This habitat is also important for other wildlife including wintering waders and wildfowl. The most common pressure facing Atlantic Salt Meadows is overgrazing with the spread of *Spartina anglica* also representing a threat (NPWS, 2013). The current conservation status of Atlantic Salt Meadows has been assessed as Inadequate, nutrient enrichment from freshwater is not identified as a pressure, neither are nutrient criteria provided for conservation status (NPWS, 2013).

*[1410] Mediterranean Salt Meadows (Juncetalia maritimi)*

Mediterranean salt meadows occupy the upper zone of saltmarshes and usually occur adjacent to the boundary with terrestrial habitats. They are widespread on the Irish coastline; however,

they are not as extensive as Atlantic salt meadows. The overall conservation status of this habitat has been assessed as Unfavourable-Inadequate (stable), nutrient enrichment from freshwater is not identified as a pressure, neither are nutrient criteria provided for conservation status (NPWS, 2013).

## Conservation Objectives of the European Sites

Article 6(3) of the EC Habitats Directive (1992) states that:

*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.*

The importance of a site designated under the Habitats Directive is defined by its qualifying features or interests. Qualifying interests for any Natura 2000 site are listed on a *pro forma*, called the Natura 2000 standard data form, which forms the basis of the rationale behind designation, and informs the Conservation Management Plan for targeted management and monitoring of key species and habitats.

### East Burren Complex SAC Conservation Objectives

The generic conservation objective (NPWS, 2016a)<sup>4</sup> of the East Burren Complex SAC is: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected:

- [1065] *Euphydryas (Eurodryas aurinia)* Marsh Fritillary
- [1303] *Rhinolophus hipposideros* Lesser Horseshoe Bat
- [1355] *Lutra lutra* Otter
- [3140] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.
- [3180] \*Turloughs
- [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation
- [4060] Alpine and Boreal heaths
- [5130] *Juniperus communis* formations on heaths or calcareous grasslands
- [6130] Calaminarian grasslands of the *Violetalia calaminariae*
- [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*)(\*important orchid sites)
- [6510] Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)
- [7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davillinae*
- [7220] \*Petrifying springs with tufa formation (*Cratoneurion*)
- [7230] Alkaline fens
- [8240] Limestone pavements\*
- [8310] Caves not open to the public
- [91E0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)\*

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<sup>4</sup>NPWS (2018) Conservation objectives for East Burren Complex SAC [001926]. Generic Version 6.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

Of these Qualifying Interests, the following have been identified as being connected to the proposed WWTP upgrade works *via* groundwater / surface water pathways:

- Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp; \*Turloughs; Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation; Calcareous fens with *Cladium mariscus* and species of the *Caricion davillinae*; \*Petrifying springs with tufa formation (*Cratoneurion*); Alkaline fens; and Otter (*Lutra lutra*).  
(\* denotes a priority habitat)

### Corofin Wetlands SPA Conservation Objectives

The generic conservation objectives (NPWS, 2016b)<sup>5</sup> for the Corofin Wetland SPA is: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:

- A004 Little Grebe (*Tachybaptus ruficollis*)
- A038 Whooper Swan (*Cygnus cygnus*)
- A050 Wigeon (*Anas penelope*)
- A052 Teal (*Anas crecca*)
- A156 Black-tailed Godwit (*Limosa limosa*)

Of the above Special Conservation Interests, all are identified as being water-dependant and hydrologically connected to the proposed WWTP upgrade works *via* groundwater / surface water pathways.

### Inagh River Estuary SAC Conservation Objectives

The Inagh River Estuary has site-specific conservation objectives (NPWS, 2017)<sup>6</sup> attributed to define favourable conservation condition for a particular habitat or species at that site. These are summarised in Table 8 for each QI.

Table 8: Summary of Conservation Objectives for the Inagh River Estuary SAC, from NPWS (2017).

| Conservation Objectives   | Attribute   | Target / Notes  | Connectivity within Zone of Impact         |
|---|---|---|--|
| To restore the favourable conservation condition of:<br>[1310] <i>Salicornia</i> and other annuals colonising mud and sand;<br>[1330] Atlantic salt meadows | Habitat area (Ha)                                 | Area stable or increasing, based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007; McCorry and Ryle, 2009).           | Nutrient influence, potential connectivity |
|   | Habitat distribution (Occurrence)                 | No decline or change in habitat distribution, based on McCorry, 2007; McCorry and Ryle, 2009.   | Nutrient influence, potential connectivity |
|   | Physical structure: Sediment supply/ Creeks/pans/ | Maintain, or where necessary restore, natural circulation of sediments and organic matter / Maintain creek and pan structure / Maintain | Processes not connected.                   |

<sup>5</sup>NPWS (2018) Conservation objectives for Corofin Wetlands SPA [004220]. Generic Version 6.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

<sup>6</sup>NPWS (2017) Conservation Objectives: Inagh River Estuary SAC 000036. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

| Conservation Objectives   | Attribute   | Target / Notes  | Connectivity within Zone of Impact         |
|---|---|---|--|
| (Glauco-Puccinellietalia maritima); [1410] Mediterranean salt meadows (Juncetalia maritimi)   | Flooding regime   | natural tidal regime  |  |
|   | Vegetation Structure: Zonation/ Vegetation height/ Vegetation cover                                 | Maintain the range of coastal habitats including transitional zones / Maintain structural variation within sward / Maintain more than 90% of the area outside of creeks vegetated.  | Nutrient influence, potential connectivity |
|   | Vegetation Composition: Typical species/ Negative indicator species                                 | Maintain the presence of species-poor communities with typical species. There is no record of common cordgrass ( <i>Spartina anglica</i> ) in the SAC and its establishment should be prevented   | Nutrient influence, potential connectivity |
| To restore the favourable conservation condition of: [2120] Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) | Habitat area (Ha)   | Area stable or increasing, based on data from the Coastal Monitoring Project (CMP) (Ryle <i>et al.</i> , 2009).   | No connectivity                            |
|   | Habitat distribution (Occurrence)   | No decline or change in habitat distribution, based on (Ryle <i>et al.</i> , 2009).   |  |
|   | Physical structure: Functionality and sediment supply   | Maintain natural circulation of sediments and organic matter.   |  |
|   | Vegetation Structure: Zonation  | Maintain the range of coastal habitats including transitional zones.  |  |
|   | Vegetation Composition: Plant health of dune grasses / Typical species / Negative indicator species | More than 95% of marram grass ( <i>Ammophila arenaria</i> ) and/or lymegrass ( <i>Leymus arenarius</i> ) should be healthy ( <i>i.e.</i> green plant parts above ground and flowering heads present). Maintain the presence of species-poor communities dominated by marram grass ( <i>Ammophila arenaria</i> ) and/or lymegrass ( <i>Leymus arenarius</i> ). Negative indicator species (including non-native species) to represent less than 5% cover |  |
| To restore the favourable conservation condition of: [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes)                     | Habitat area (Ha)   | Area stable or increasing, based on data from the Coastal Monitoring Project (CMP) (Ryle <i>et al.</i> , 2009).   | No connectivity                            |
|   | Habitat distribution (Occurrence)   | No decline or change in habitat distribution, based on (Ryle <i>et al.</i> , 2009).   |  |
|   | Physical structure: Functionality and sediment supply   | Maintain natural circulation of sediments and organic matter.   |  |
|   | Vegetation Structure: Zonation/ Bare ground/ Sward height   | Maintain the range of coastal habitats including transitional zones. Bare ground should not exceed 10% of fixed dune habitat. Maintain structural variation within sward  |  |
|   | Vegetation Composition: Typical species/ Negative indicator species                                 | Percentage cover at a representative number of monitoring stops. Maintain range of subcommunities with typical species listed in Delaney <i>et al.</i> (2013). Negative indicator species (including non-native species) to represent less than 5% cover  |  |

## Impact Prediction

### Construction Phase Impacts

#### *Impacts affecting Annex I habitats*

The groundwater and surface water dependent qualifying interests and special conservation interests of the East Burren Complex SAC, Corofin Wetlands SPA and Inagh River Estuary SAC are directly dependant on the water quality of groundwater and surface water habitats. According to Geosyntec (2014) fissured limestone comprising large open conduits can transport groundwater great distances over relatively short periods of time, identifying a pathway for effects. Groundwater pathways with connectivity to surface water between Kilfenora WWTP and the qualifying interests of these European Sites have been identified, all of which are located down-gradient on the identified groundwater flowpaths.

During construction, and in the absence of best practice site management measures, there is potential for the accidental release of silt laden waters and hydrocarbons during site works. The excavation for the percolation area is identified as having the potential to meet groundwater and thus require management of suspended solids discharges to groundwater. The impacts from silt laden waters during construction is considered to be temporary in nature.

The presence of plant machinery may result in the accidental release of hydrocarbons, e.g. during refuelling and maintenance activities or in the absence of maintenance. The risk of spillage of hydrocarbons is considered unlikely, with the implementation of avoidance measures and in the absence of works within the aquatic environment; however, the impact could potentially be significant. Hydrocarbons can directly affect the breathing / respiration of aquatic organisms as well as a deterioration in supporting aquatic habitats. Impacts arising from the accidental spillage or release of hydrocarbons and other chemicals could result in impacts on riverine and lacustrine plant communities. Mitigation measures are prescribed to avoid such effects during the construction phase.

#### *Impacts affecting Annex II Species*

Water pollution represents one of the principal threats to otter survival in Ireland (Reid *et al*, 2013). Although Otters can tolerate significant levels of pollution (Chanin, 2003; Bailey & Rochford, 2005), poor water quality affects the abundance and diversity of forage fish species with consequences for Otter. There is potential for temporary water quality impacts during the construction phase to affect downstream / down gradient surface water features. Suspended Solids releases would potentially affect instream macroinvertebrates and fish species, with adverse effects on otter food supply. The accidental release of hydrocarbons could also impact on fish stocks, and directly on individual otters; however, the risk of a large hydrocarbon spillage is considered to be low. Mitigation is required to avoid water quality impacts arising during construction works.

#### *Impacts on Special Conservation Interests of SPAs*

Potential impacts on the Special Conservation Interests of Corofin Wetland SPA during the construction stage include the release of Suspended Solids which could result changes in riverine and lacustrine plant and invertebrate communities and a reduced foraging area for birds. The release of hydrocarbons could also impact on the extent of foraging area for birds and directly on the birds themselves; however, the risk of any significant hydrocarbon spillage is

considered to be low; mitigation measures are prescribed to avoid such effects during the construction phase.

### **Operation Phase Impacts**

Existing pressures on the groundwater bodies and catchments pose the greatest risk to the conservation objectives of these European Sites, which may interact cumulatively or in combination with the operational discharge of the proposed WWTP upgrade. Existing water quality pressures which may interact cumulatively with the proposed operational discharge, and give rise to cumulative effects on the water dependent qualifying habitats and species listed for SAC and SPA sites may result from the following:

- Chemical fertiliser application to agricultural lands (the main fertilisers in use supply nitrogen, phosphorus, potassium and sulphur)
- Agricultural practices such as ploughing leads to greater mineralisation and nitrification, and in the case of old grassland, it can result in an increase in the release of nitrogen over a number of years (OECD, 1986)
- Artificial drainage increases nitrate leaching and reduce the morphological qualities of watercourses, thereby reducing the quality of habitat for flora and fauna
- Forestry may alter water quality indirectly through increased evaporation losses and hence an increase in solute concentrations
- On-site waste water treatment systems, poorly performing septic tank units and other small effluent systems can be significant sources of nutrients to rivers.
- Point pressures including Section 4 licenced facilities and IPPC licenced facilities
- Peat siltation due to peat harvesting, over-grazing by sheep leading to erosion and forestry practices in the hills during planting and harvesting operations

In the absence of a Conservation Objectives Supporting Document for designated European Site, Pressures and Threats can be extracted from the relevant Natura 2000 Standard Data Form under the section '*Vulnerability*' and the Site Synopsis where such details have been recorded in the documents. Further data is presented in the online WFD platform ([www.catchments.ie](http://www.catchments.ie)) which identifies agriculture and anthropogenic pressures affecting the groundwater bodies within the Ennis GWB (E\_SH\_G\_080) which is hydrologically and hydrogeologically connected to the Kilfenora WWTP discharge. The River Fergus upstream of the East Burren Complex SAC and Corofin Wetlands SPA, and downstream of connectivity to the Kilfenora WWTP discharge, is evaluated as being at '*Good* ecological status' from 2016 monitoring. Similarly, the next station upstream on the Cloneen Stream was also evaluated as being at '*Good*' status in 2016. The chemical water quality monitoring for the Fergus at Riverstown Bridge and Popular Bridge indicate nutrient parameters generally between '*Good*' to '*High*' status.

According to the Natura 2000 Standard Data Form for the East Burren Complex SAC the main threat to this site is from agricultural improvement activities, these involve clearance of limestone pavement and associated habitats (heaths and grassland), subsequent reseeding, fertilisation and then grazing. Heavy grazing pressures is a threat to the lowland areas of the site. The water quality of the various wetlands is vulnerable to run-off from agricultural lands (NPWS, 1997). The Site Synopsis states that clearance and intensification of agriculture has caused damage to some parts of the site. This threatens the heath and scrub communities and may cause eutrophication (nutrient enrichment) of the lakelands to the east. Drainage and land reclamation

have occurred in places around the edges of wetlands, while some marginal fen areas have been afforested. Areas of agriculturally-improved land have been included within the site in order to protect the hydrology and nutrient status of the wetland system (NPWS, 2013). According to the Natura 2000 Standard Data Form for the Corofin Wetland SPA there are no known threats to the site (NPWS, 2010).

The Natura 2000 Standard Data Form for the Inagh River Estuary SAC (NPWS, 1999) does not identify any potential impacts *via* surface or groundwater pathways. Based on the Conservation Objectives (NPWS, 2017) the area of fixed dune within the site is threatened by sand removal and recreational pressures. Tourism is very important in the area and there have already been developments such as golf courses, caravan parks and holiday homes around the site. Such developments continue to threaten the site. Most of the wet grassland and salt marsh is grazed by cattle, intensification of this activity and associated land improvement, is a threat.

According to the West Clare WMU Action Plan (2010) water quality in the River Dealagh is in decline; agriculture is the main pressure with localised impacts, e.g. cattle access in places. The Shannon River Basin District Transitional and Coastal Waters Action Programme (2010) lists the Inagh River Estuary SAC as a waterbody at risk, or probably at risk, from land-based point source pressures and identifies WWTPs as the point source. From a review of EPA data (available on [www.catchments.ie](http://www.catchments.ie)), it is noted that Kilfenora WWTP is not listed specifically as a pressure within the surface water or groundwater catchments. The River Dealagh between Smithstown Bridge and Aughvackeen Bridge are evaluated as being at 'Good Status' according to EPA monitoring. Due to limited hydrological and hydrogeological connectivity to the Inagh River Estuary SAC, except under peak flow, the potential for a consequential effect is excluded due to the distance of separation; the high dilution factors in place under such a peak flow event; in addition to the fact that the current discharge is not compromising water quality at this designation, alone or in combination in view of the improved discharge values proposed from the upgraded WWTP.

#### *Impacts on Annex I Habitats*

Water quality strongly influence the species composition, extent and condition of river and lake habitats and associated plant and animal communities, the key parameters include alkalinity, Orthophosphate and Total Phosphorous, Ammonia, Potassium and Suspended Solids. The groundwater and surface water dependant habitats of the East Burren Complex SAC and Corofin Wetlands SPA (in particular open bodies of water) e.g. turloughs, hard water lakes and alkaline fens are identified as being sensitive receptors with regard to potential releases of both nutrient loading and operational suspended solids releases, which may affect plant life, photosynthesis and alteration to species composition. Based upon a review of the water quality within the groundwater and surface water catchments which would have the potential to affect the Annex I habitats of the East Burren SAC and the wetland habitat of the SPA, it has been concluded that the current discharge is not currently affecting the conservation status of either of these sites, with '*good status*' water quality identified downstream of the existing discharge. In this respect, it is evaluated that the proposed improvement to the discharge effluent quality will result in a significant improvement in effluent quality, thus reducing the potential for cumulative and in combination pressures on these European Sites with regard to the water quality within the wider catchment.

The coastal and transitional habitats listed as QIs for the Inagh River Estuary SAC are located ca. 7.2 km downstream of any hydrological connection with the proposed Kilfenora WWTP

upgrade works. Although the habitats listed as QIs for the site are identified as being nutrient sensitive and water-dependent, it is also acknowledged that the saltmarsh and sand/mud flat habitats are tolerant of elevated Suspended Solids. Furthermore, the Annex I dune habitats are not directly connected to any potential pathways for water quality impacts associated with this project, and due to distance will not be indirectly affected.

### **Summary of Potential Impacts**

Table 9 presents a summary of the potential impacts arising during construction and operation of the proposed Kilfenora WWTP upgrade, as described above, with regard to the qualifying interests / special conservation interests of the respective European Sites.

Table 9: Habitats listed as QIs/SCIs potentially impacted by the Kilfenora WWTP upgrade

| Qualifying Habitats   | Distance of Separation | Connectivity and Potential Impacts  | Brief Explanation  | Mitigation required |
|---|------------------------|---|--|---------------------|
| <i>East Burren Complex SAC</i>                              |                        | 9.6 km  |  |                     |
| Hard Water Lakes  |                        | Yes - indirect  | <p><i>Construction</i><br/>Water-dependant Annex I habitats within this designation are downstream of the proposed works. Potential construction phase pollution events, such as suspended solids or hydrocarbon discharges, in the absence of mitigation, may affect the conservation status of these habitats.</p> <p><i>Operation</i><br/>The long-term operational discharge from the upgraded WWTP has the potential to affect water quality within the groundwater body which is hydrogeologically connected to this SAC. However, the proposed project design and compliance with the discharge standards has been evaluated as comprising appropriate limits to avoid discharge related inputs which would affect the conservation status of these Annex I habitats, with regard to their conservation objectives. This evaluation is with cognisance of the imperceptible effect of the existing discharge which does not affect the SAC currently, and the significant improvement proposed.</p> | Yes                 |
| Turloughs *   |                        | Yes - indirect  |  | Yes                 |
| Floating River Vegetation                                   |                        | Yes - indirect  |  | Yes                 |
| Cladium Fens*   |                        | Yes - indirect  |  | Yes                 |
| Petrifying Springs with Tufa formation*                     |                        | Yes - indirect  |  | Yes                 |
| Alkaline Fens   |                        | Yes - indirect  |  | Yes                 |
| Otter   | Yes - indirect         | <p><i>Construction</i><br/>Potential for suspended solids or hydrocarbon pollution to affect the River Fergus system downstream with impacts resulting in reduced foraging area and fish stocks which, in the absence of mitigation, would have the potential to affect the conservation status of otter within the SAC.</p> <p><i>Operation</i><br/>The long-term operational discharge from the upgraded WWTP has the potential to affect water quality within the groundwater body which is hydrogeologically connected to this SAC. However, the proposed project design and compliance with the discharge standards has been evaluated as comprising appropriate limits to avoid discharge related inputs which would affect the conservation status of otter, with regard to its conservation objectives.</p> | Yes  |                     |
| <i>Inagh River Estuary SAC</i>                              |                        | 7.2 km  |  |                     |
| <i>Salicornia</i> and other annuals colonising mud and sand |                        | Yes - indirect  | <p><i>Construction</i><br/>There is a potential pathway for pollutants to impact on the Annex I habitats of this SAC during the construction of the proposed upgrade to the WWTP via the accidental release of hydrocarbons or suspended solids. However, taking account of the short temporal potential for connectivity to the Dealagh River, the distance of approx. 7.2 km downstream and the absence of significant nutrient pressures affecting these habitats, it is evaluated that potential significant adverse effects (indirect or cumulative) are unlikely. Mitigation measures are prescribed to avoid impacts during construction.</p> <p><i>Operation</i></p>   | Yes                 |
| Atlantic Salt Meadows                                       |                        | Yes - indirect  |  | Yes                 |
| Mediterranean Salt Meadows                                  |                        | Yes - indirect  |  | Yes                 |

| Qualifying Habitats                               | Distance of Separation | Connectivity and Potential Impacts | Brief Explanation  | Mitigation required |
|---|------------------------|------------------------------------|--|---------------------|
|   |                        |                                    | The long-term operational discharge from the upgraded WWTP has limited potential to affect water quality within the Dealagh River, which is connected to this SAC. However, the proposed project design and compliance with the discharge standards has been evaluated as comprising appropriate limits to avoid discharge related inputs which would affect the conservation status these habitats, with regard to their conservation objectives. This evaluation is with cognisance of the imperceptible effect of the existing discharge which does not affect the SAC currently, and the significant improvement proposed.   |                     |
| <i>Corofin Wetlands SPA</i>                       | 8.6 km                 |                                    |  |                     |
| SPA Wetland habitat                               |                        | Yes - indirect                     | <p><i>Construction</i><br/>Water-dependant wetland habitats within this designation are downstream of the proposed works. Potential construction phase pollution events, such as suspended solids or hydrocarbon discharges, in the absence of mitigation, may affect the conservation status of these habitats.</p> <p><i>Operation</i><br/>The long-term operational discharge from the upgraded WWTP has the potential to affect water quality within the groundwater body which is hydrogeologically connected to this SPA. However, the proposed project design and compliance with the discharge standards has been evaluated as comprising appropriate limits to avoid discharge related inputs which would affect the conservation status of these Annex I habitats, with regard to their conservation objectives. This evaluation is with cognisance of the imperceptible effect of the existing discharge which does not affect the SPA currently, and the significant improvement proposed.</p> | Yes                 |
| Little Grebe<br>( <i>Tachybaptis ruficollis</i> ) |                        | Yes - indirect                     | <p><i>Construction</i><br/>Potential for reduced foraging area due to changes in plant and invertebrate communities due to the potential for accidental release of Suspended Solids or hydrocarbons affecting habitat for this species within the SPA downstream, in the absence of mitigation.</p> <p><i>Operation</i><br/>The long-term operational discharge from the upgraded WWTP has the potential to affect water quality within the groundwater body which is hydrogeologically connected to this SPA. However, the proposed project design and compliance with the discharge standards has been evaluated as comprising appropriate limits to avoid discharge related inputs which would affect the conservation status of these SCI species, with regard to the conservation objectives of the SPA.</p>  | Yes                 |
| Whooper Swan<br>( <i>Cygnus cygnus</i> )          | Yes - indirect         |                                    |  |                     |
| Wigeon<br>( <i>Anas penelope</i> )                | Yes - indirect         |                                    |  |                     |
| Teal ( <i>Anas crecca</i> )                       | Yes - indirect         |                                    |  |                     |
| Black-tailed Godwit<br>( <i>Limosa limosa</i> )   | Yes - indirect         |                                    |  |                     |

## Mitigation Measures

### Construction Phase Mitigation Measures

Avoidance and mitigation measures required to prevent significant impacts affecting European Sites downstream of the project during the construction of the upgrade to the existing WWTP, percolation area and discharge rising main/gravity pipeline are as follows:

- The Contractor nominated to carry out the works will follow good site practice in accordance with Section 3 of the Local Government (Water Pollution) Act, 1977, which states a general prohibition on the entry of polluting matter to waters.
- Throughout the works, the Contractor will take account of all relevant legislation and best practice UK CIRIA guidance including but not limited to the following:
  - C532 Control of water pollution from construction sites: guidance for consultants and contractors;
  - SP156 Control of water pollution from construction sites – guide to good practice.
  - C648 Control of water pollution from linear construction projects;
- The Contractor will be required to prepare and agree a detailed Construction Environmental Management Plan (EMP) with Irish Water prior to construction works commencing on site. An Environmental Emergency Preparedness and Response Plan will form part of this EMP.
- All plant and machinery will be regularly maintained and serviced to minimise release of hydrocarbons. Spill kits will be present in all plant machinery. Used engine oil and hydraulic oil will be disposed of by a licensed waste handler. All refuelling will take place off site on sealed and bunded surfaces in order to avoid the potential for accidental spillage of hydrocarbons.
- Silt laden waters will not be permitted to access local karstified features or watercourses. The following measures are proposed to ensure that suspended sediment impacts affecting groundwater (and subsequently surface water within any European Site) are avoided:
  - The nearest hydrologically connected European Site is 7.2 km downstream; however, due to the hydrogeological connectivity, it is proposed that a series of water quality treatment measures are implemented on site.
  - Direct discharges of water from the site will be avoided through the use of surface water containment features including silt fences, silt bags and mobile settlement tanks. Excavated settlement ponds will not be constructed given the aquifer vulnerability of *'extreme with rock at surface/Karst features'* for the Miltown Malbay\_2 Groundwater Body (GWB) as they are unlikely to function effectively with potential risks to groundwater. However, surface features will be employed which will retain silty water and allow settlement and percolation above ground. These will be constructed using layers of silt-fence material which increases retention time and will achieve adequate settlement prior to percolation off site.
  - In the event that the contractor encounters groundwater during any excavation activities on site, this will be discharged clean to the swallow hole adjacent to the WWTP. Where contamination of groundwater with suspended solids occurs, a silt buster or equivalent preliminary treatment system will be deployed to allow settlement of fine silt material before discharge over ground. It is proposed to discharge to agricultural grassland adjacent to the site to allow further

dispersion and percolation. Retention areas to increase settlement of silty water will be constructed using silt fencing dug into the ground, as per the manufacturers guidelines.

- The contractor will be required to keep any contamination of the groundwater during excavation to a minimum; thus returning the same groundwater back to where it came from in the first place. There will be no bacteriological or nutrient inputs affecting groundwater arising from the construction activities. The implementation of the proposed measures will avoid the potential for significant suspended solids contamination affecting designated European Sites at a distance downstream.
- The required concrete pouring events will be scheduled to avoid wet weather windows. Simultaneous, large concrete pours will be avoided during the construction stage to minimise the risks to groundwater. No pouring of concrete will be allowed in contact with groundwater.
- The site compound will be constructed on an existing sealed area and bunded due to the risk of accidental spillage of hydrocarbons to groundwater from parked vehicles. Locally sourced soil and stone (limestone) will be sourced for the construction of the access of haul road. Any waste arising from the construction works will be disposed of to a licensed waste facility by a licensed waste handler.

Mitigation measures for incorporation into the Kilfenora WWTP upgrade project scope for the protection of localised ecological interests have been identified, and are included here, although their delivery and implementation is not pertinent to the protection of or avoidance of impacts to any designated European Site.

- Locally sourced or Irish provenance native grass seed mix will be utilised in the landscaping of the percolation area for landscape and visual purposes. In the absence of a source of Irish provenance material, natural recolonisation of native semi-natural grasslands will be accommodated as part of the maintenance of the percolation area. Locally sourced soil and stone should be utilised where feasible in the design of the percolation area and any access road required. Tree whips using native species of Irish provenance should be utilised in any landscape planting screening mix which will reflect the species mix and percentage species composition of existing hedgerows and tree-lines in the adjacent landscape.
- The Irish Water standard protocol for management of Invasive Alien Species should be employed to manage Japanese knotweed identified within proximity to the access route to the site. Management on lands not owned by Irish Water is not within the remit of this project; however, a detailed Invasive Species Management Plan following IW protocols will be prepared to cover the locations where invasive species have been identified within 25 m of the working area to include the Kilfenora WWTP, existing effluent and discharge location (NOD, 2016<sup>7</sup>). This is to ensure that the proposed works do not result in the localised spread and introduction of invasive species. The Plan will prescribe detailed site-specific management measures in the treatment and control of invasive species during the construction phase.

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<sup>7</sup> NO'D (2016). Kilfenora Wastewater Treatment Plant and Network Upgrade: Invasive Species Survey. Consultant's report prepared by Nicholas O'Dwyer on behalf of Irish Water.

- Temporary site lighting must accommodate foraging bats, lighting will require direction away from foraging corridors, be limited to work-specific areas and be shielded to minimise spill in order to avoid impacts to foraging/commuting bats.

### **Operation Phase Monitoring**

Standard operational monitoring and ongoing site management will be implemented at the proposed Kilfenora WWTP upgrade site, to ensure continuous compliance with the proposed discharge standards and also to allow for the collection of data to demonstrate achievement of the design parameters.

All results will be available for inspection on request by authorised persons of the EPA in compliance with the CoA conditions.

## **Natura Impact Statement Conclusion to Inform Appropriate Assessment**

This NIS has been prepared to inform the Appropriate Assessment process required to be completed by the EPA with regard to the Wastewater Discharge Certificate of Authorisation. This report has been prepared following standard guidance (EPA 2009; NPWS 2010), with reference to the requirements of Article 6(3) of the EC Habitats Directive (1992). The NIS investigates the potential adverse effects on the qualifying interests of the Natura 2000 network arising from the proposed Kilfenora WWTP upgrade works, in combination with other plans/projects, which would potentially affect the qualifying interests and conservation objectives of these European Sites. The assessment considers whether the proposed WWTP upgrade works: including the integration of a percolation area; the existing treated effluent rising main/gravity pipeline decommissioning and replacement works; and the improved operational discharge standards, alone or in combination with other projects or plans, will have adverse effects on the *integrity* of any European Site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects.

With the implementation of the proposed mitigation measures, in addition to compliance with the proposed improved discharge standards, it is concluded that there will be no significant adverse effects on the integrity of any European Site, with particular cognisance of the water-dependant qualifying interests of those designations hydrologically connected to the WWTP discharge, *i.e.*: the East Burren Complex SAC; Corofin Wetlands SPA; and Inagh River Estuary SAC. This conclusion has been evaluated in view of their conservation objectives and the conservation status of the habitats and species listed as Qualifying Interests / Special Conservation Interests for these sites.

It is concluded that the construction and operation of the Kilfenora WWTP upgrade works, alone or in-combination with other plans and/or projects will not give rise to significant effects on the integrity of any European Site, contingent on the implementation of the mitigation measures as specified above. On this basis, further assessment is not considered necessary with regard to the requirements of Article 6(3) of the EC Habitats Directive (1992).

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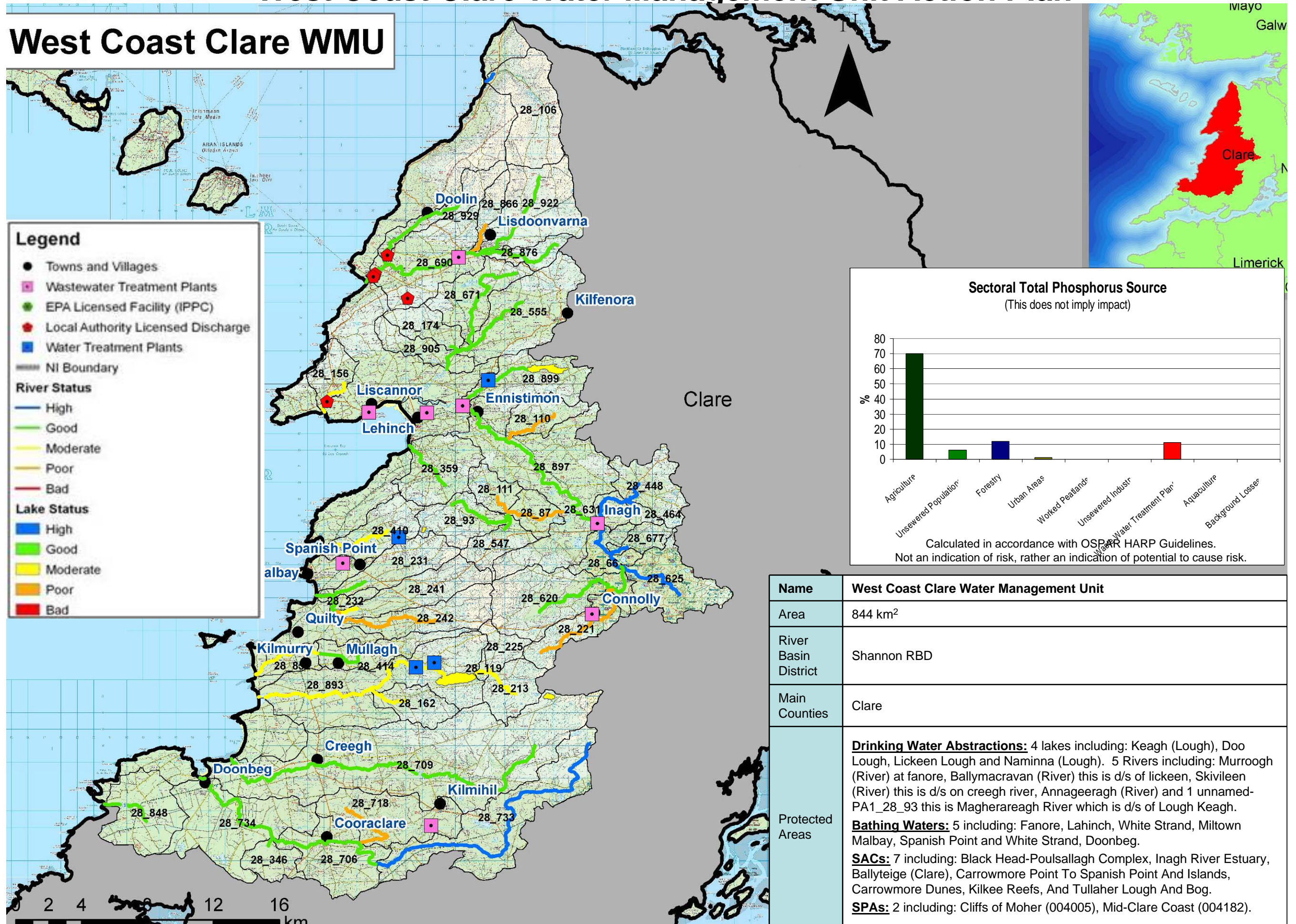
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## Appendix A - Waste Assimilative Capacity (WAC) Calculation

| Waste Assimilative Capacity (WAC) Calculation                         |                        |   |                                  | Calculation Sheet                                |   |              |              |
|---|------------------------|---|----------------------------------|--|---|--------------|--------------|
|   |                        |   | Date                             |  | 19/10/2017                              |              |              |
| WWTP  | Kilfenora              |   |                                  |  |   |              |              |
| Name of River   | Fergus                 |   |                                  |  |   |              |              |
| Dry Weather Flow  |                        | Data Source   | m <sup>3</sup> /d                | 0  |   |              |              |
| 95% Flow  | 0.226                  | <a href="http://www.epa.ie/hydronet/#27027">http://www.epa.ie/hydronet/#27027</a> |                                  | 19,526   |   |              |              |
| Mean Annual Flow  |                        |   |                                  | 0  |   |              |              |
| <b>Achievable Effluent Standards</b>                                  |                        | (Notional)  | (Actual)                         |  |   |              |              |
| Carbonaceous BOD  |                        | 25.000  | 10.000                           | mg/l   |   |              |              |
| Ammonia   |                        | 2.300   | 1.900                            | mg/l   |   |              |              |
| Ortho Phosphate (OP)  |                        | 1.200   | 0.900                            | mg/l   |   |              |              |
| <b>Average Background Concentration (Notional)</b>                    |                        |   |                                  | <b>Average Background Concentration (Actual)</b> |   |              |              |
| Parameter   | mg/l                   | Data Source   | mg/l                             | Data Source                                      |   |              |              |
| Carbonaceous BOD  | 0.260                  | EPA Notionally Clean  | 2.02                             | Clare CoCo                                       | 2013-2015                               |              |              |
| Ammonia   | 0.008                  | EPA Notionally Clean  | 0.03                             | Clare CoCo                                       | 2013-2016                               |              |              |
| Ortho Phosphate (OP)  | 0.005                  | EPA Notionally Clean  | 0.02                             | Clare CoCo                                       | 2013-2017                               |              |              |
| <b>Allowable Downstream Concentration (Surface Water Regulations)</b> |                        |   |                                  |  |   |              |              |
| Parameter   | 95%ile mg/l            | Mean mg/l   | Data Ref                         |  |   |              |              |
| Carbonaceous BOD  | 2.60                   | 1.50  | Surface Water Regs (Good Status) |  |   |              |              |
| Ammonia   | 0.14                   | 0.065   | Surface Water Regs (Good Status) |  |   |              |              |
| Ortho Phosphate (OP)  | 0.075                  | 0.035   | Surface Water Regs (Good Status) |  |   |              |              |
| <b>PE</b>   | <b>WWTP Daily Flow</b> | <b>Allowable effluent conc (Notionally Clean)</b>                                 |                                  |  | <b>Allowable effluent conc (Actual)</b> |              |              |
|   |                        | BOD   | NH                               | OP   | BOD                                     | NH           | OP           |
|   | m <sup>3</sup> /d      | mg/l  | mg/l                             | mg/l   | mg/l                                    | mg/l         | mg/l         |
| <b>330</b>  | 59                     | <b>771.82</b>   | <b>43.53</b>                     | <b>23.09</b>                                     | <b>193.26</b>                           | <b>37.41</b> | <b>17.66</b> |
| <b>PE</b>   | <b>WWTP Daily Flow</b> | <b>WAC (Notionally Clean)</b>   |                                  |  | <b>WAC (Actual)</b>                     |              |              |
|   |                        | BOD   |                                  |  | BOD                                     | NH           | OP           |
|   | m <sup>3</sup> /d      | kg/d  | kg/d                             | kg/d   | kg/d                                    | kg/d         | kg/d         |
| <b>330</b>  | 59                     | <b>45.85</b>  | <b>2.59</b>                      | <b>1.37</b>                                      | <b>11.48</b>                            | <b>2.22</b>  | <b>1.05</b>  |
| <b>PE</b>   | <b>WWTP Daily Flow</b> | <b>Resultant Concentration (Notionally Clean)</b>                                 |                                  |  | <b>Resultant Concentration (Actual)</b> |              |              |
|   |                        | BOD   | NH                               | OP   | BOD                                     | NH           | OP           |
|   | m <sup>3</sup> /d      | mg/l  | mg/l                             | mg/l   | mg/l                                    | mg/l         | mg/l         |
| <b>330</b>  | 59                     | <b>0.34</b>   | <b>0.015</b>                     | <b>0.009</b>                                     | <b>2.0503</b>                           | <b>0.032</b> | <b>0.024</b> |
|   |                        | Acceptable  | Acceptable                       | Acceptable                                       | Acceptable                              | Acceptable   | Acceptable   |

# West Coast Clare Water Management Unit Action Plan

## West Coast Clare WMU



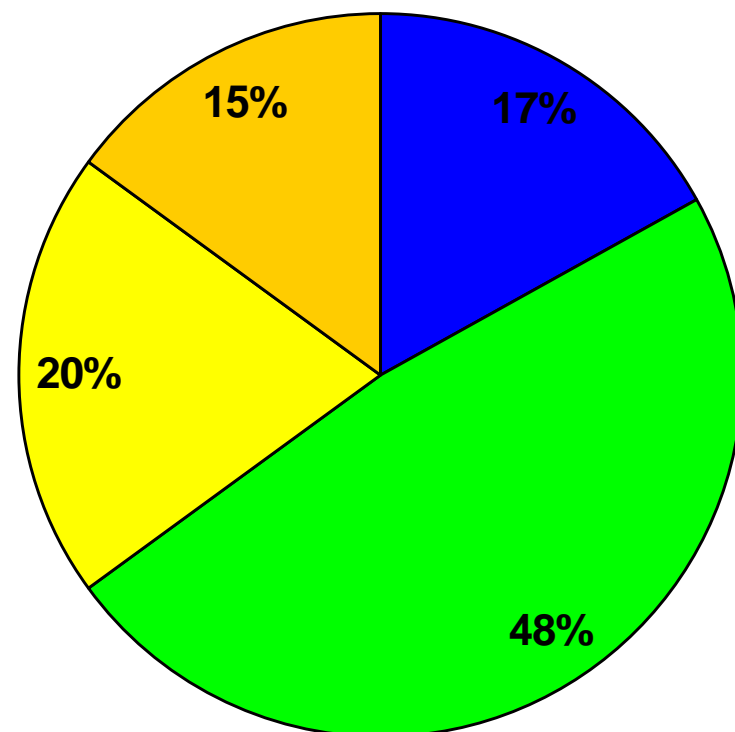
# West Coast Clare Water Management Unit Action Plan

| STATUS/IMPACTS                            |  |
|---|--|
| Overall status                            | 46 River Waterbodies – 8 high, 22 good, 9 moderate and 7 poor river water bodies.<br>4 Moderate lake status, all are monitored – Licken Lough, Doo Lough, Namina, Keagh  |
| Status elements                           | <p>Rivers: Q score dictates overall status for all river water bodies. Physchem is moderate in 1 poor WB. Fish status is moderate in 1 Moderate WB.</p> <p>Lkaes: Licken Lough driven by Macrophytes, Nutrients – Total Phosphorus.<br/>Doo Lough driven by Chlorophyll, Nutrients – Ammonium, Total Phosphorus.<br/>Namina Lough driven by Nutrients – Ammonium, Total Phosphorus.<br/>Keagh Lough driven by Nutrients – Ammonium, Total Phosphorus.</p>  |
| Possible Impacts - EPA Water Quality 2008 | <p>AILLE (CLARE) - Overall quality is good but mid reaches of this river have a drop in quality. Localised impacts most likely. D/s at Doolin is unsewered.</p> <p>ANNAGEERAGH - Currently moderate status (Q3-4). The quality is mainly moderate for macroinvertebrates along the entire course. There is a large amount of the upper catchment under forestry on peat soils. The Sruhaunakit Stream joins the Annageeragh d/s of Doo Lough, quality is moderate for macroinvertebrates also. Doo Lough is a large abstraction source for a public water supply.</p> <p>ANNAGH (CLARE - Currently moderate status (Q3-4) at site 200 (bridge at Drehide) and good status (Q4) at site 900 (Bealaclogga Bridge). The upper reaches of the Annagh are mainly forestry and agricultural pressures. Quality improves in the middle reaches to satisfactory but drops downstream due to localised pressures and/or because it is affected by seawater.</p> <p>AUGHAGLANNA - Currently good status. Upper reaches of this river have shown deterioration more recently, the main land use here is forestry.</p> <p>AUGHAVEEMA - Currently moderate status (Q3-4). The lower reaches have deteriorated in SH_28_852, a hub of unsewered holidays homes here possibly impacting.</p> <p>BALLINPHONTA - Currently moderate status (Q3-4). Clare Co. Co. macroinvertebrate monitoring in 2007 have shown improvements in this river to Q4. May be localised pressures causing fluctuations in quality.</p> <p>BALLYMACRAVAN - Currently good status (Q4). Quality is good however localised impacts also occurring here.</p> <p>CAHER (CLARE) - Currently good status (Q4-5).</p> <p>CASTLEPARK STREAM - Currently good status (Q4-5). Tributary of the Creegh. Quality satisfactory, however may be localised impacts here.</p> <p>CLOONEENAGH STREAM - Currently good status (Q4-5). Tributary of the Creegh. Recent drop in quality pressures are mainly agriculture, some forestry upstream.</p> <p>COOLEEN - Currently good status (Q4).</p> <p>CREEGH - Currently good status (Q4). Overall satisfactory quality. Some deterioration in the lower reaches, possibly localised impact.</p> <p>DEALAGH - Currently good status (Q4). There has been more recent drop in quality, agriculture is the main pressure and possibly localised impacts, e.g. cattle access in places.</p> <p>DOONBEG - Currently good status (Q4). Overall quality is good. Drop in quality at SH_28_706 and SH_28_734 which is downstream of Kilmihil WWTP, Cooraclare village and also agricultural pressures here. Quality improves in the lower reaches.</p> <p>GLENDINE (CLARE) - Currently good status (Q4).</p> <p>INAGH (ENNISTYMON) - Currently good status.</p> <p>KILDEEMA - Currently good status (Q4).</p> |

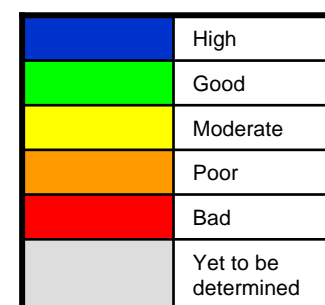
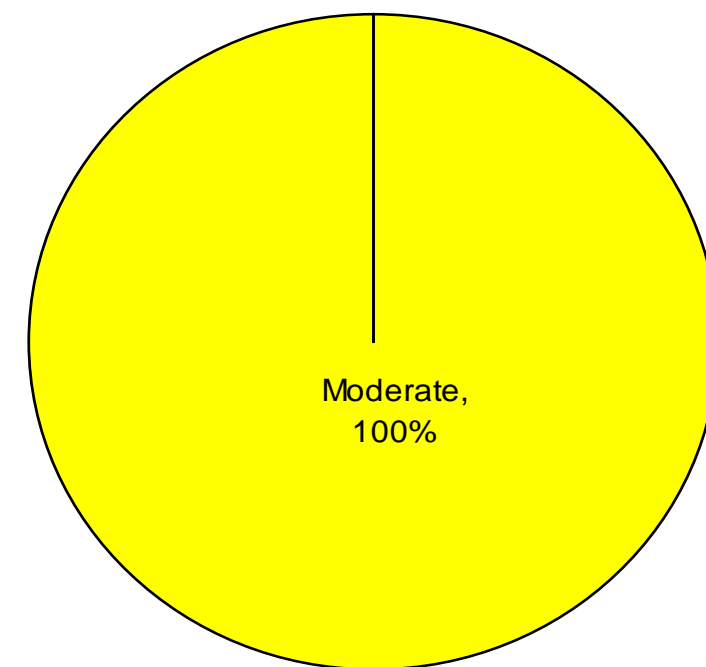
# West Coast Clare Water Management Unit Action Plan

| STATUS/IMPACTS                            |  |
|---|--|
| Possible Impacts - EPA Water Quality 2008 | <p><b>KILMOON STREAM</b> - north trib of Aill at Lisdoonvarna. Overall Q is Q3-4. This is a tributary of the Aille River at Lisdoonvarna. The catchment of the Kilmoon is forested as well as agricultural pressures.</p> <p><b>Doo Lough</b> - Macrophytes sampled in 2005, Good-Q1, recent data, 2004-2006 mesotrophic and in 2007, 2007 Chlorophyll- moderate, low frequency 2007 data but Ammonium, Total Phosphorus =moderate. There is a large amount of the upper catchment under forestry on peat soils. The Sruhaunakit Stream joins the Annageeragh d/s of Doo Lough, quality is moderate for macroinvertebrates also. Doo Lough is a large abstraction source for a public water supply.</p> <p><b>Licken Lough</b> - Macrophytes sampled in 2006, moderate -Q1, recent data, Fish sampled 2007 good, 2004-2006 Chlorophyll mesotrophic, 2007 Chlorophyll - m-E and moderate status, 2007 Total Phosphorus and Ammonium moderate. 2004-2006 n=6, Total Phosphorus ad Ammonium good. Peat catchment.</p> <p><b>Namina Lough</b> - Macrophytes sampled 2002, Q4 in high status; old data. 2004-2006 Chlorophyll oligotrophic. And 2007 Chlorophyll oligotrophic. And high status; 2007 Ammonium and TP, n=4 for both moderate - query over data? 2004-2006 data low frequency data but TP = 0.034 mg/L; n=5, moderate. See meeting note for good status. 2007-2008 Amm and TP put in Moderate status. Peat catchment, forestry main land use draining to Naminia.</p> |

River Status



Lake Status



# West Coast Clare Water Management Unit Action Plan

| PRESSURES/RISKS  |   |
|--|---|
| Nutrient sources   | Most TP is diffuse (89%), mainly from agriculture (70%) and unsewered properties (6%). 12% comes from forestry and 11% from WWTP.   |
| Point pressures  | 10 Council Sewage Treatment Plants:- Ennistymon, Inagh, Kilmihil, Lahinch, Lisdoonvarna, Milltown Malbay, Kilfenora, Quilty, Liscannor and Doonbeg.<br>4 Comunal Septic tanks - Connolly, Moy (Lahinch), Fanore, Cooraclare, 1 Waste Facility.<br>0 IPPCs<br>24 Section-4s: Hostel, Public House, 2 Housing Estates, Shop/cafe, 5 Hotels, 3 Holiday Home Developments, Admiralty Lodge, Refuse and Recycling Unit, Quarry, Travelling Community Accommodation Unit, Nursing Home, Caravan Park, Visitor Centre/Restaurant, Guest House, Golf/Leisure Club, Quarry.<br>4 WTPs: Ennistymon, Milltown Malbay, West Clare New and West Clare Old (same source Doo Lough, two treatment plants). |
| Wastewater Treatment Plants (WWTP) and Industrial Discharges | The following WWTPs are at risk:<br>Ennistymon WWTP<br>Inagh WWTP<br>Kilmihil WWTP<br>Liscannor WWTP<br>Lisdoonvarna WWTP<br>Milltown/Malbay WWTP<br><br>No industries are at risk.   |
| Quarries, Mines & Landfills                                  | 20 Quarries. SH_28_734, SH_28_706, SH_28_718, SH_28_709, SH_28_733, SH_28_213, SH_28_893, SH_28_242, SH_28_620, SH_28_231, SH_28_410, SH_28_111, SH_28_897, SH_28_899, SH_28_555, SH_28_929, SH_28_690, SH_28_922, SH_28_106, SH_28_56. 1 WB at risk; SH_28_410.<br>1 Mine – ClarePhosphates_Doolin - 1 WB at risk; SH_28_690<br>1 Landfills - Ballyduff Beg Landfill (central waste management facility Licenced).   |
| Agriculture  | 19 WB at risk; SH_28_110, SH_28_156, SH_28_414, SH_28_718, SH_28_852, SH_28_706, SH_28_734, SH_28_866, SH_28_410, SH_28_87 SH_28_221, SH_28_241, SH_28_119, SH_28_893, SH_28_162, SH_28_225, SH_28_213, SH_28_242, SH_28_111.   |
| On-site systems  | There are 8428 septic tanks within this WMU, 3,226 of these are located in areas of very high or extreme risk.  |
| Forestry   | 9 at risk; SH_28_929, SH_28_866 (Kilmoon Stream, trib of Aille), SH_28_213 (U/s of Doo Lough), SH_28_225(Doo Lough), SH_28_162 (Annageeragh), SH_28_111 (Inagh) and SH_28_119, SH_28_893, SH_28_241.  |
| Dangerous substances   | None  |
| Morphology   | None  |
| Abstractions   | 4 River WB at risk; SH_28_899, SH_28_93, SH_28_893 and SH_28_709.<br>4 Lakes at Risk: Doo Lough (IE_SH_28_82); Keagh Lough (IE_SH_28_64); Lickeen Lough (IE_SH_28_85); Naminna Lough (IE_SH_28_87).   |
| Other  | N/A   |

| SELECTED ACTION PROGRAMME   |   |
|---|---|
| <i>NB All relevant basic measures, general supplementary measures and SEA mitigation measures apply</i> |   |
| Point Sources   | WWTP measures are summarised in the Table below WWTP upgrades & licensing to be implemented where required.<br>Examine the terms of discharge authorisations to determine whether they require review for the purpose of compliance with water body objectives including protected area objectives and environmental quality standards. |
| Diffuse Sources   | Good Agricultural Practice regulations inspections/enforcement.<br><br>Septic Tanks: At Risk septic tanks are to be prioritised for inspections. Subsequent upgrade or connection to municipal systems depends on inspection and economic tests.<br>Other diffuse sources may need recommendations.                                     |
| Other   | Morphological pressures in the West-Coast Clare WMU may require channelisation investigation to establish if supplementary measures are required to address water quality issues associated with morphology.<br><br>Abstractions - Future abstractions licensing programme and assessment   |
| <i>Future Pressures and Developments</i>  | <i>Throughout the river basin management cycle future pressures and developments will need to be managed to ensure compliance with the objectives of the Water Framework Directive and the Programme of Measures will need to be developed to ensure issues associated with these new pressures are addressed.</i>                      |

| OBJECTIVES             |  |
|------------------------|--|
| Restore 2015 Protect   | 9 river water bodies. 4 lakes.<br>30 river waterbodies.  |
| Alternative Objectives | Extended deadlines – 7 River Waterbodies with 2021 deadlines. 0 extensions for lakes.<br><br>1 New Modification or Development - Pumped hydro storage facility involving the construction of two man-made reservoirs<br><br>HMWB/AWB – 1 HMWB – Doo Lough. 0 AWB |

| Point Source Discharge | County | Priority | Measure (Capital Works)   |
|------------------------|--------|----------|---|
| Kilmihil WWTP          | Clare  | 2        | Provide tertiary treatment or relocate outfall.                                   |
| Kilmihil WWTP          | Clare  | 2        | Provide nutrient removal or relocate outfall.                                     |
| Milltown/Malbay WWTP   | Clare  | 1        | Increase capacity of treatment plant.   |
| Point Source Discharge | County | Priority | Measure (Investigation before Capital Works)                                      |
| Liscannor WWTP         | Clare  | 2        | Investigate the need for increase in capacity of treatment plant.                 |
| Lisdoonvarna WWTP      | Clare  | 3        | Investigate the need for tertiary treatment or for the relocation of the outfall. |
| Point Source Discharge | County | Priority | Measure   |
| Ennistymon WWTP        | Clare  | 1        | Implement an appropriate performance management system                            |
| Inagh WWTP             | Clare  | 1        | Implement an appropriate performance management system                            |
| Kilmihil WWTP          | Clare  | 1        | Implement an appropriate performance management system                            |

# West Coast Clare Water Management Unit Action Plan

| IE_SH_Inagh |                   |                              |                 |                     |                         |      |                         |                     |                     |                 |                              |                   |                 |                         |                           |                |     |           |                               |
|-------------|-------------------|------------------------------|-----------------|---------------------|-------------------------|------|-------------------------|---------------------|---------------------|-----------------|------------------------------|-------------------|-----------------|-------------------------|---------------------------|----------------|-----|-----------|-------------------------------|
| County      | Member State Code | Monitored Y (Extrapolated N) | Donor Waterbody | Biological Elements |                         |      |                         | Supporting Elements |                     |                 |                              | Ecological Status | Chemical Status | Protected Areas         |                           |                |     | Objective | Date objective to be achieved |
|             |                   |                              |                 | Macrobenthos (O)    | Freshwater Pearl Mussel | Fish | Phytoplankton (Diatoms) | Morphology          | Specific Pollutants | Physio-chemical | Special Area of Conservation |                   |                 | Special Protection Area | Nutrient Sensitive Waters | Drinking Water |     |           |                               |
| Clare       | SH_28_106         | Y                            |                 | H                   |                         |      |                         | H                   |                     |                 | H                            |                   | Y               |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_110         | N                            | SH_27_1143      |                     |                         |      |                         |                     |                     |                 | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_111         | N                            | SH_27_264       |                     |                         |      |                         |                     |                     |                 | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_119         | N                            | SH_28_213       |                     |                         |      |                         |                     |                     |                 | M                            |                   |                 |                         |                           |                | GES | 2015      |                               |
| Clare       | SH_28_156         | N                            | SH_28_410       |                     |                         |      |                         |                     |                     |                 | M                            |                   |                 | Y                       |                           |                | GES | 2015      |                               |
| Clare       | SH_28_162         | N                            | SH_28_893       |                     |                         |      |                         |                     |                     |                 | M                            |                   |                 |                         |                           |                | GES | 2015      |                               |
| Clare       | SH_28_174         | N                            | SH_28_905       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_213         | Y                            |                 | M                   |                         |      |                         |                     |                     | H               | M                            |                   |                 |                         |                           |                | GES | 2015      |                               |
| Clare       | SH_28_221         | Y                            |                 | P                   |                         |      |                         |                     |                     |                 | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_225         | N                            | SH_28_213       |                     |                         |      |                         |                     |                     |                 | M                            |                   |                 |                         |                           |                | GES | 2015      |                               |
| Clare       | SH_28_231         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_232         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       |                           |                | GES | 2009      |                               |
| Clare       | SH_28_241         | Y                            |                 | M                   |                         |      |                         |                     |                     |                 | M                            |                   |                 |                         |                           |                | GES | 2015      |                               |
| Clare       | SH_28_242         | Y                            |                 | P                   |                         |      |                         |                     |                     |                 | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_346         | N                            | SH_28_709       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_359         | N                            | SH_28_899       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_410         | Y                            |                 | M                   |                         | M    |                         |                     |                     |                 | M                            |                   |                 |                         |                           |                | GES | 2015      |                               |
| Clare       | SH_28_414         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_448         | N                            | SH_28_66        |                     |                         |      |                         |                     |                     |                 | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_464         | N                            | SH_28_66        |                     |                         |      |                         |                     |                     |                 | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_547         | N                            | SH_28_897       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_555         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_620         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_625         | N                            | SH_28_66        |                     |                         |      |                         |                     |                     |                 | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_631         | N                            | SH_28_66        |                     |                         |      |                         |                     |                     |                 | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_66          | Y                            |                 | H                   |                         |      |                         |                     |                     |                 | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_671         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_677         | N                            | SH_28_66        |                     |                         |      |                         |                     |                     |                 | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_690         | Y                            |                 | G                   |                         |      |                         |                     |                     | H               | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_706         | Y                            |                 | G                   |                         |      |                         |                     |                     | H               | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_709         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       |                           |                | GES | 2009      |                               |
| Clare       | SH_28_718         | Y                            |                 | P                   |                         |      |                         |                     |                     | M               | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_733         | Y                            |                 | H                   |                         |      |                         |                     |                     | H               | H                            |                   |                 |                         |                           |                | HES | 2009      |                               |
| Clare       | SH_28_734         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       | Y                         |                | GES | 2009      |                               |
| Clare       | SH_28_848         | N                            | SH_28_709       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       |                           |                | GES | 2009      |                               |
| Clare       | SH_28_852         | Y                            |                 | M                   |                         |      |                         |                     |                     |                 | M                            |                   |                 |                         | Y                         |                | GES | 2015      |                               |
| Clare       | SH_28_866         | N                            | SH_27_1143      |                     |                         |      |                         |                     |                     |                 | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_87          | N                            | SH_27_264       |                     |                         |      |                         |                     |                     |                 | P                            |                   |                 |                         |                           |                | GES | 2021      |                               |
| Clare       | SH_28_876         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       |                           |                | GES | 2009      |                               |
| Clare       | SH_28_893         | Y                            |                 | M                   |                         |      |                         |                     |                     | H               | M                            |                   |                 | Y                       | Y                         |                | GES | 2015      |                               |
| Clare       | SH_28_897         | Y                            |                 | G                   |                         |      |                         |                     |                     | H               | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_899         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       |                           |                | GES | 2009      |                               |
| Clare       | SH_28_905         | Y                            |                 | G                   |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_922         | N                            | SH_28_876       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 | Y                       |                           |                | GES | 2009      |                               |
| Clare       | SH_28_929         | N                            | SH_28_690       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |
| Clare       | SH_28_93          | N                            | SH_28_897       |                     |                         |      |                         |                     |                     |                 | G                            |                   |                 |                         |                           |                | GES | 2009      |                               |

# West Coast Clare Water Management Unit Action Plan

## Lake Data

| IE_SH_Inagh |                   |                   |                                 |                     |             |      |                     |                     |                  |                              |                   |                 |                         |                           |               |                |     |           |                               |
|-------------|-------------------|-------------------|---------------------------------|---------------------|-------------|------|---------------------|---------------------|------------------|------------------------------|-------------------|-----------------|-------------------------|---------------------------|---------------|----------------|-----|-----------|-------------------------------|
| County      | Member State Code | Name              | Monitored Y<br>(Extrapolated N) | Biological Elements |             |      | Supporting Elements |                     |                  |                              | Ecological Status | Chemical Status | Protected Areas         |                           |               |                |     | Objective | Date objective to be achieved |
|             |                   |                   |                                 | Macrophytes         | Chlorophyll | Fish | Morphology          | Nutrient Enrichment | Physico Chemical | Special Area of Conservation |                   |                 | Special Protection Area | Nutrient Sensitive Waters | Bathing Water | Drinking Water |     |           |                               |
| Clare       | SH_28_64          | Keagh ( Lough )   | Y                               |                     | G           |      |                     | M                   | M                | M                            |                   |                 |                         |                           |               | Y              | GES | 2015      |                               |
| Clare       | SH_28_82          | Doo Lough         | Y                               | G                   | M           |      |                     | M                   | M                | M                            |                   |                 |                         |                           |               | Y              | GEP | 2015      |                               |
| Clare       | SH_28_85          | Lickeen Lough     | Y                               | M                   | G           |      | G                   | M                   | M                | M                            |                   |                 |                         |                           |               | Y              | GES | 2015      |                               |
| Clare       | SH_28_87          | Naminna ( Lough ) | Y                               | H                   | H           | G    |                     | M                   | M                | M                            |                   |                 |                         |                           |               | Y              | GES | 2015      |                               |

## **SECTION G – PROGRAMME OF IMPROVEMENTS**

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- **This section not applicable**