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Report

Uisce Éireann National Recovery and Resilience Plan - Sub-measure 2

Executive Summary



Delivering Water Services for Ireland

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Abbreviations

Abbreviation	Description
AA	Appropriate Assessment
AFA	Area for Action
ASP	Activated Sludge Process
BOD	Biological Oxygen Demand
CAPEX	Capital Expenditure
cBOD	Carbonaceous Biological Oxygen Demand
COD	Chemical Oxygen Demand
CSMU	Catchment Science and Management Unit's
CSO	Central Statistics Office
DO	Dissolved Oxygen
DPI	Developer Provided Infrastructure
DWF	Dry Weather Flow
EAAT	Early Assessment and Allowance Tracker
EclA	Ecological Impact Assessment
EED	Energy Efficiency Design
EIA	Environmental Impact Assessment
EIMS	Environmental Information Management System
ELV	Emission Limit Value
EnPI	Energy Performance Indicator
EPA	Environmental Protection Agency
EQS	Environmental Quality Standard
ESB	Electrical Supply Board

Abbreviation	Description
ESRI	Economic and Social Research Institute
EU	European Union
FBDA	Fine Bubble Diffused Air
FE	Final Effluent
FFT	Full Flow to Treatment
FNPV	Financial Net Present Value
FWPM	Freshwater Pearl Mussel
GSI	Geological Survey Ireland
GFNPV	Gross Financial Net Present Value
HAZOP	Hazard and Operability Analysis
HLR	Hydraulic Loading Rate
HSO	High Status Objective
HSQE	Health Safety Quality Environment
IAS	Invasive Alien Species
ICA	Instrumentation, Control and Automation
IPPC	Integrated Pollution Prevention and Control
IPS	Investments Planning System
LAWPRO	Local Authority Waters Programme
MCA	Multi-Criteria Analysis
MCC	Mayo County Council
MCDP	Mayo County Development Plan
N COUF	Nitrifying Continuously Operated Up flow Filter
NHA	Natural Heritage Areas

Abbreviation	Description
NIS	Natura Impact Statement
NPRP	National Phosphorous Removal Program
N SAF	Nitrifying Submerged Aerated Filter
OPEX	Operational Expenditure
PE	Population Equivalent
pNHA	Proposed Natural Heritage Areas
PRA	Property Registration Authority
PST	Primary Settlement Tank
PV	photovoltaic cells
RAS	Return Activated Sludge
RBMP	River Basin Management Plan
RCMS	Risk Control Management System
SAC	Special Area of Conservation
SBR	Sequential Batch Reactor
SDRB	Sludge Drying Reed Bed
SLR	Surface Loading Rate
SPA	Special Protection Area
SST	Secondary Settlement Tank
SWO	Stormwater Overflow
TGN	Technical Guidance Note
TN	Total Nitrogen
TSS	Total Suspended Solids
UÉ	Uisce Éireann

Abbreviation	Description
UWWTD	Urban Wastewater Treatment Directive
WAC	Wastewater Assimilative Capacity
WFD	Water Framework Directive
WWDL	Waste Water Discharge Licence
WwTP	Wastewater Treatment Plant

Executive Summary

Overview

Uisce Éireann (UÉ) River Basin Management Plan (RBMP) Enhanced Ambition Programme is funded by the European Union under Ireland's National Recovery and Resilience Plan (NRRP). This will support the objectives of Ireland's River Basin Management Plans and improve water quality in receiving waters by ensuring that Uisce Éireann assets are not impacting on the ability of receiving waters to achieve their water quality objectives under three sub-measures:

- a)** Sub-measure 1 - complete at least 10 small Wastewater Treatment Plant (WWTP) upgrades;
- b)** Sub-measure 2 - carry out feasibility studies for larger WWTPs; and
- c)** Sub-measure 3 - undertake assessments to quantify improvements in receiving waters.

The three sub-measures in the Uisce Éireann proposal align with RBMP priorities, including:

- a)** High status objective (HSO) water bodies
- b)** Area for Action (AFA) water bodies;
- c)** Water bodies with water-related protected area objectives; and
- d)** Urban wastewater significant pressures in at risk water bodies.

Sub-measure 2 is aimed at completing feasibility study assessments for WWTPs which align with RBMP objectives, that are not being addressed within the current investment plan. Completing these assessments will allow for WWTPs to be ready for progression to planning and construction in a shorter timeframe in the next investment period (2025-2029), if they constitute a 'project', thereby providing for the completion of relevant measures under the RBMP within the Cycle 3 period (i.e., 2022-2027).

The candidate list produced for Sub-measure 2 includes WWTPs that have been identified as significant pressures by EPA and which, in most cases, discharge to priority water bodies. UÉ has carried out the assessments of the current potential impact and where required outlines the proposed investment for the WWTPs.

Site 01 – Abbeydorney WWTP

Purpose of Assessment

The Abbeydorney WWTP has been identified as a significant pressure on the Brick_020 river waterbody which is currently at moderate ecological status. The EPA Catchment Science and Management Unit's (CSMU) initial characterisation assessment points to elevated ammonia and orthophosphate levels downstream of the WWTP and highlights the fact that the WWTP is overloaded with ongoing ELV breaches. The water body is not in a Priority Area for Action (PAA) and therefore is not subject to further characterisation assessment by LAWPRO.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053) Design Loadings were assessed to be 684 PE, 800 PE and 850 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the Abbeydorney / Boheroe Stream (BRICK_020) are presented in the main report.

A low flow hydrological estimation using hydrotool was completed for Abbeydorney / Boheroe Stream (BRICK_020) and it estimated:

- 95%ile flow rate at 0.009m³/sec (50% of NATQ95 0.018 m³/s)
- Mean flow rate at 0.1638m³/sec (70% of NATQ30 0.234 m³/s)

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's for the 25-year horizon load:

- Carbonaceous BOD: 5.0 mg/L
- Ammonia Nitrogen: 0.4 mg/L
- Ortho Phosphate: 0.1 mg/L

The Report describes the existing site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options have been assessed in the report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, proposed treatment standards, and the site considerations e.g., site selection, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Abbeydorney WWTP.

- Because of the low ELV's needed at the existing discharge point it is recommended to move the site to the new location and discharge to a river with more assimilative capacity.
- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each options, the recommended technical solution is **5Q : New WwTP with ASP treatment process and discharging to the Shannow River or the BRICK_020.**
- The ELV's at the proposed discharge points are very similar.
 - Shannow – Ammonia 1.4mg/l ; BOD 26mg/l ; Ortho P 0.8mg/l
 - BRICK_020 - Ammonia 1.2mg/l ; BOD 21mg/l ; Ortho P 0.6mg/l
- It is recommended to await the ambient river data for the Shannow River and the BRICK_020 to make an informed decision on which discharge to use.
- It is recommended to await the BRICK_020 measured low flow summer spot samples to make an informed decision on which discharge to use.
- The WWTP shall be designed for the 25-Year (2053) Design Loading of 850 PE and shall comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 02 – Balla WWTP

Purpose of Assessment

The Balla WWTP has been identified as a significant pressure on the Loughnaminoe Stream_010 river waterbody, which is currently at moderate ecological status. The EPA Catchment Science and Management Unit's (CSMU) initial characterization assessment points to a deterioration in Q values downstream of the WWTP compared to upstream with orthophosphate Emission Limit Value (ELV) breaches and elevated levels of orthophosphate downstream. The assessment also highlights concerns about washout of the plant and flow bypassing the plant via a Storm Water Overflow (SWO) at the inlet works. The agglomeration lies within the Castlebar Lannagh Area of Action (AFA). Local Authority Waters Programme (LAWPRO) further characterization assessments are ongoing with early desktop assessment indicating that nutrient and organic pollutants from urban wastewater are impacting the Loughnaminoe Stream_010 river waterbody, along with other pressures.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current population equivalent (PE) based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 1,250 PE, 1,650 PE and 1,800 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP Sub-measure 2 project, the current impact to/water quality assessment of the Loughnaminoe_010 stream are presented in the main report.

A low flow hydrological estimation was completed for Loughnaminoe_010 stream and it estimated Q_{95} and Q_{30} flow conditions of $0.025 \text{ m}^3/\text{s}$ and $0.45 \text{ m}^3/\text{s}$ respectively.

A preliminary Waste Assimilative Capacity (WAC) assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's for the 25 year horizon load:

- Carbonaceous BOD: 5.7 mg/L
- Ammonia Nitrogen: 0.3 mg/L
- Ortho Phosphate: 0.2 mg/L

The Report describes the existing site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Balla WWTP and to improve water quality in Loughnaminoo_010 stream:

- Based on the Gross Financial Net Present Value (GFNPV), Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 5: New WWTP with new treatment process.**
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 1,650 PE and 25-Year (2053) Design Loading of 1,800 PE and to comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- An AA Screening, EIA Screening and NIS is required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach will be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.
- Acquisition of a site of minimum 0.6ha is required to accommodate the new WWTP.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 03 – Ballindine WWTP

Purpose of Assessment

The Ballindine WWTP has been identified as a significant pressure on the Ballindine_010 river waterbody, which is currently at Poor ecological status. The EPA CSMU's initial characterisation assessment points to small increases in orthophosphate and significant increases in ammonia downstream. The plant is hydraulically overloaded at times which may be due to infiltration on the network and rehabilitation of the network is required according to the CSMU's assessment. The agglomeration lies within the Lough Mask and Lough Carra Area for Action (AFA). LAWPRO's further characterisation assessments are currently ongoing with a desktop assessment completed for the Lough Mask and Lough Carra AFA during the 2nd Cycle. Early assessments have indicated that the main issues affecting water quality are nutrients (orthophosphate), sediment and pesticides (herbicides and insecticides).

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design loadings were assessed to be 750 PE, 900 PE and 1,000 PE respectively.

Details on the existing conditions of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP SM2 project, the current impact assessment on water quality of the Ballindine_010 *stream* are presented in the main report.

A low flow hydrological estimation was completed for Ballindine _010 stream and it estimated Q₉₅ and Q₃₀ flow conditions of 0.031 m³/s and 0.305 m³/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 13 mg/L
- Ammonia Nitrogen: 0.6 mg/L
- Ortho Phosphate: 0.2 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Ballindine WwTP and to improve water quality in Ballindine_010 stream:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 4B: New ICW**.
- Provide new ICW type WWTP on a greenfield site in Ballindine to treat the collected load from the agglomeration. The proposed WWTP will include:
 - Existing inlet works
 - New ICW
 - Final Collection Pond
 - P removal dosing system
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 900 PE and 25-Year (2053) Design Loading of 1,000 PE and to comply with the ELVs outlined above.
- Recommended to replace the inlet screen at the end of its life cycle.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Preliminary Design Stage is recommended.
- Acquisition of a site of minimum 4.5 ha is required to accommodate the new ICW.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 04 – Ballingearry WWTP

Purpose of Assessment

The Ballingearry WWTP has been identified as a significant pressure on the Allua lake water body, which is currently at poor ecological status. The EPA Catchment Science and Management Unit's (CSMU) initial characterisation assessment points to levels of chlorophyll downstream of the plant that are indicative of poor status, and highlights that the plant is overloaded and is not compliant with its Emission Limit Values (ELVs). The agglomeration lies within the Allua Area of Action (AFA). LAWPRO's further characterisation assessments are ongoing with early assessment pointing to wastewater, among other pressures, causing water quality issues in the lake.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053) Design Loadings were assessed to be 610 PE, 700 PE and 750 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the Bunsheelin River are presented in the main report.

A low flow hydrological estimation using the EPA's hydrotool was completed for the Bunsheelin River and it is estimated:

- 95%ile flow rate at 0.0325 m³/sec (50% of NATQ95 0.065 m³/s)
- Mean flow rate at 0.6258 m³/sec (70% of NATQ30 0.894 m³/s)

A low flow hydrological estimation was completed by a hydrologist for the River Lee downstream of Bunsheelin and it is estimated:

- 95%ile flow rate at 0.160 m³/sec
- Mean flow rate at 3.173 m³/sec

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates for the River Lee outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's for 25 YR Horizon load:

- Carbonaceous BOD: 89 mg/L (limited to 25mg/l)
- Ammonia Nitrogen: 3.9 mg/L
- Ortho Phosphate: 2.2 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'net gain').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the new Ballingearry WWTP.

- Because of the extensive flood zone in and around Ballingearry, it is proposed to move the site to an area outside of the flood zone.
- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each options, the recommended technical solution is **Option 5W : New WwTP with ASP treatment process and discharging to the River Lee.**
- The new site has the advantage of having the sewage pumping station away from the main street and allows the treated effluent to discharge to more diluted waters.
- The ELV's at the proposed discharge point is
 - River Lee - Ammonia 3.9mg/l ; BOD 89mg/l (limited to 25mg/l); Ortho P 2.2mg/l
- It is recommended to obtain ambient river data from the monitoring programme to enhance the accuracy of the WAC assessment.
- The WWTP shall be designed for the 25-Year (2053) Design Loading of 750 PE and shall comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Detailed Design Stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 05 – Ballitore WWTP

Purpose of Assessment

Ballitore WwTP is listed as a significant pressure in the 3rd Cycle Draft Barrow Catchment Report (HA 14) on Greese_030. However, the WwTP in fact discharges into the Greese_040. The Greese_040 river waterbody, is currently at Moderate ecological status and also at risk of not achieving good water quality status.

Based on the studies conducted previously, the Ballitore WwTP has been identified as a significant pressure on the Greese_030 river waterbody, which is currently at Poor ecological status. The EPA Catchment Science and Management Unit's (CSMU) initial characterisation assessment points to the fact that ecological status downstream of the plant deteriorated to poor in 2017, while acknowledging that the close proximity of the monitoring point to the discharge point (25m) may be exacerbating the issue. Physico-chemical results at the monitoring point are erratic. The assessment also noted that a pumping station at Ballitore Bridge may be also impacting water quality. The agglomeration lies within the Greese Area for Action (AFA); however, Local Authority Waters Programme's (LAWPROs) further characterisation assessments have not yet begun for this water body.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

The main report evaluates the existing wastewater agglomeration network extents, current agglomeration loading, and the design horizon loadings (projected) e.g., 10 and 25-year design horizon loadings. The 10-year (2038) and 25-year (2053) design loadings were assessed at 1,050 PE and 1,200 PE respectively.

Details on:

- The existing condition of the receiving waterbody i.e., Greese_040,
- The current wastewater discharge standards includes ELVs of:
 - cBOD: 25 mg/l,

- Ammonia (as N): 3.0 mg/l,
 - Orthophosphate (as P): 2.0 mg/l,
 - The legislative background to the requirements of the NRRP-SM2 project,
 - The current impact to/water quality assessment of the Greese_040 via WAC calculation, and,
- are presented in the main report.

A low flow hydrological estimation was completed for Greese_040, and it estimated Q95 and Q30 flow conditions of 0.330 m³/s and 1.45 m³/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. ELVs were calculated as follows:

- Carbonaceous BOD: 25 mg/L
- Ammonia Nitrogen: 2.7 mg/L
- Ortho Phosphate: 3.8 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including

labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the ÚÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of Ballitore WwTP and to improve water quality in the Greese_040 receiving waters:

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis and risk associated, the recommended technical solution is **Option 3: Process Refurbishment**.
- The measures included in the report are proposed to ensure continuous compliance with the ELVS proposed in the WWDL application and provide operational resilience.
- The WWTP shall be designed for the 25-Year (2053) Design Loading of 1,200 PE and shall comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Detailed Design Stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 06 – Ballycanew WWTP

Purpose of Assessment

The Ballycanew WWTP has been identified as a significant pressure on the Owenavorrhagh_050 river waterbody, which is currently at Poor ecological status. The EPA Catchment Science and Management Unit's (CSMU's) initial characterisation assessment points to elevated levels of ammonia and orthophosphate downstream of the discharge, and visual evidence of sewage fungus in the area of the discharge has also been noted. The agglomeration lies within the Owenavorrhagh Area for Action (AFA). LAWPRO's further characterisation assessment work has yet to commence.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 770 PE, 1000 PE and 1,050 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the *Owenavorrhagh River* are presented in the main report.

A low flow hydrological estimation was completed for the existing discharge with a Q_{95} flow estimate of $0.049\text{m}^3/\text{s}$ (8l/s) and a Q_{30} flow estimate $0.859\text{m}^3/\text{s}$.

A preliminary WAC assessment was carried for the existing discharge point using notional clean concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 18.6 mg/L

- Ammonia Nitrogen: 1.0 mg/L
- Ortho Phosphate: 0.5 mg/L

A low flow hydrological estimation was completed for the *Owenavoragh_060* at alternative discharge location E315022, N154699 with a Q95 flow estimate of 0.029m³/s and a Q30 flow estimate of 0.836m³/s.

A preliminary WAC assessment was carried for the alternative discharge point at *Owenavoragh_060* using the notional clean concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 78.2 mg/L (limited to 25mg/l)
- Ammonia Nitrogen: 4.4 mg/L
- Ortho Phosphate: 2.3 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net

Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the Ballycanew WWTP and to improve water quality in the Owenavoragh River.

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 7B Pump sewage to the Courtown sewer collection system near Riverchapel P.S.**
- The SPS shall be designed for the Future 25-Year (2053) Formula A flow of 1,664m³/day or 69.3m³/hr
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Preliminary design Stage is recommended.
- Acquisition of a site is required to accommodate the new header chamber.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 07 – Blacklion WWTP

Purpose of Assessment

The Blacklion WWTP has been identified as a significant pressure on the Lough Macnean Lower Lake. The final effluent currently discharges to Lough Macnean Lower which is part of the Erne Catchment. This is a cross border catchment with a surface area of 4,415km², 2,512km² of which is located within the Republic of Ireland. The current ecological status has been determined as Bad and WFD Risk status is at Risk. Urban wastewater pressures have been identified for this sub catchment. The Wastewater Treatment plant at Blacklion is a “a recognized problematic wastewater facility” in the sub catchment assessment of the WFD Cycle 2. The 2019, 2020 and 2021 AER indicated that WWTP had failed on overall compliance for Total Ammonia (as N) mg/l. Hence the Blacklion WWTP plant is considered under this programme.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann’s assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053) Design Loadings were assessed to be 850 PE, 950 PE and 1000 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the Lough Macnean Lower are presented in the main report.

A preliminary WAC assessment was carried out using the Lake ambient concentrations. Based on this, it is recommended that the WWTP be designed to comply with the following ELV’s

- Carbonaceous BOD: 25 mg/L
- Ammonia Nitrogen: 5 mg/L
- Ortho Phosphate: 0.5 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Blacklion WwTP and to improve water quality in Lough Macnean Lower:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 4C: Asset Reuse with Additional Investment** using treatment reed beds (Nature Based Solution) for secondary and tertiary treatment.
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 950 PE and 25-Year (2053) Design Loading of 1,000 PE and to comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at detailed design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Detailed Design Stage is recommended.
- Land acquisition of minimum 0.3ha, adjacent to existing WwTP is required to accommodate the preferred Option.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 08 – Borrisokane WWTP

Purpose of Assessment

The Borrisokane WwTP has been identified as a significant pressure on the Ballyfinboy_050 river waterbody, which is currently at Moderate ecological status. The EPA CSMU's initial characterisation assessment acknowledges that that plant is operation well and that ambient monitoring does not indicate downstream impact but identifies a high ammonia recorded due to a shock load event. The agglomeration lies within the Ballyfinboy Area for Action (AFA). LAWPRO's further characterisation assessments have not yet begun for this WWTP.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 1800 PE, 2,200 PE and 2,500 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the *Ballyfinboy_050* are presented in the main report.

A low flow hydrological estimation was obtained for the Ballyfinboy_050 at the existing discharge point and it estimated Q_{95} and average flow conditions of $0.094 \text{ m}^3/\text{s}$ and $0.928 \text{ m}^3/\text{s}$ respectively.

A preliminary WAC assessment for the existing discharge point was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 16.1 mg/L
- Ammonia Nitrogen: 1.2 mg/L

- Ortho Phosphate: 0.6 mg/L

A low flow hydrological estimation was also obtained for River Ballyfinboy_060 at the alternative discharge point and it estimated Q_{95} and average flow conditions of 0.209 m³/s and 2.055 m³/s respectively.

A preliminary WAC assessment for the alternative discharge point at Ballyfinboy_060 was also carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 34 mg/L (limited to 25mg/l)
- Ammonia Nitrogen: 1.9 mg/L
- Ortho Phosphate: 1.0 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net

Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Borrisokane WWTP and to improve water quality in the Ballyfinboy_050:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 4A: Asset Reuse with Additional Investment discharge to existing discharge point**
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 2,200 PE and 25-Year (2053) Design Loading of 2,500 PE and to comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Preliminary design Stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 09 – Castlecomer WWTP

Purpose of Assessment

The Castlecomer WWTP has been identified as a significant pressure on the Dinin (North)_040 river waterbody, which is currently at Moderate ecological status. The EPA CSMU's initial characterization assessment acknowledges marked improvements in effluent and ambient quality, but points to previous compliance investigations for ELV breaches. Further assessment is required. The agglomeration lies within Dinin Area for Action (AFA). LAWPRO's further characterization assessments are ongoing. A desktop assessment has been completed but does not include the Dinin (North)_040 waterbody as it was not part of the AFA during Cycle 2.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 2,600 PE, 3,250 PE and 3,550 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the *River Dinin_010* are presented in the main report.

A low flow hydrological estimation were obtained for *Dinin_010* at the discharge point and it estimated Q_{95} and Q_{30} flow conditions of 0.19 m^3/s and 2.98 m^3/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 15 mg/L
- Ammonia Nitrogen: 1.5 mg/L
- Ortho Phosphate: 0.4 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Castlecomer WWTP and to improve water quality in River Dinin_010.

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 4A: 3rd SBR tank, additional chemical dosing, FE balance tank, tertiary treatment and new FE washwater PS/chamber**
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 3,250 PE and 25-Year (2053) Design Loading of 3,550 PE and to comply with the ELVs outlined above.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Preliminary design Stage is recommended.
- It is recommended to keep the overhanging branches around the perimeter of the site felled back to avoid twigs and leaves effecting the treatment processes.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 10 – Coill Dubh WWTP

Purpose of Assessment

The Coill Dubh WwTP has been identified as a significant pressure on the Slate_020 water body, which is currently at poor ecological status. The EPA Catchment Science and Management Unit's (CSMU) initial characterisation assessment points to elevated levels of ammonia and orthophosphate downstream of the plant, despite improvements in ELV compliance following upgrade works in 2017. The agglomeration lies within Upper Slate Area of Action (AFA), but LAWPRO's further characterisation assessments have not yet begun in this waterbody.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design loadings were assessed to be 1,550 PE, 1,700 PE and 1,950 PE respectively.

Details on the existing conditions of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP SM2 project, the current impact assessment on water quality of the Slate_020 water body are presented in the main report.

A low flow hydrological estimation was completed for Slate_020 water body and it estimated Q_{95} and Q_{30} flow conditions of 0.013 m³/s and 0.14 m³/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's for the 25 year design horizon:

- Carbonaceous BOD: 5.3 mg/L
- Ammonia Nitrogen: 0.2 mg/L

- Ortho Phosphate: 0.1 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations to minimise the impact on the River Slate_020 receiving waters:

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis, the recommended technical solution is **Option 4: Asset Reuse with Additional Investment**.
- The resilience measures included in Option 4, including H&S item, are proposed to address the D0242-01 ELV 95%ile exceedances at the WwTP to ensure compliance and operational certainty. It is not expected that a WWDA licence review is required as there appears to be no impact to the WFD status of the Slate River from the WwTP. This would ensure that the plant is able to operate efficiently and be compliant for another 10-15 years.
- It is recommended that **Option 6A: Relocate effluent discharge to another location with Asset Reuse with Additional Investment**, can be implemented as an additional step after 10 to 15 years to further maintain plant compliance and resilience e.g., deferred implementation. The 10/25-Year horizon Proposed ELVs at the relocated outfall are in the same range as the D0242-01 ELVs at the existing outfall, allowing the WwTP to meet it's 10 and 25-year design horizon loadings without significant additional upgrade to the treatment process in comparison to Option 4.
- The surveys/investigative works recommended at preliminary design stage are outlined in the report.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Detailed Design Stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 11 – Colecott Cottages WWTP

Purpose of Assessment

The Colecott Cottages WWTP has been identified as a significant pressure on the Ballough Stream_020 river waterbody, which is currently at Moderate ecological status. The Environmental Protection Agency (EPA) CSMU's initial characterisation assessment points to elevated ammonia and orthophosphate concentrations both upstream and downstream of the discharge. The agglomeration lies within Rogerstown Estuary Area for Action (AFA). LAWPRO's further characterisation assessments are completed and indicate that water quality problems are due to excessive amounts of nutrients and sediment mainly coming from urban wastewater and agricultural lands in the catchment.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to remove Colecott Cottages WWTP as a significant pressure on the BALLOUGH STREAM_020 water body, which is currently at Moderate ecological status. These works will improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates, the 25 year design loading was assessed to be 61PE.

Details on the existing conditions of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP SM2 project, the current impact assessment on water quality of the BALLOUGH STREAM_020 are presented in the main report.

A low flow hydrological estimation was completed for BALLOUGH STREAM_020 for Q₉₅ and Q₃₀ flow conditions. As there is no discharge from Colecott Cottages under dry weather, which is when 95%ile river flows would be expected, the Mean Flow Conditions in the river have been considered for the WAC Calculations.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates for the BALLOUGH STREAM_020 outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's for 25 YR Horizon load:

- Carbonaceous BOD: 25 mg/L
- Ammonia Nitrogen: 4.1 mg/L
- Ortho Phosphate: 2.1 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations to minimise the impact on the BALLOUGH STREAM_020 receiving waters:

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis, the recommended technical solution is **Option 3: Process Refurbishment**.
- Process refurbishment is recommended to monitor and reduce discharges and stormwater overflows to outfall and subsequently the impact to BALLOUGH_STREAM_020.
- The list of recommended surveys and investigative works are recommended in the main report.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.
- It is recommended that a phased approach is implemented: Once the frequency and volume of the discharges under wet weather conditions has been quantified with the measures proposed in Option 3, additional design can be then undertaken.
- Option 4 could be progressed if it is deemed required to provide additional stormwater storage and treatment. Current available information indicates that the WwTP only discharges 10% of the time in wet weather conditions where the river flows would be higher than the assessed mean flows.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 12 – Dunleer WWTP

Purpose of Assessment

The Dunleer WwTP has been identified as a significant pressure on the White (Louth)_020 river waterbody, which is currently at Moderate ecological status, and the White (Louth)_030 river water body which is currently at Poor status. The EPA CSMU's initial characterisation assessment points to elevated orthophosphate concentrations in these water body and states that no upgrade works have been completed. The agglomeration lies within River White (Louth) Area for Action (AFA). LAWPRO's further characterisation assessments have not yet begun for this WwTP.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

The report evaluates the existing wastewater agglomeration network extents, current agglomeration loading, and the design horizon loadings e.g., 10-year and 25-year design horizon loadings. The base-year (2028), 10-year (2038) and 25-year (2053) design loadings were assessed at 3,400 PE, 3,600 PE and 4,150 PE respectively, based on a calculation of the current domestic and non-domestic PE and projected growth estimates provided by the UÉ Forward Planning Specialist.

Details on the following are presented in the main report:

- The existing condition of the receiving waterbody i.e., White (Louth)_020,
- The current wastewater discharge standards of:
 - cBOD: 8.0 mg/l,
 - Ammonia (as N): 0.5 mg/l,
 - Orthophosphate (as P): 0.2 mg/l,
- The legislative background to the requirements of the NRRP-SM2 project,
- The River White (Louth)_020 upstream ambient concentrations, and,

- The required effluent ELVs at existing outfall for the current, 10-Year, and 25-Year loading via WAC calculation,

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations at Dunleer WwTP to minimise the impact on the River White (Louth)_020 receiving waters.

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis, the recommended technical solution is **Option 4A: Asset Reuse with Additional Investment**.
- The Dunleer WwTP site appears to have available space to accommodate additional treatment equipment e.g., asset reuse with additional investment will need to achieve adequate treatment to the 25-year capacity design load theoretical/proposed ELVs and a reduction in Ammonia Nitrogen concentrations. Option 4A is proposed to achieve this with a minimal impact to the current wastewater treatment stream.
- The list of recommended surveys and investigative works are recommended in the report.
- Design measures may be required to mitigate against risk at planning stage for Option 4. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.
- Due to the high dilutions available for proposed/theoretical ELVs at the relocated outfall no.2 location at River Dee_080, **Option 6B: Relocate effluent discharge to another location with Asset Reuse with Additional Investment** may be implemented as an additional step if treatment capacity greater than the 25-year design horizon loading is required.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 13 – Kilcoole WWTP

Purpose of Assessment

The Kilcoole WwTP has been identified as a significant pressure on the Kilcoole Stream_010 river waterbody, which is currently at Poor ecological status. The EPA Catchment Science and Management Unit's (CSMU) initial characterisation assessment points to elevated total ammonia and orthophosphate concentrations downstream of the discharge. The agglomeration lies within Kilcoole Newcastle and Newtownmountkennedy Area for Action (AFA). Local Authority Waters Programme's (LAWPRO's) further characterisation assessments have not yet begun for this WWTP.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

The report evaluates the existing wastewater agglomeration network extents, current agglomeration loading, and the design horizon loadings e.g., 10 and 25-year design horizon loadings. The base-year (2028), 10-year (2038) and 25-year (2053) design loadings were assessed at 2,800 PE, 3,200 PE and 3,800 PE respectively, based on a calculation of the current domestic and non-domestic PE and projected growth estimates provided by the UÉ Forward Planning Specialist.

Details on the following are presented in the main report:

- The existing condition of the receiving waterbody i.e., Kilcoole_010,
- The current wastewater discharge standards ELVs of:
 - cBOD: 20 mg/l,
 - Ammonia (as N): 5 mg/l,
 - Orthophosphate (as P): 2 mg/l,
- The legislative background to the requirements of the NRRP-SM2 project,
- The Kilcoole _010 stream upstream ambient concentrations, and,
- The required effluent ELVs at existing outfall for the current, 10-Year, and 25-Year loading via WAC calculation,

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for Kilcoole WwTP to minimise the impact on the Kilcoole_010 stream:

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis, the recommended technical solution is **Option 7: Pump away to another WWTP for treatment.**
- The pumping station shall be designed for the future 10-Year (2038) design loading of 3,200 PE (M&E) and 25-Year (2053) design loading of 3,800 PE (Civils).
- The list of recommended surveys and investigative works are recommended in the main report.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 14 – Kilcormac WWTP

Purpose of Assessment

The Kilcormac WWTP has been identified as a significant pressure on the Silver (Kilcormac)_030 river waterbody, which is currently at Moderate ecological status. The EPA CSMU's initial characterisation assessment points to increases in both ammonia and orthophosphate concentration downstream. The agglomeration lies within the Silver (Kilcormac) Area for Action (AFA). LAWPRO's further characterisation assessments are complete and point to ammonia and nutrient issues from Kilcormac, including from misconnections.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

The report evaluates the existing wastewater agglomeration network extents, current agglomeration loading, and the design horizon loadings e.g., 10-year and 25-year design horizon loadings. The base-year (2028), 10-year (2038) and 25-year (2053) design loadings were assessed at 1,650 PE, 1,850 PE and 2,100 PE respectively, based on a calculation of the current domestic and non-domestic PE and projected growth estimates provided by Uisce Éireann's Forward Planning Specialist.

Details on the following are presented in the main report:

- The existing condition of the receiving waterbody i.e., Silver (Kilcormac)_030,
- The current wastewater discharge standards of:
 - cBOD: 25.0 mg/l,
 - Ammonia (as N): 7.5 mg/l,
 - Orthophosphate (as P): 3.5 mg/l,
- The legislative background to the requirements of the NRRP-SM2 project,
- The River Silver (Kilcormac)_030 upstream ambient concentrations, and,
- The required effluent ELVs at existing outfall for the current, 10-Year, and 25-Year loading via WAC calculation,

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The purpose of this report is to assess the works or upgrades necessary at Kilcormac WwTP to minimise the impact on the River Silver (Kilcormac)_030 receiving waters.

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis, the recommended technical solution is **Option 4A: Asset Reuse with Additional Investment**.
- Option 4C scored the best economic and multi-criteria benefit, however there is a large process risk that the NCOUF may not be able to achieve the 25-year design loading Required ELVs. Option 4A is therefore proposed e.g., the additional tertiary treatment of the effluent by ASP, to guarantee the treatment of wastewater to the 25-year design loading Required ELVs.
- The list of recommended surveys and investigative works are recommended in the main report.
- Design measures may be required to mitigate against risk at planning stage for Option 4A. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 15 – Kilkelly WWTP

Purpose of Assessment

The Kilkelly WWTP has been identified as a significant pressure on the Trimoge_010 river waterbody, which is currently at Moderate ecological status. The EPA CSMU's initial characterisation assessment points to impacts on water quality being caused by the proximity of the discharge to the ecological station. The agglomeration lies within the Trimoge Area for Action (AFA). LAWPRO's further characterisation assessment work has yet to commence.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 550 PE, 650 PE and 750 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the Trimoge_010 river are presented in the main report.

A low flow hydrological estimation was completed for Trimoge_010 River (Existing discharge Point), and it estimated Q_{95} and Q_{30} flow conditions of $0.169 \text{ m}^3/\text{s}$ and $1.147 \text{ m}^3/\text{s}$ respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP to be designed to comply with the following ELV's:

- Carbonaceous BOD: 25 mg/L
- Ammonia Nitrogen: 1.0 mg/L
- Ortho Phosphate: 1.4 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Kilkelly WWTP and to improve water quality in Trimoge_010 River:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 4A: Asset Reuse with Additional Investment – Additional ASP and Clarifier in parallel with existing treatment units, New chemical dosing system and sludge drying reed bed.**
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 650 PE and 25-Year (2053) Design Loading of 750 PE and to comply with the ELVs outlined above.
- The list of recommended surveys and investigative works are recommended in the main report.
- An AA Screening, EIA Screening, NIS and fisheries survey would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. In order to inform this, proactive engagement with stakeholders as part of the Preliminary Design Stage is recommended.
- Options 4B and 4D have similar scopes. It is recommended to further assess in the Preliminary Design Stage in terms of the actual capital cost and energy consumption of the Forced Bed Aeration. Acquisition of a site minimum of 0.2 ha is required

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 16 – Killygordon WWTP

Purpose of Assessment

The Killygordon WWTP has been identified as a significant pressure on the Finn (Donegal)_070 and Finn (Donegal)_080 river water bodies, which are currently at moderate and poor ecological status respectively. The EPA Catchment Science and Management Unit's (CSMU) initial characterisation assessment points to a deterioration in Q values downstream of the WWTP, and the presence of filamentous algae, which is indicative of nutrient enrichment. The agglomeration lies within the Finn (Donegal) Area for Action (AFA). LAWPRO's further characterisation assessments are ongoing with early assessment indicating that urban wastewater is impacting water quality via excessive nutrients, along with other pressures.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), design loadings were assessed to be 850 PE, 900 PE and 1,000 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge license, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the River Finn are presented in Section 3.

A low flow hydrological estimation was completed for River Finn and it is estimated that Q95 and Q30 flow conditions are 1.841 m³/s and 24.682 m³/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 25 mg/L
- Ammonia Nitrogen: 5 mg/L
- Ortho Phosphate: 9 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Killygordon WWTP to improve water quality in the River Finn:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 5A: New WWTP with new treatment process (Nature Based Solution)**.
- The WWTP shall be designed for the Future 10-Year (2038) Design Loading of 900 PE and 25-Year (2053) Design Loading of 1,000 PE and to comply with the ELVs outlined above.
- The list of recommended surveys and investigative works are recommended in the main report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at the preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. In order to inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.
- Acquisition of a site of minimum 0.25 ha is required to accommodate the new WWTP.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 17 – Kilpedder WWTP

Purpose of Assessment

The Kilpedder WwTP has been identified as a significant pressure on the Kilcoole Stream_010 river waterbody, which is currently at Poor ecological status. The EPA CSMU's initial characterisation assessment acknowledges an improvement in downstream ambient quality, but points to possible assimilative capacity issues and the fact that UÉ assessments indicate the ELVs are not stringent enough. The agglomeration lies within the Kilcoole Newcastle and Newtownmountkennedy Area for Action (AFA). LAWPRO's further characterisation assessments have not yet begun for this WwTP.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

The report evaluates the existing wastewater agglomeration network extents, current agglomeration loading, and the design horizon loadings e.g., 10-year and 25-year design horizon loadings. The base-year (2028), 10-year (2038) and 25-year (2053) design loadings were assessed at 692 PE, 734 PE and 900 PE respectively, based on a calculation of the current domestic and non-domestic PE and projected growth estimates provided by the UÉ Forward Planning Specialist.

Details on the following are presented in the main report:

- The existing condition of the receiving waterbody i.e., Kilcoole Stream_010,
- The current wastewater discharge standards of:
 - cBOD: 8.0 mg/l,
 - Ammonia (as N): 0.7 mg/l,
 - Orthophosphate (as P): 0.4 mg/l,
- The legislative background to the requirements of the NRRP-SM2 project,
- The Kilcoole _010 stream upstream ambient concentrations, and,
- The required effluent ELVs at existing outfall for the current, 10-Year, and 25-Year loading via WAC calculation,

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring, operations/maintenance/H&S requirements, and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations at Kilpedder WwTP to minimise the impact on the Kilcoole_010 stream:

- Based on the Gross Financial Net Present Value and Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 7A: Pump away to Greystones WwTP for treatment.**
- The pumping station shall be designed for the Future 10-Year (2038) design loading of 734 PE (M&E) and 25-Year (2053) design loading of 900 PE (Civils).
- The list of recommended surveys and investigative works are recommended in the main report.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 18 – Lisdoonvarna WWTP

Purpose of Assessment

The Lisdoonvarna WWTP has been identified as a significant pressure on the Aille (Clare)_010 and Aille (Clare)_020 river water bodies, which are both currently at Moderate ecological status. The EPA CSMU's initial characterisation assessment points to elevated orthophosphate concentrations in both water bodies. The agglomeration lies within the Aille Area for Action (AFA). LAWPRO's further characterisation assessments work is ongoing.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 2500 PE, 2800 PE and 3,000 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the River Aille are presented in Section 3.

A low flow hydrological estimation was completed for River Aille and it is estimated that Q95 and Q30 flow conditions of 0.031 m³/s and 0.908 m³/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 4.6 mg/L
- Ammonia Nitrogen: 0.25 mg/L
- Ortho Phosphate: 0.12 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring, and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Lisdoonvarna WWTP and to improve water quality in River Aille:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with both options, the recommended technical solution is **Option 4B: Asset Reuse with Additional Investment (ASP Process with sludge drying reed beds)**
- The WWTP shall be designed for the Future 25-Year (2053) Design Loading of 3,000 PE and to comply with the ELVs outlined above.
- The list of recommended surveys and investigative works are recommended in the main report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at Preliminary Design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the Preliminary Design Stage is recommended.
- Acquisition of a site of minimum 0.5 ha is required to accommodate the new WWTP.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 19 – Mohill WWTP

Purpose of Assessment

The Mohill WWTP has been identified as a significant pressure on the Rinn_010 river waterbody, which is currently at Poor ecological status. The EPA CSMU's initial characterization assessment points to network related issues, as well as numerous ELV breaches despite the building of a new plant with tertiary treatment in 2019. The agglomeration lies within the Lough Rinn Forbes Area for Action (AFA). LAWPRO's further characterisation assessments are complete, with excessive amounts of nutrients and pesticides noted as the main issues that have caused water quality problems.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 1,850 PE, 2,050 PE and 2,200 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge licence, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the Rinn_010 river/ Mohill stream are presented in the main report.

A low flow hydrological estimation was completed for Mohill Stream (Existing discharge Point), and it estimated Q95 and Q30 flow conditions of 0.018 m³/s and 0.144 m³/s respectively.

A preliminary WAC assessment was carried out using the actual background concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP to be designed to comply with the following ELV's:

- Carbonaceous BOD: 4.7 mg/L

- Ammonia Nitrogen: 0.2 mg/L
- Ortho Phosphate: 0.1 mg/L

A low flow hydrological estimation was completed for Rinn_020 (Proposed discharge Point), and it estimated Q₉₅ and Q₃₀ flow conditions of 0.148 m³/s and 2.409 m³/s respectively.

A preliminary WAC assessment was carried out using the notionally clean approach concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP to be designed to comply with the following ELV's:

- Carbonaceous BOD: 19.4 mg/L
- Ammonia Nitrogen: 0.8 mg/L
- Ortho Phosphate: 0.4 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, land acquisition and wayleaves, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net

Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the upgrade of the Mohill WWTP and to improve water quality in Mohill stream:

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 6D: Relocate effluent discharge to another location with Asset Reuse with Additional Investment (Nature Based Solution)**.
- The WWTP shall be designed for the Future 25-Year (2053) Design Loading of 2,200 PE and to comply with the ELVs outlined above.
- The list of recommended surveys and investigative works are recommended in the main report.
- An AA Screening, EIA Screening, NIS and fisheries survey would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at detailed preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. In order to inform this, proactive engagement with stakeholders as part of the Preliminary Design Stage is recommended.
- Acquisition of a site minimum 1.2 ha is required to accommodate the new Forced Bed Aeration and Sludge Drying Reed Bed

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.

Site 20 – Mullinahone WWTP

Purpose of Assessment

The Mullinahone WWTP has been identified as a significant pressure on the Mullinahone Stream_010 river waterbody, which is currently at Poor ecological status. The EPA CSMU's initial characterization assessment points to elevated orthophosphate and total ammonia downstream of the discharge causing water quality issues and acknowledges that plant upgrade works are continuing onsite. The agglomeration lies within the Anner River Area for Action (AFA). LAWPRO's further characterisation assessments have not yet begun for this WWTP.

Summary

The purpose of this report is to assess the feasibility of a short list of upgrade options of the existing WWTP to improve water quality in receiving waters and ensure that Uisce Éireann's assets are not impacting on the ability of receiving waters to achieve their water quality objectives.

Following a calculation of the current PEs based on available data and projected growth estimates for project base year (2028), 10-Year (2038) and 25-Year (2053), Design Loadings were assessed to be 777 PE, 950 PE and 1,050 PE respectively.

Details on the existing condition of the receiving waterbody, the current wastewater discharge standards e.g., existing discharge license, the legislative background to the requirements of the NRRP-SM2 project, the current impact to/water quality assessment of the Mullinahone stream are presented in the report.

A low flow hydrological estimation was completed for the existing discharge at location 233643E 139611N with a Q₉₅ flow estimate of 0.008m³/s (8l/s) and a Q₃₀ flow estimate 0.265m³/s.

A low flow hydrological estimation was completed for the ANNER_30 at alternative discharge location 233017E, 137328N with a Q₉₅ flow estimate of 0.029m³/s and a Q₃₀ flow estimate of 0.836m³/s.

A low flow hydrological estimation was completed for the ANNER_20 at alternative discharge location 232907E, 136366N with a Q₉₅ flow estimate of 0.044 m³/s and a Q₃₀ flow estimate 1.26m³/s.

A preliminary WAC assessment was carried for the existing discharge point using notional clean concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 4.5 mg/L
- Ammonia Nitrogen: 0.2 mg/L
- Ortho Phosphate: 0.1 mg/L

A preliminary WAC assessment was carried for the alternative discharge point to the ANNER_020 at Five Eye Bridge using the notional clean concentrations and the low flow estimates outlined above. Based on this, it is recommended that the WWTP be designed to comply with the following ELV's:

- Carbonaceous BOD: 9.6 mg/L
- Ammonia Nitrogen: 0.5 mg/L
- Ortho Phosphate: 0.3 mg/L

The Report describes the existing WwTP site layout, process flow and description, asset energy performance, influent wastewater monitoring and effluent performance.

The long list of options was presented and considered, with a shortlist of viable options created. The shortlisted options were further assessed in the Report. This includes the technical details e.g., proposed treatment standards, process flow diagram, design flow and loads, and proposed treatment standards, and the site considerations e.g., site selection, land acquisition and wayleaves, planning, flood risk, environmental and geotechnical.

The sustainability requirements of each option are summarised in the report. Three headings are used to assess sustainability; energy efficient design (e.g., Register of Opportunities, IPS Outcomes and Renewable Energy), climate change assessment (e.g., prolonged dry times, flooding, and heavy rainfall), and biodiversity (e.g., biodiversity 'no-net loss').

A quantitative assessment in terms of the CAPEX and OPEX of the upgrade options is presented in the report. It details the estimated costs related to Capital Expenditure, Operational Expenditure including labour, chemical use, material and consumables cost, and incremental OPEX/yr.

Financial and Economic appraisals were assessed for all options using the UÉ Financial Appraisal Model e.g., to calculate the Financial Net Present Value (FNPV), and the Multi-Criteria Analysis tool e.g., providing assessment of multi-criteria analysis based on the Value Framework.

The short-listed options were summarized and discussed, and a preferred option recommended based on assessment.

Future considerations to inform the preliminary and detailed design, and the estimation of option specific assumptions, allowances and risks are provided in the report.

Recommendations

The following are the primary recommendations for the new Mullinahone WwTP and to improve water quality in the Mullinahone Stream.

- Based on the Gross Financial Net Present Value, Multi-Criteria Analysis and risk associated with each option, the recommended technical solution is **Option 5A: ASP at new site and discharge to the Mullinahone Stream**
- The WWTP shall be designed for the Future 25-Year (2053) Design Loading of 1,050 PE and to comply with the ELVs outlined above.
- The list of recommended surveys and investigative works are recommended in the main report.
- An AA Screening, EIA Screening and NIS would be required to confirm that the project does not significantly impact on designated ecological areas of interest and/or the environment.
- The planning approach should be confirmed at preliminary design stage following the completion of the AA Screening and EIA Screening reports.
- Design measures may be required to mitigate against risk at planning stage. To inform this, proactive engagement with stakeholders as part of the preliminary design stage is recommended.
- Acquisition of a site of minimum 0.6ha is required to accommodate the new WWTP.

The above preferred option shall be considered concept design for a defined project that will require investment approval for further delivery.