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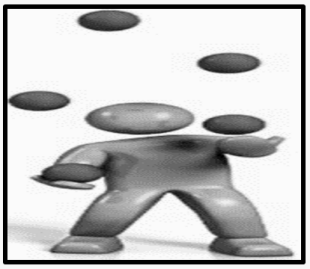

Feasibility Report

KEADUE WASTEWATER TREATMENT PLANT
UPGRADE WORKS

KMCF ENGINEERING
DUBLIN ROAD
ATHLONE

2014

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1. Introduction

1.1. Purpose of the Feasibility Report

The purpose of this report is to outline the works required for the upgrade of the existing wastewater treatment plant at Keadue, Co. Roscommon.

It may also be a possibility to produce a generic project management and tendering tool to help with future works of a similar nature.

1.2. Project Description

The village of Keadue in County Roscommon is serviced by a wastewater treatment plant which was originally constructed circa. 1980. The effluent from the village flows by gravity towards and through the works which currently consist of the following in sequence:

- split flow chamber and screens
- Imhoff tank
- rotary filter
- humus tank
- sludge drying beds
- outlet inspection chamber
- reed bed

The final effluent discharges into the adjoining Lough Meelagh.

It is proposed to incorporate an additional treatment plant to the existing setup, with the possibility of utilising as much of the existing infrastructure as possible. It is a requirement that the existing plant be kept operational during any upgrade works, with any disruption to be kept to a minimum.

From a tendering viewpoint, the entire process can be quite laborious, therefore, the introduction of a generic tender process aid, could be of great benefit to any interested contractor. Another vital component of any publicly funded works is that of the management of the project by a successful contractor. The combination of the above could result in the

generation of a combined tendering and project management tool, that can be utilised and amended, where appropriate, to all future projects in this area.

1.3. Justification for the Upgrade Works

In 2000, the EU passed a piece of legislation called the Water Framework Directive (WFD). The basis of this directive is that it established a framework for the protection of all waters including lakes, rivers, groundwater, estuaries, coastal waters and their dependant wildlife / habitats under one piece of environmental legislation. On foot of this, it became necessary for all local authorities throughout the country to closer examine all wastewater treatment plants under their control.

In the case of the Keadue WWTP, it was deemed necessary to upgrade the system so as to comply with the WFD.

1.4. Desired Outcome from the Upgrade Works

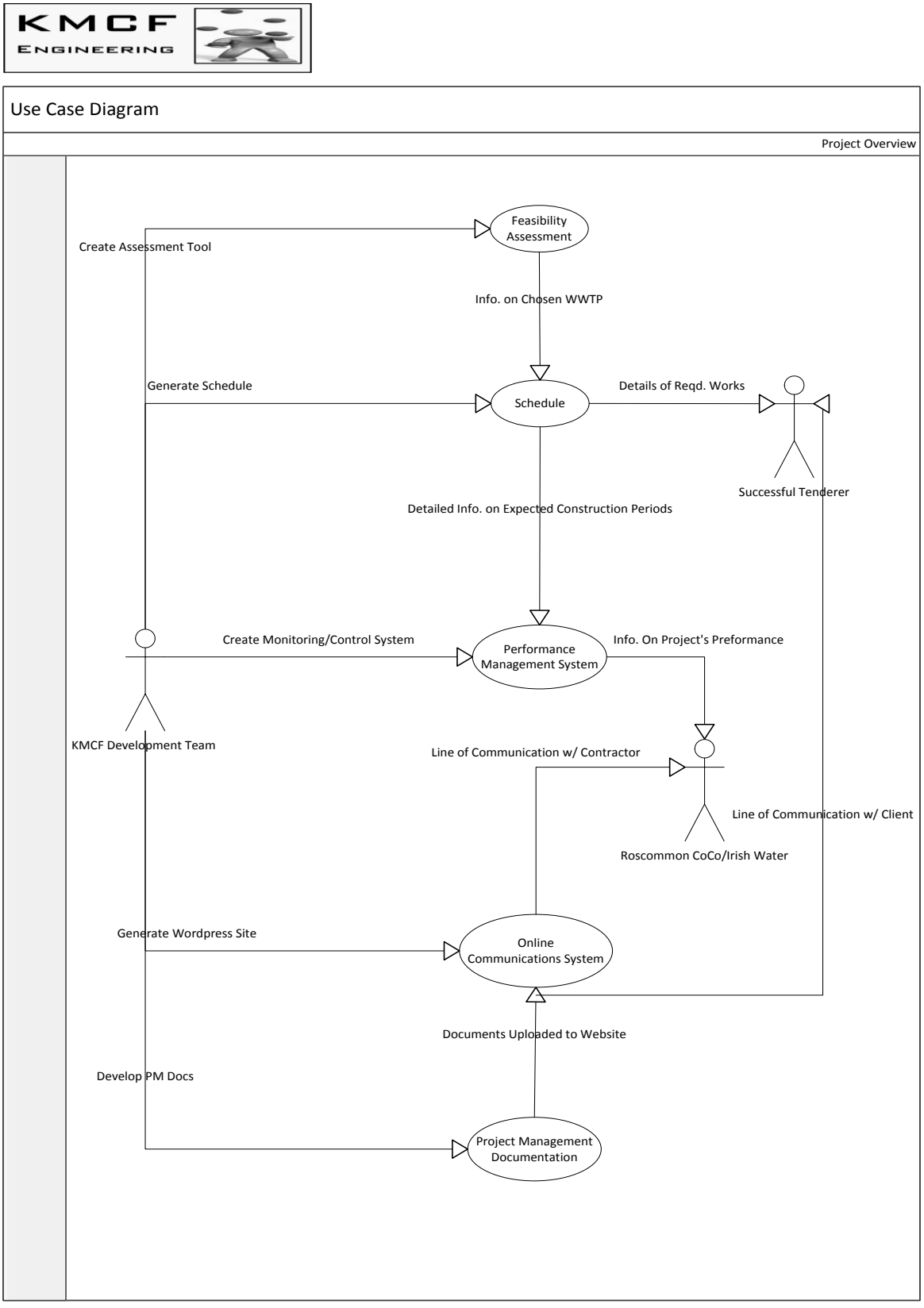
It would be envisaged that the appropriate, and correct, decisions will be made in order to ensure that the most appropriate treatment plant is installed at this site. The direct outcome of such works would be the reduction of the risks associated with WWTP in relation to environmental pollution and to help sustain the natural ecology of the area.

A subsequent outcome of these works could be the development of a tender selection system for projects of a similar nature. This system may form the basis of a generic aid, which may in turn be tailored for use on projects which are similar to that as with the Keadue works.

This system may comprise of several key components as outlined below:

- Feasibility assessment
- Schedule of works
- Construction schedule
- Performance management system
- All associated project management documentation

1.4.1. Use Case Diagram



1.4.2. Actors

1. KMCF Engineering

Primary actors within the project. Initiators of all of the use case scenarios.

2. Roscommon County Council / Irish Water

Clients for the project.

3. Successful Tenderer (D.B.O.)

Secondary suppliers to the main client of the project. Once construction has commenced they replace KMCF as primary actor.

1.4.3. Use Case Descriptions

1. Feasibility Assessment

Selection program, containing criteria for the selection of treatment unit.

2. Schedule

Sets out the works which are required to complete the project.

3. Performance Management System

Monitoring and controlling program for the project.

4. Online Communications System

Online interface for communication between all actors of the project.

5. Project Management Documentation

Development of all PRINCE 2 project management documents.

2. Available Methods and Technologies

2.1. WWTP Upgrade Works

2.1.1. Package Wastewater Treatment Systems

Package WWTP's generally provide an 'all-in-one' effluent treatment solution. They can prove to be an ideal solution to effectively upgrade a treatment plant serving a small community such as the one in question.

2.1.2. Traditionally Designed Treatment Systems

The modern, traditionally designed, treatment plant can be assembled in any form necessary to deal with many of the problems that can be encountered at WWTP's today. Additions to a plant to improve its final effluent standard can be a simple and straight-forward solution. However, it may also be necessary to replace certain structures within a plant, possibly due to their age and structural integrity, to improve growing populations and standard of final effluent.

2.2. Proposed Tendering & Management System

2.2.1. Microsoft EXCEL

EXCEL is a very powerful software program that can be used by all professions to help perform tasks such as numerical calculations and also for non-numeric applications. Below are some of the uses for EXCEL which can prove to be very beneficial for projects such as this:

- Number crunching, design calculations, analysis of budgets and survey results.
- Summarises data instantly for easy comparisons.
- Creation of charts and graphs.
- Organising lists.
- Accessing and organising data from other sources.
- Automation of complex tasks.

2.2.2. Microsoft WORD

WORD is a word processing software program for Windows and MAC. It is available stand alone and also as part of the Microsoft Office suite. It contains rudimentary desktop publishing capabilities and can also be linked to other Microsoft products to allow for more advanced use with projects such as this.

2.2.3. Microsoft VISIO

VISIO is a diagramming and vector graphics application which is a part of the Microsoft Office suite. It has been proved to be very beneficial when used with project management for creation of flow charts - to database designs automatically imported and generated from existing database systems.

2.2.4. AutoCAD

AutoCAD is a software application from Autodesk which is used for the creation of 2D and 3D drawings. The benefits to projects such as this can be in the formation of the proposed site layouts for the upgrade works, to the formation of other layout drawings such as underground services.

2.2.5. Mapping & Other Technical Info.

Groups and organisations, such as the ones mentioned below, can provide vital information for projects such as this:

- Ordnance Survey Ireland – www.osi.ie
- Geological Survey of Ireland – www.gsi.ie
- Environmental Protection Agency – www.epa.ie
- National Parks and Wildlife Service – www.npws.ie
- Local Authorities – www.roscommoncoco.ie

3. WWTP Solution Options

When considering the upgrade of a treatment plant such as Keadue, it is obvious that the available package wastewater treatment systems on the market be investigated together with the traditionally designed WWTP. Each chosen option is to be reviewed with the pros and cons of each type analysed.

3.1. ANUA – Platinum 2175

This product is a package waste water treatment unit manufactured in Ireland by ANUA. The maximum operating p.e. of this unit is 175 with a BOD of 10.5 kg/day. For this particular project, having a p.e. 550+, it would be necessary to install 4 no. units of this type.

3.1.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.1.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. It is also not capable of operating in parallel.

3.2. ENVIROCARE – Platinum

This product is a package waste water treatment unit manufactured in Ireland by ENVIROCARE. The maximum operating p.e. of this unit is 50. For this particular project, having a p.e. 550+, it would be necessary to install 11 no. units of this type.

3.2.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.2.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. It is also not capable of operating in parallel.

3.3. EPS – Clereflo MBR

This product is a package waste water treatment unit manufactured in Ireland by EPS. The maximum operating p.e. of this unit is 750 with a BOD of 41.2 kg/day . This unit is capable of dealing with the capacity requirements of this particular project in one unit.

3.3.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required. This unit requires an area of approximately 80 sq/m .

3.3.2. Limitations

This treatment plant does not meet the requirements for this project as the area required for the plant exceeds that available on site. It is capable of operating in parallel.

3.4. FM ENVIRONMENTAL - MBR

This product is a package waste water treatment unit manufactured in Ireland by FM Environmental. The maximum operating p.e. of this unit is 350 with a BOD of 5 kg/day.. For this particular project, having a p.e. 550+, it would be necessary to install 2 no. units of this type.

3.4.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.4.2. Limitations

This treatment plant does not meet the requirements for this project as the area required for the plant exceeds that available on site. It is not capable of operating in parallel.

3.5. SEPCON - Tricel

This product is a package waste water treatment unit manufactured in Ireland by SEPCON. The maximum operating p.e. of this unit is 50 with a BOD of 3 kg/day. For this particular project, having a p.e. 550+, it would be necessary to install 11 no. units of this type.

3.5.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.5.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. It is also not capable of operating in parallel.

3.6. MOLLOY ENVIRONMENTAL - PFBR

This product is a package waste water treatment unit manufactured in Ireland by Molloy Environmental. The maximum operating p.e. of this unit is 150. For this particular project, having a p.e. 550+, it would be necessary to install 4 no. units of this type.

3.6.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.6.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. However, it is capable of operating this treatment system in parallel.

3.7. MOLLOY ENVIRONMENTAL

This product is a package waste water treatment unit manufactured in Ireland by Molloy Environmental. The maximum operating p.e. of this unit is 50 with a BOD of 30 kg/day. For this particular project, having a p.e. 550+, it would be necessary to install 11 no. units of this type.

3.7.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.7.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. It is also not capable of operating in parallel.

3.8. FM ENVIRONMENTAL - Biosam

This product is a package waste water treatment unit manufactured in Ireland by FM Environmental. The maximum operating p.e. of this unit is 250 with a BOD of 20 kg/day. For this particular project, having a p.e. 550+, it would be necessary to install 3 no. units of this type.

3.8.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.8.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. It is also not capable of operating in parallel.

3.9. MOLLOY ENVIRONMENTAL – 6D

This product is a package waste water treatment unit manufactured in Ireland by Molloy Environmental. The maximum operating p.e. of this unit is 200. For this particular project, having a p.e. 550+, it would be necessary to install 3 no. units of this type.

3.9.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole. Following its commissioning the unit carries out the treatment process as required.

3.9.2. Limitations

This treatment plant does not meet the requirements for this project as it does not meet the minimum p.e. required. It is also not capable of operating in parallel.

3.10. BUTLER MANUFACTURING SYSTEMS (BMS) – Blivet BL 4000

This product is a package waste water treatment unit manufactured in Ireland by BMS. The maximum operating p.e. of this unit is 500. For this particular project, having a p.e. 550+, it would be necessary to install 2 no. units of this type.

3.10.1. Resources Needed

The operation of this unit does not require any special training. The unit can be delivered to site intact and placed into a pre-prepared hole or pre-installed concrete slab. Following its commissioning the unit carries out the treatment process as required.

3.10.2. Limitations

This treatment plant does meet the requirements for this project. It will be required to be operated in series.

3.11. Traditionally Designed Treatment System

This treatment system can be designed for any size p.e. or final BOD & SS requirement. The method of construction can be in-situ concrete panels or sectional tank panels.

3.11.1. Resources Needed

The operation of this unit does not require any special training. When the entire system is operational, its operation will be monitored using a PLC monitoring system.

3.11.2. Limitations

This treatment system can be designed to meet the requirements of this project. The area of ground required for this entire system will be substantial.

4. Emerging WWTP Solutions

The two emerging WWTP solutions from the selection criteria for the Keadue WWTP are the BMS Blivet 3500 and the Traditionally Designed Treatment System. The selection criteria employed for the treatment plant selection are outlined below.

1. Person Equivalent (P.E.) Availability

   The required P.E. for each chosen treatment plant is to be established, where possible.

2. Biochemical Oxygen Demand (B.O.D.)

   The BOD of the treatment plant is to be established.

3. Max Flow

   The maximum flow through the treatment plant is to be established.

4. Max Loading

   The maximum loading for the treatment plant is to be established.

5. Underground / Overground Installation

   Establish if the treatment plant can be installed over or underground.

6. Area Required

   Establish what the maximum area is required for the treatment plant.

7. Dimensions

   Establish the overall dimensions of the treatment plant.

8. Delivery Distance

   Establish the location of the treatment plant manufacturers, collection time and distance from site.

9. Possible Further Design Requirements

   Establish if there is any further design required for the treatment plant.

10. Parallel Operation Capabilities

    Establish the possibility for the installation of the treatment plants in parallel for the future growth of the plant.

5. Risks and Cost Estimates

5.1. Risks and Risk Responses (mitigations)

As with any project, a certain amount of risk must be accounted for. The following is a outline of certain risks that could be associated with a project such as the upgrading of Keadue WWTP and also their mitigation measures.

Risk	Response
Incompetent staff assigned to a project	Make sure Staff have adequate training and experience to work on the project
Approval and decision processes cause delays	esure all approval and decision processes are worked out prior to project commencement
Air quality pollution	Need to insure air pollution is kept to a minimal
Contamination of water	Need to provide back- up system for temporary treatment
Unidentified utility impacts	Need to identity the utilise impacts
Variations during construction	Ensure all project requirements identified prior to construction
Site is unsafe	Need to ensure the site is safe to build on in order to prevent failure
Delays due to traffic management and lane closures	Need to make sure there is a proper traffic management plan
Changes to brief and / or scope of works	Need to focus on firming up scope in the planning process
Differing site conditions	Need to do a Site Investigation on the site
Supplied of Materials to site	Controlling material in and out of site
Incomplete/ Inadequate quantity estimates	Need to have adequate quantity estimates
Insufficient design analysis and data	The consulting engineer is responsible for ensuring that an adequate design is completed
Hydraulic features	Need to ensure comprehensive hydraulic analysis is completed
Inaccurate assumptions during the design phase	Consulting engineer is responsible for ensuring that an adequate design is completed
Project not fully funded	Ensure funding is obtained and available
Externally driven accelerated schedule County Council actions cause unexpected delays	Need to have a accelerated schedule Organise a meeting with the county council to discuss delays
Public objections	Ensure all concerns are satisfied prior to submission for planning applications
Permits delay	Make sure all permits are in order before commencing the project

Inadequate project scoping	Make sure comprehensive scope statement is prepared at planning stage
Consultant and contractor delays	Make sure all relevant parties are on board before commencing of the project
Cost estimating and /or scheduling errors	Make sure a skilled quantity surveyor is hired
Lack of coordination and communication	Make sure to have a meeting to improve communication

5.2. Schedule and Cost Estimates

Outlined below is a breakdown of the works schedule and some initial cost estimates for the project

Company Name:	KMCF Engineers Ltd.		**Start Date:**	**Finish Date:**	**Total Project Duration:**
Project Name:	Upgrade Works to WWTP at Keadue, Co. Roscommon		**01/03/2014**	**17/06/2014**	**138**

PROJECT SCHEDULE					
Code	Task Name	Duration	Start	Finish	Cost
1	**Tendering**	52	01/03/2014	22/04/2014	€3,835.00
2	**Procurement**	47	12/04/2014	09/05/2014	€4,800.00
3	**Preliminaries**	0.5	06/05/2014	06/05/2014	€8,000.00
4	**Construction**	25	06/05/2014	07/06/2014	€188,140.00
5	**Testing**	1	25/05/2014	26/05/2014	€450.00
6	**Completion**	12.5	05/06/2014	17/06/2014	€2,350.00

6. Comparison of Solutions

The following table is an example of the selection criteria used to compare two possible emerging preferred solutions for the Keadue WWTP.

Criteria / WWTP Option	BMS – Blivet BL 3500	Traditionally Designed Treatment Plant
1. P.E.	650	550
2. B.O.D. & S.S.	20 / 30	25 / 35
3. Max Flow	65 m^3/day	
4. Max Load		
5. Over/Underground	Both	Over Ground
6. Area Required	50	75
7. Dimensions	L=10.075m B=2.27m H=2.88m	Varies
8. Delivery Distance	Close	Varies
9. Further Design Required	No	Yes
10. Parallel Operation	Yes	N/A
11. Const. Costs	€	€
12. Maintenance Costs	€	€

7. Conclusions

The conclusions and recommendation outlined in this report will help to condense and reduce the laborious tasks involved during the selection, design and management of projects such as the one in question. The resulting selection and tendering tool can then be successfully transferred to and used with other projects, concerning wastewater treatment plant upgrades, which are similar in nature. The final system can then be updated where necessary, when codes of practice and legislation are introduced or updated. This will result in a very useful and practical tool for civil engineers and contractors into the future.