ULTIMATE

WATER SMART INDUSTRIAL SYMBIOSIS

D1.2 Operational demo cases

CS7 Tain

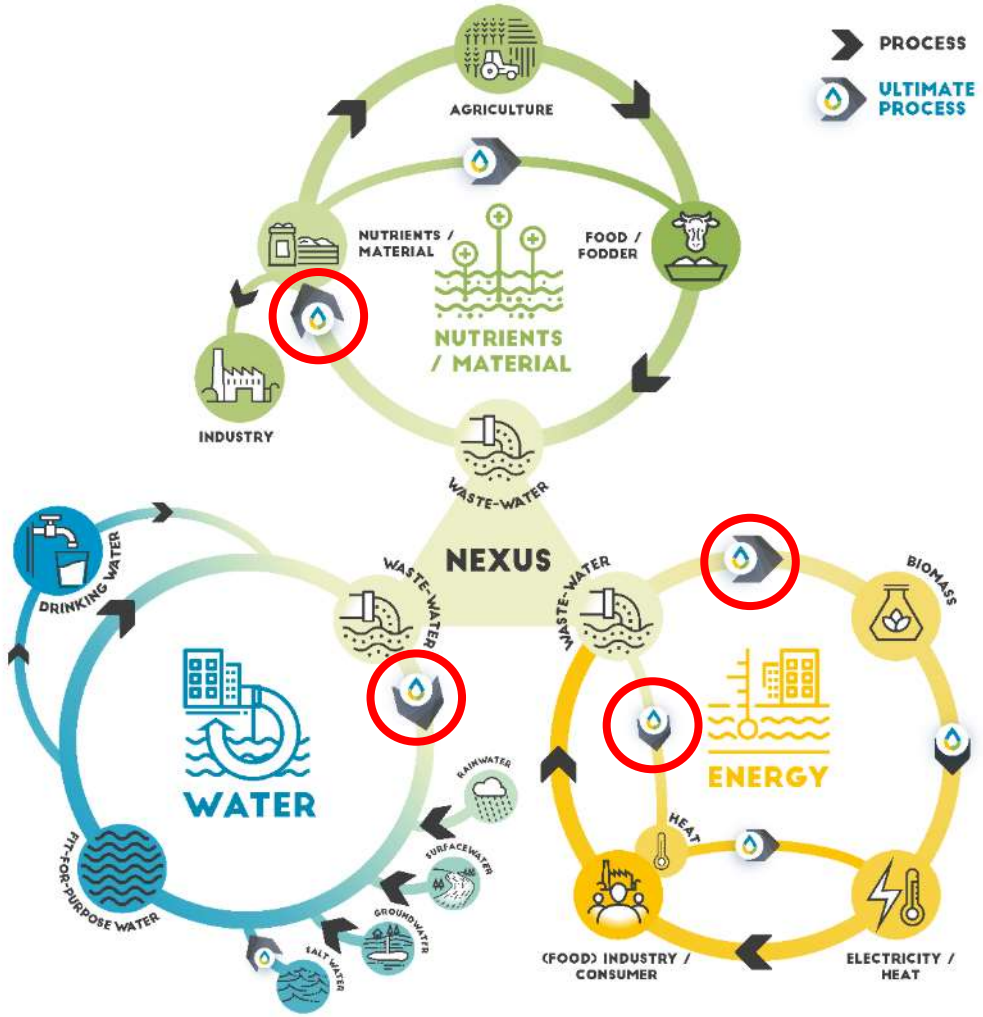
UCRAN, Aquabio

CS7: Tain

Lead partner:

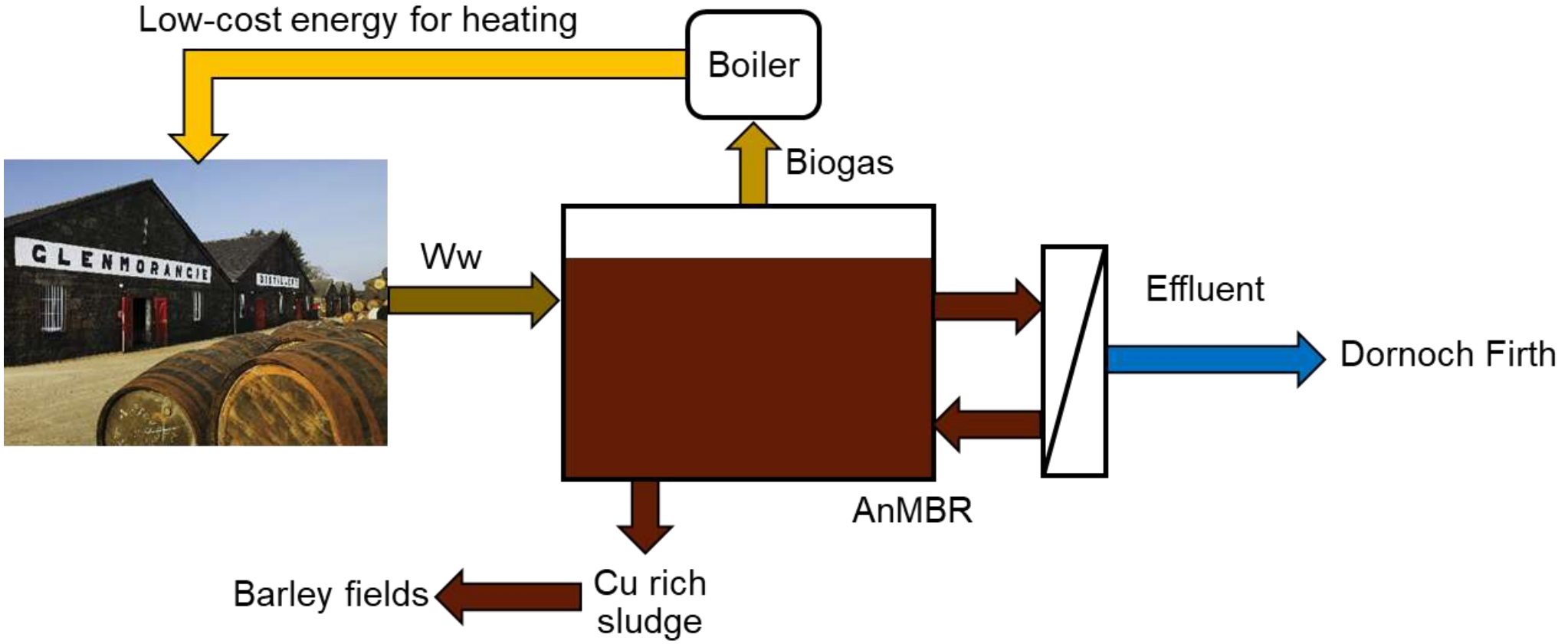
Other partner:

With support of:



The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869318

CS7: Situation before Ultimate



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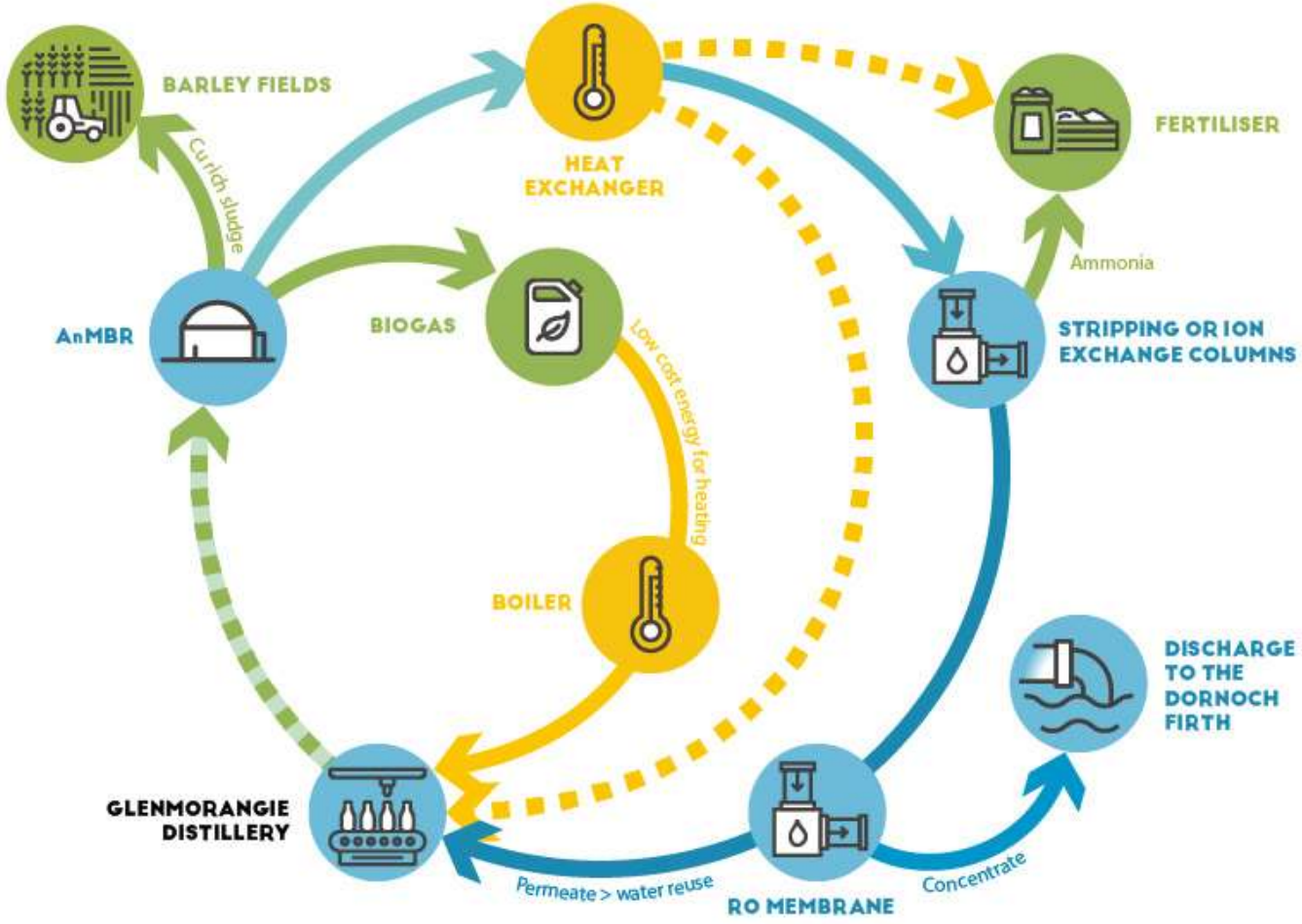
CS7: Objectives of the Ultimate solutions



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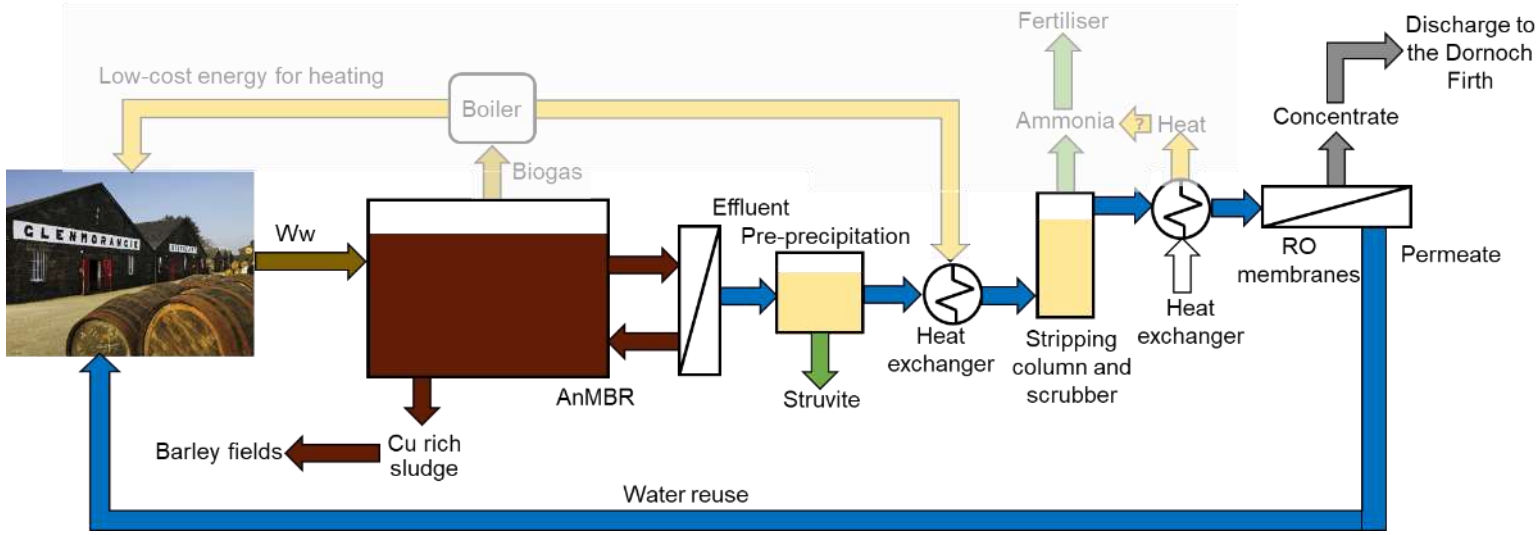
CS7: Subtask 1.2.6 status/progress

Subtask: 1.2.6 RO treatment of distillery wastewater after AnMBR for internal water reuse
Baseline technology: no water reuse so far (discharge of AnMBR effluent to Dornoch Firth)

Ultimate solution to foster circular economy: RO system for distillery wastewater (AnMBR effluent)



TRL: 5 → 7

Capacity of demo plant: 1 m³/d

Quantifiable target: At full scale, potential for the production of 58,000 m³/a for internal water reuse; >40 % reduction of freshwater through reuse of treated water

Status/progress:

- detailed design completed
- system available but needs adapting to fit latest configuration

CS7: Pictures of the new technologies

Subtask: 1.2.5 RO treatment of distillery wastewater after AnMBR for internal water reuse

The RO unit is designed to achieve high quality water for reuse from the distillery wastewater after treatment through a pre-precipitation stage and ammonia stripping.

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CS7: Task 1.2.6 - Timeline

Subtask: 1.2.5 RO treatment of distillery wastewater after AnMBR for internal water reuse

T1.2.6 - RO treatment of distillery wastewater after AnMBR for internal water reuse in Tain

Baseline conditions assessed

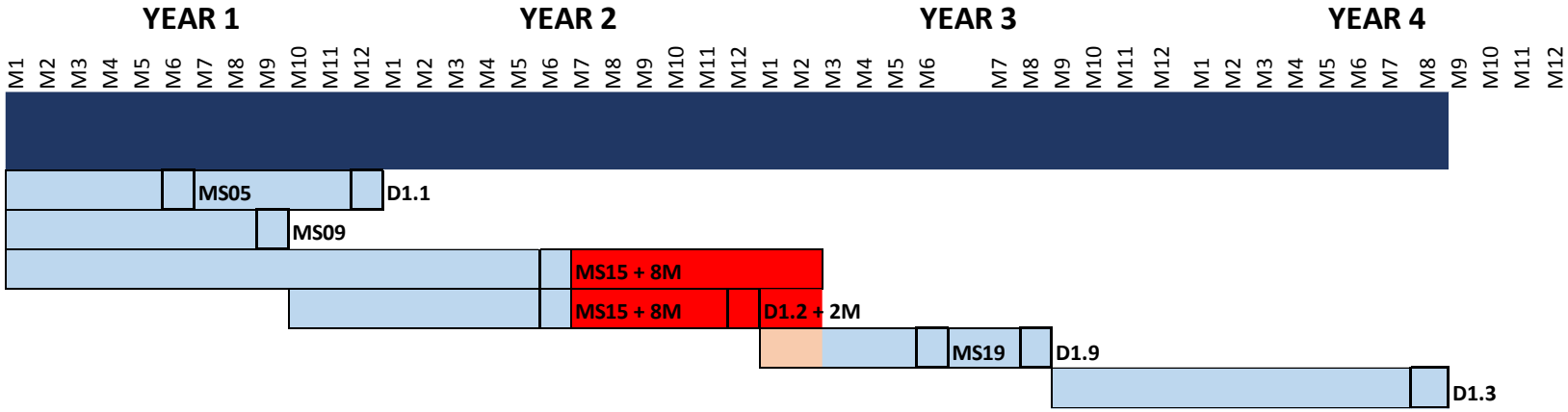
Design of pilot system

Laboratory scale experiments

Pilot system operational

Start-up & results

Best practices for water recycling



→ **Pilot system expected to be operational in July 2022 (M26)**

→ **Still enough time to complete the pilot experiments**

Legend

- Task/Subtask
- Activity as planned
- Postponed activity
- Delay of activity

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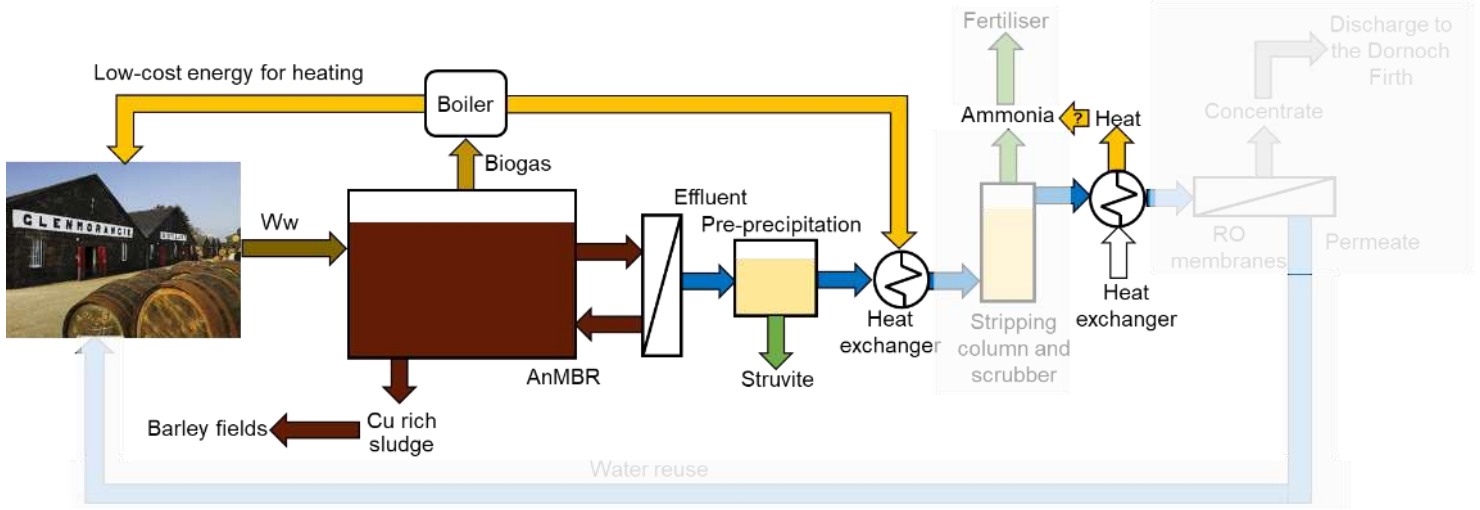
CS7: Subtask 1.3.5 status/progress

Subtask: 1.3.5 Heat recovery from treated (AnMBR) distillery wastewater
Baseline technology: Biogas production via existing AnMBR; no heat recovery before Ultimate

Ultimate solutions to foster circular economy: heat recovery from the AnMBR effluent via heat exchangers



TRL: 5 → 7

Capacity of demo plant: heat utilization will be tested in all systems at 1 m3/d for the RO and 12 m³/d for the nutrients recovery system and 14 kW of heat recovery can be expected

Quantifiable targets: At full scale, >15 % reduction of energy demand from biogas and 60 % heat recovery within stripping column unit

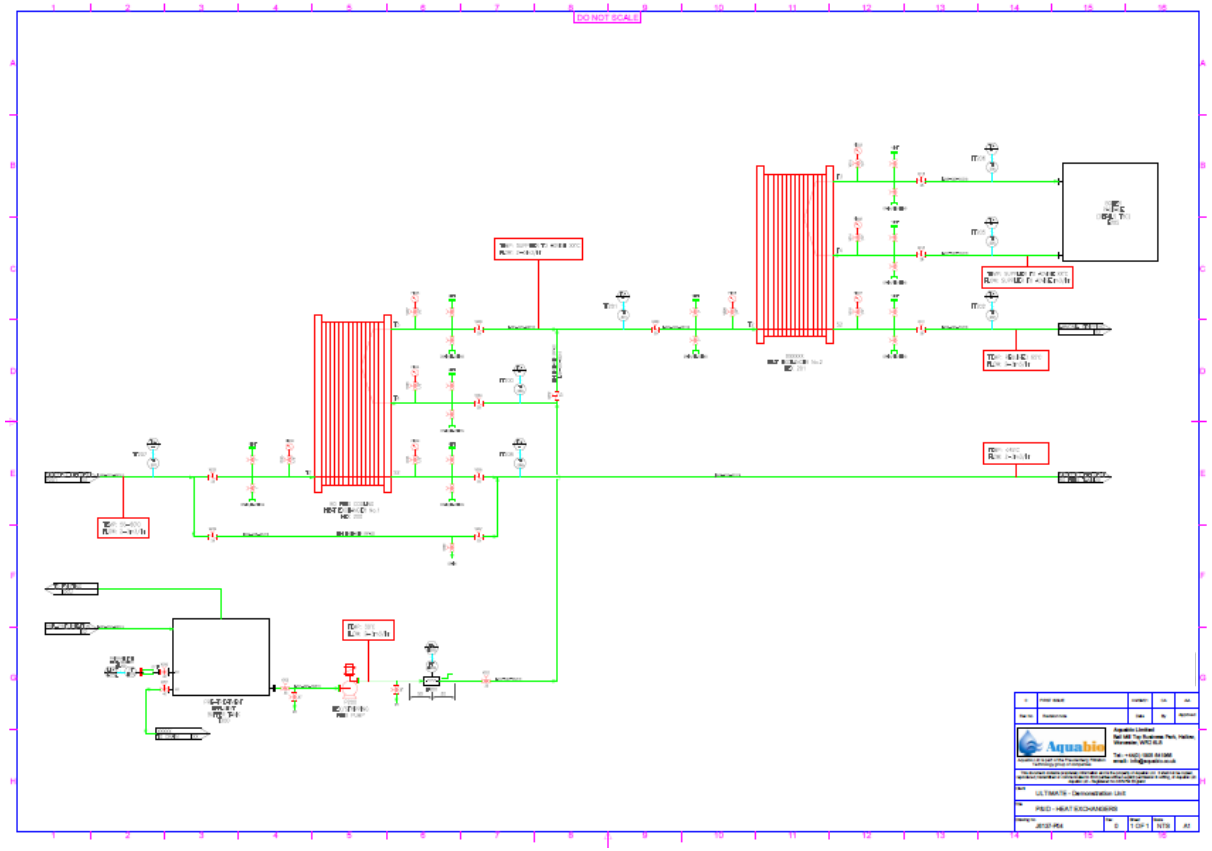
Status/progress:

- detailed design completed
- parts ordered

CS7: PID of the heat exchanging unit

Subtask: 1.3.5 Heat recovery from treated (AnMBR) distillery wastewater

P&ID of the heat exchange unit



The heat exchanger units are designed to maximise heat utilisation from the effluent after the ammonia stripping process.

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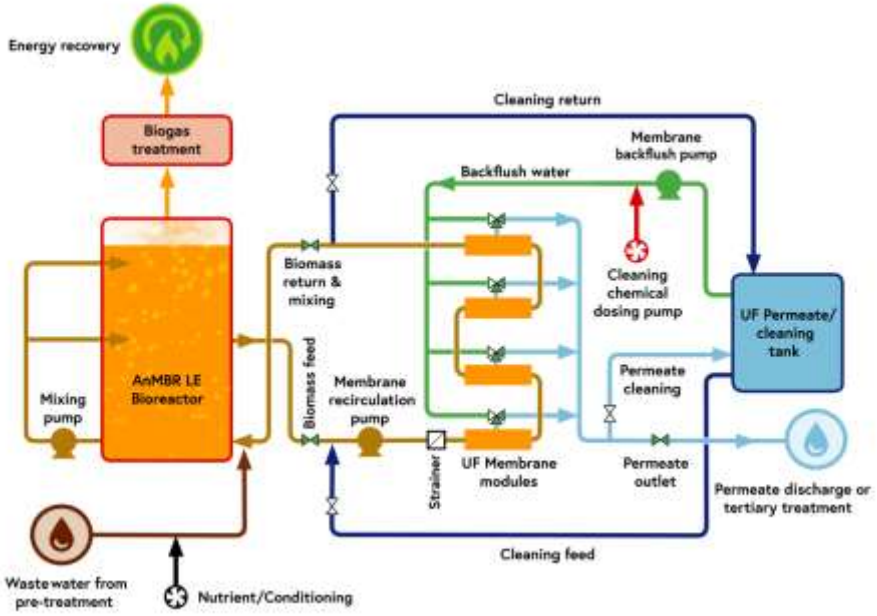
CS7: First results of the new technologies

Subtask: 1.3.5 Heat recovery from treated (AnMBR) distillery wastewater

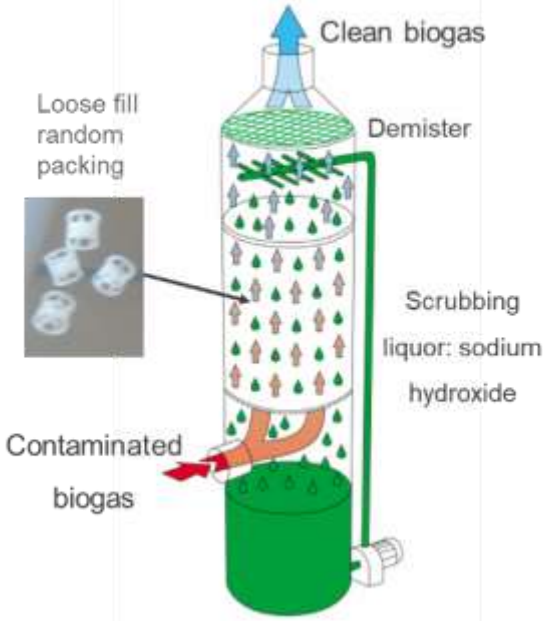
The biogas produced in the AnMBR first goes through a scrubber for H_2S removal and is then converted to steam in a boiler.

The steam produced is reused to heat the stills in the distillery and contribute to reduce its dependence on fossil fuel by 15%.

Biogas Generation (Nm^3/d)	8,000
CH_4 content (%)	55-70



Packed tower scrubber for H_2S removal



https://www.forbesgroup.co.uk/environmental-technologies/packed-tower/

Biogas fired steam boiler

Maximum continuous rating (kg/hr)	2067
Design temperature (°C)	188
Working pressure	8 barg

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CS7: Task 1.3.5 - Timeline

Subtask: 1.3.5 Heat recovery from treated (AnMBR) distillery wastewater

T1.3.5 - Heat recovery from treated (AnMBR) distillery wastewater in Tain

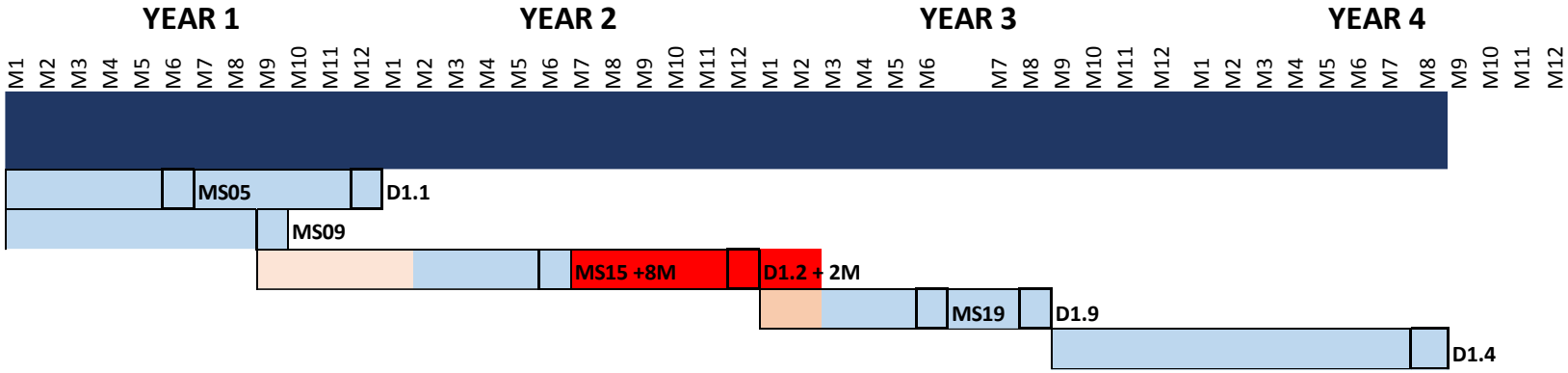
Baseline conditions assessed

Design of pilot system

Pilot system operational

Start-up & results

Best practices for energy recovery



→ **Heat recovery system expected to be operational in July 2022 (M26)**

→ **Still enough time to complete the pilot experiments**

Legend

- Task/Subtask
- Activity as planned
- Postponed activity
- Delay of activity

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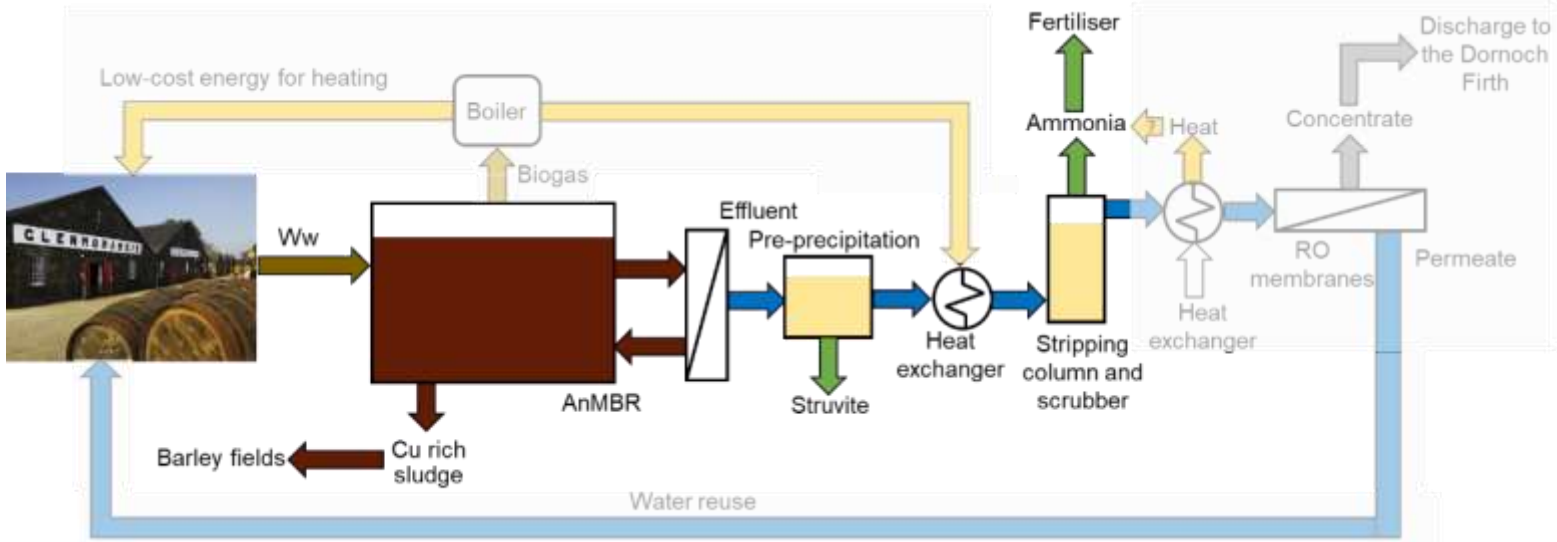
CS7: Subtask 1.4.6 status/progress

Subtask: **1.4.6 Recovery of ammonia from distillery wastewater via IEX/packed columns after AnMBR**
Baseline technology: reuse of digestate on the barley fields

Ultimate solution to foster circular economy: air stripping column & scrubber; struvite precipitation



TRL: 5 → 7 (air stripping column & scrubber)**; 5 → 7** (struvite precipitation)

Capacity of demo plants:12-24 m³/d

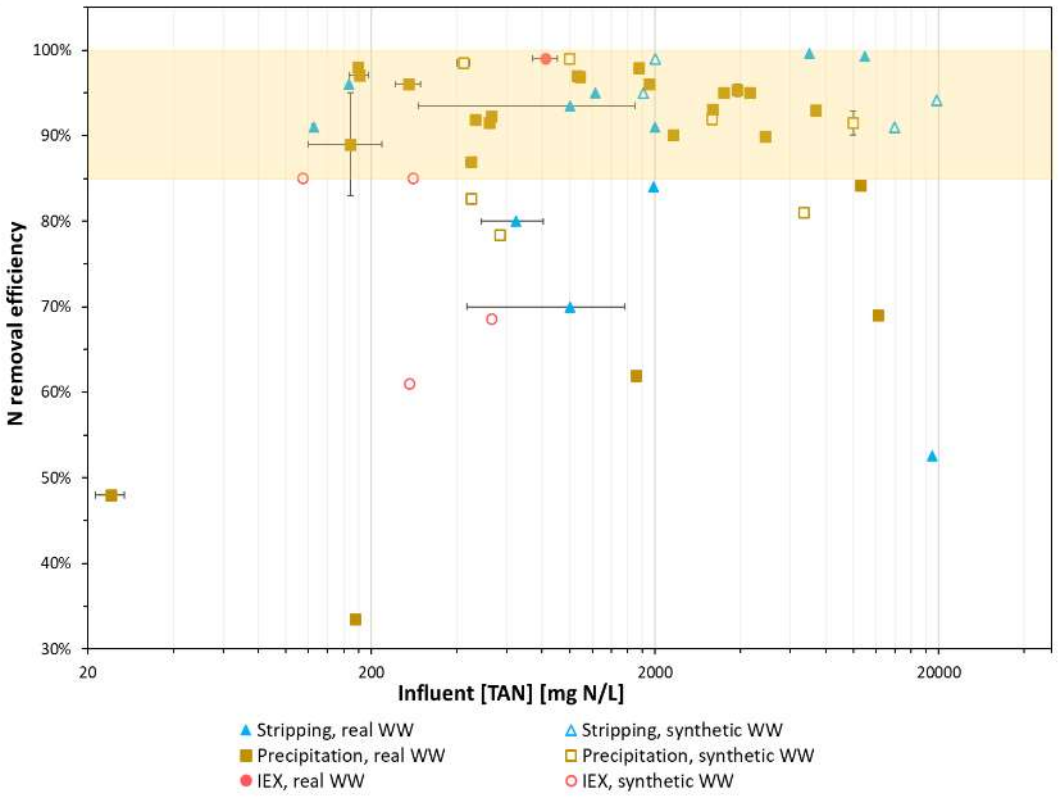
Quantifiable target: At full scale, potential for the production of 122 t struvite/a from the pre-precipitation stage and 47 t nitrogen/a from ammonia stripping, corresponding to about 80% P recovery and 80% N recovery in total

Status/progress:

- detailed design completed
- parts ordered

CS7: Results of the preliminary evaluation

Subtask: 1.4.6 Recovery of ammonia from distillery wastewater via IEX/packed columns after AnMBR



The evaluation of current knowledge and performance (see figure on the right) of ion exchange, stripping and precipitation based systems for ammonia recovery form industrial wastewaters and the measured characteristics of the anaerobically treated distillery wastewater led to the selection of a two-stage system comprising pre-precipitation (struvite) followed ammonia stripping to maximize the recovery of nutrients.

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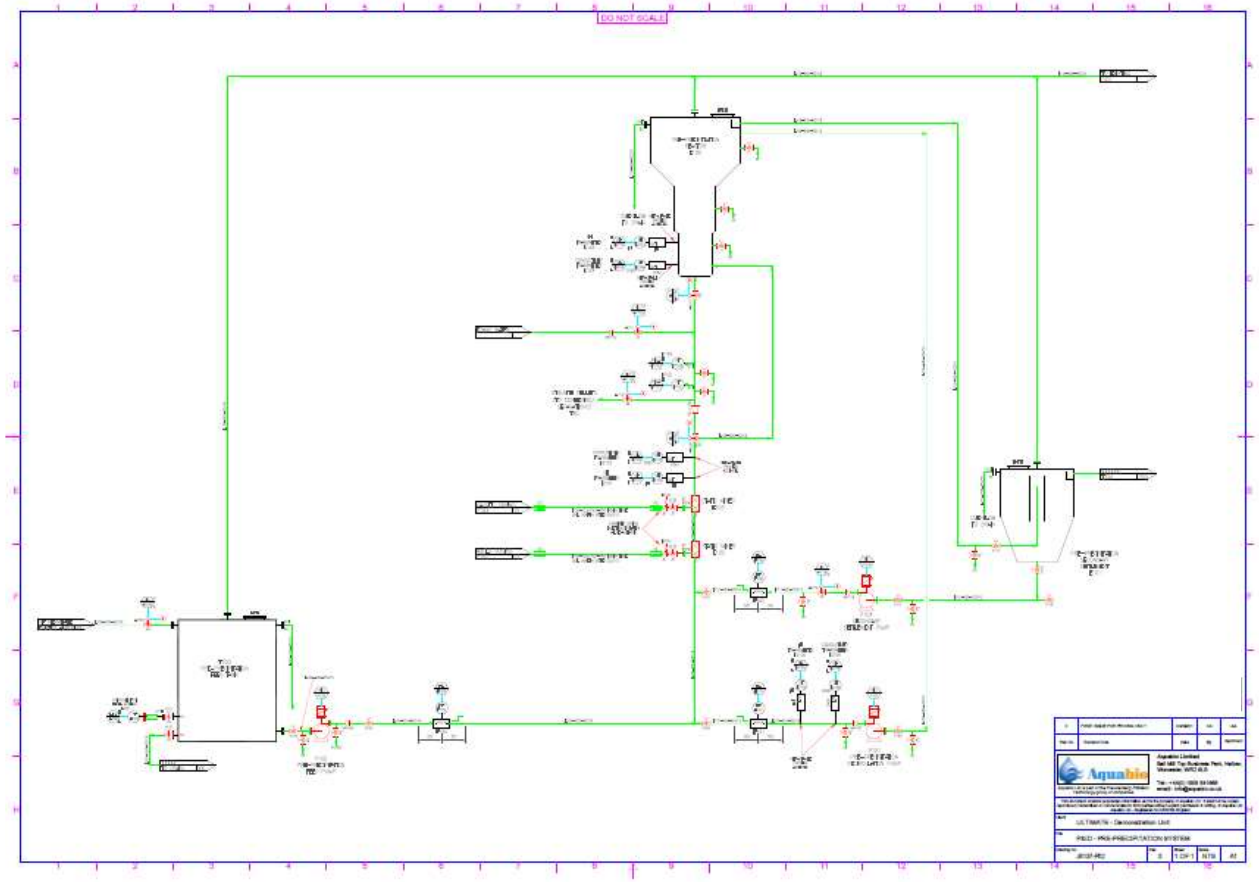
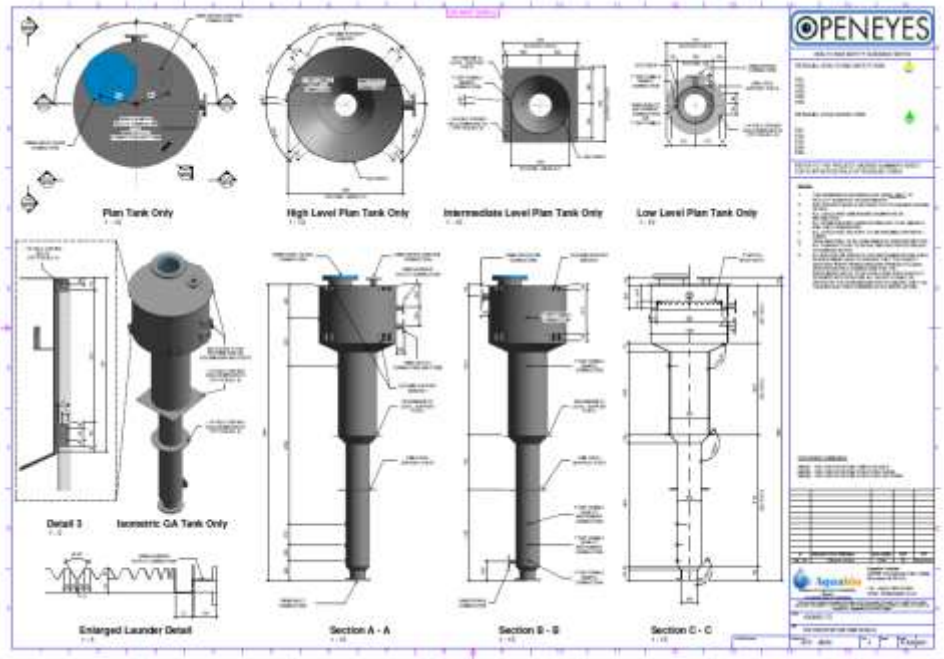
CS7: Pictures of the struvite precipitator

Subtask: 1.4.6 Recovery of ammonia from distillery wastewater after AnMBR

P&ID and drawing of the of the pre-precipitation reactor





The pre-precipitation stage will act as pre-treatment to maximize ammonia recovery in the subsequent stripping unit while also recovering P and N in the form of struvite.

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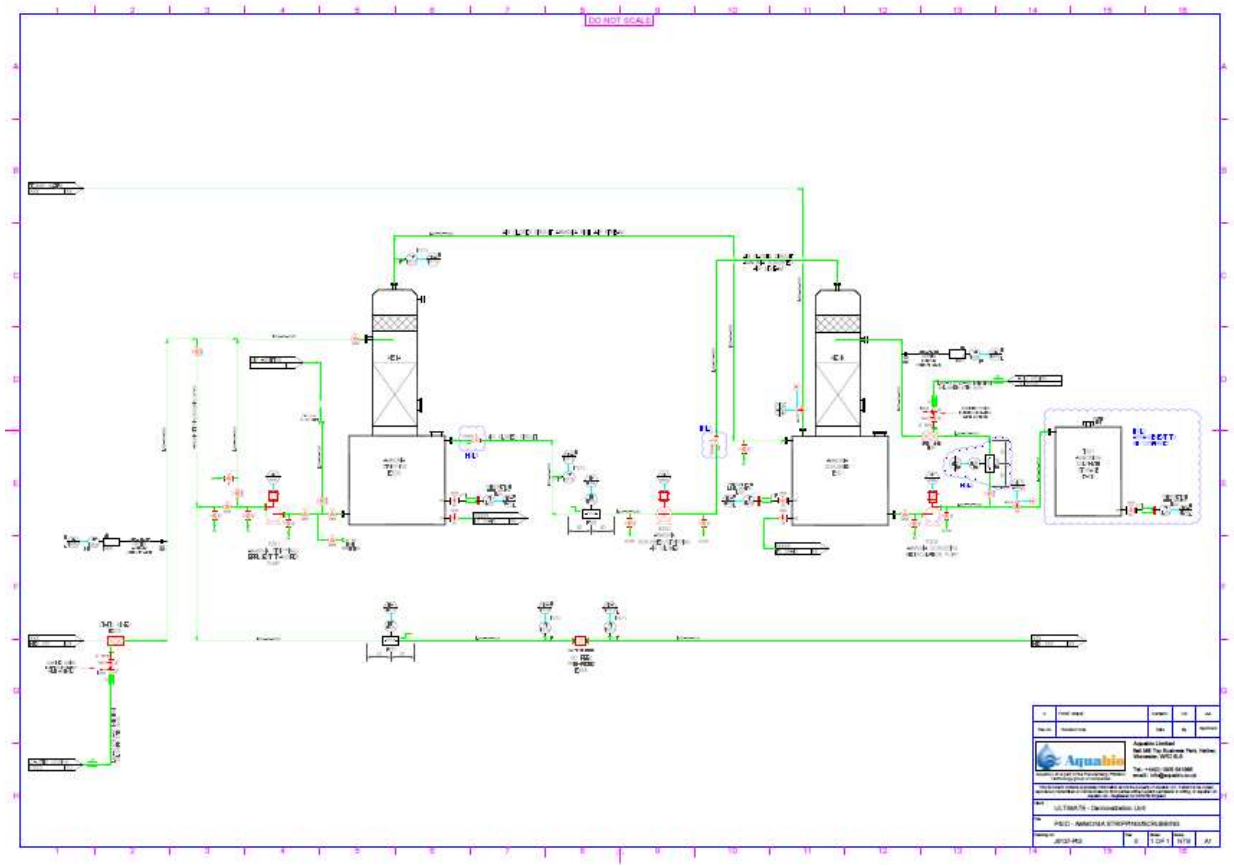
CS7: PID of the ammonia stripping unit

Subtask: **1.4.6 Recovery of ammonia from distillery wastewater after AnMBR**

P&ID of the ammonia stripping unit



The stripping unit is designed to maximize the recovery of ammonia from the anaerobically treated distillery wastewater in the form of either an ammonia solution or ammonium sulphate.

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CS7: Task 1.4.6 - Timeline

Subtask: 1.4.6 Recovery of ammonia from distillery wastewater after AnMBR

T1.4.6 - Recovery of ammonia from distillery wastewater by IEX/packed columns after AnMBR in Tain

Baseline conditions assessed

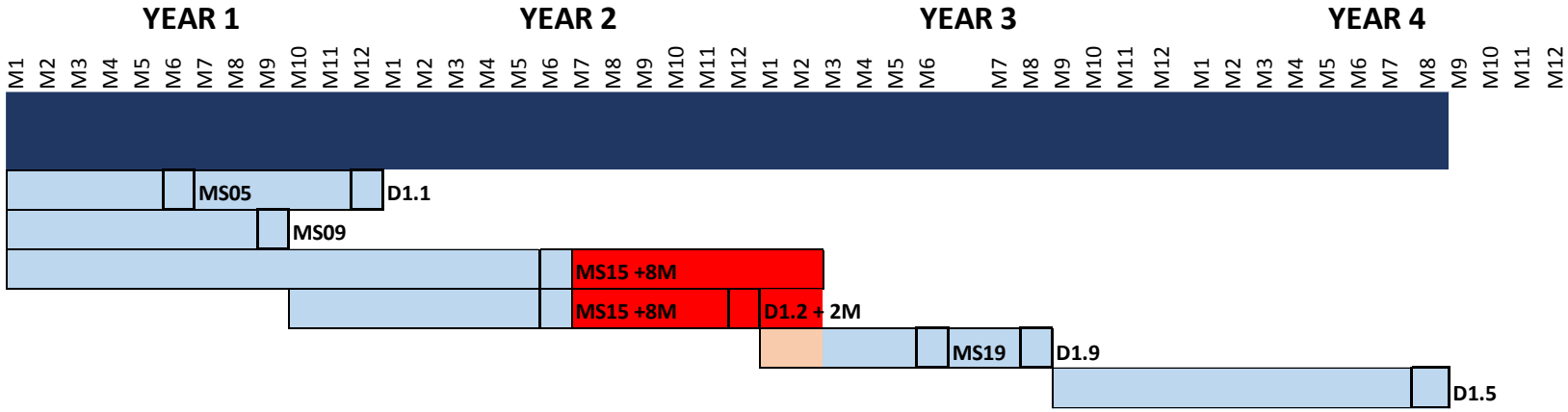
Design of pilot system

Laboratory scale experiments

Pilot system operational

Start-up & results

Best practices for material recovery



→ **Nutrients recovery system expected to be operational in July 2022 (M26)**

→ **Still enough time to complete the pilot experiments**

Legend

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- Activity as planned
- Postponed activity
- Delay of activity

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WATER SMART INDUSTRIAL SYMBIOSIS

CS7 Contacts

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