Microhydropower Recovery

Exploring the potential to recover energy from urban stormwater

FACTSHEET

Project area: *Stormwater as a resource*
Intended audience: *Developers, local authorities, asset owners*

Introduction

Stormwater runoff is most commonly associated with flood risk, but in certain urban settings, when effectively controlled it can be used as an energy source. A step-wise methodology has been developed to assess the energy recovery potential from stormwater in urban environments. This methodology can be of practical use to asset owners and local authorities where attenuation ponds are already developed or are being planned. The method provides a feasibility assessment based on local rainfall patterns, catchment characteristics and the economics of the scheme to eliminate unsuitable sites before proceeding to detailed design.

What is micro-hydropower?

Microhydropower refers to the generation of renewable energy of up to 100 kilowatts of electricity by utilising the potential energy of water. Typically, it is produced using run-of-the-river systems where a portion of a river/stream is diverted to a pressurised pipe and passed through a turbine, which then powers a generator. In the present evaluation, the source of energy is the controlled stormwater release from an attenuation pond rather than diverted water.

Why produce micro-hydropower from a SuDS system?

It is a renewable (but not continuous) source of energy and is an alternative to fossil fuel consumption. It also supports decentralisation of energy supply. The pond is primarily built for flood protection and energy generation is a coincidental benefit.

How much energy can a site produce?

The key factors controlling energy generation are outflow rates and the hydraulic head available between pond and turbine. Flow rate is a function of the drainage area, its imperviousness, and precipitation patterns. Local topography and pond location selection controls head drop.

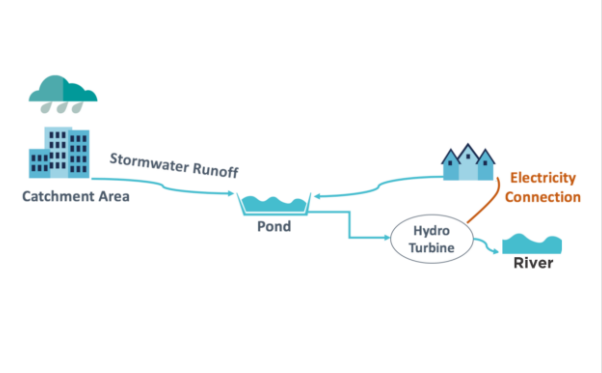

Figure 1: A generic multi-purpose flood attenuation and decentralised energy generation scheme

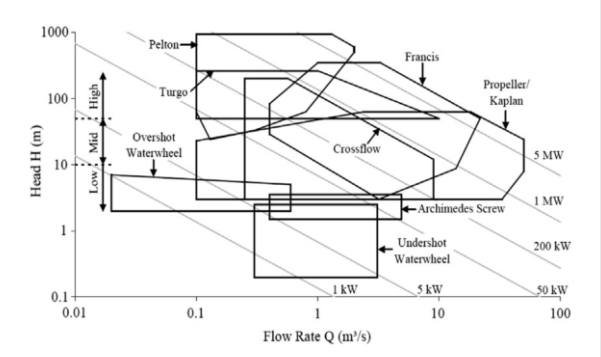

Figure 2: Head flow ranges of small hydropower turbines (source: Williamson et al., 2011)

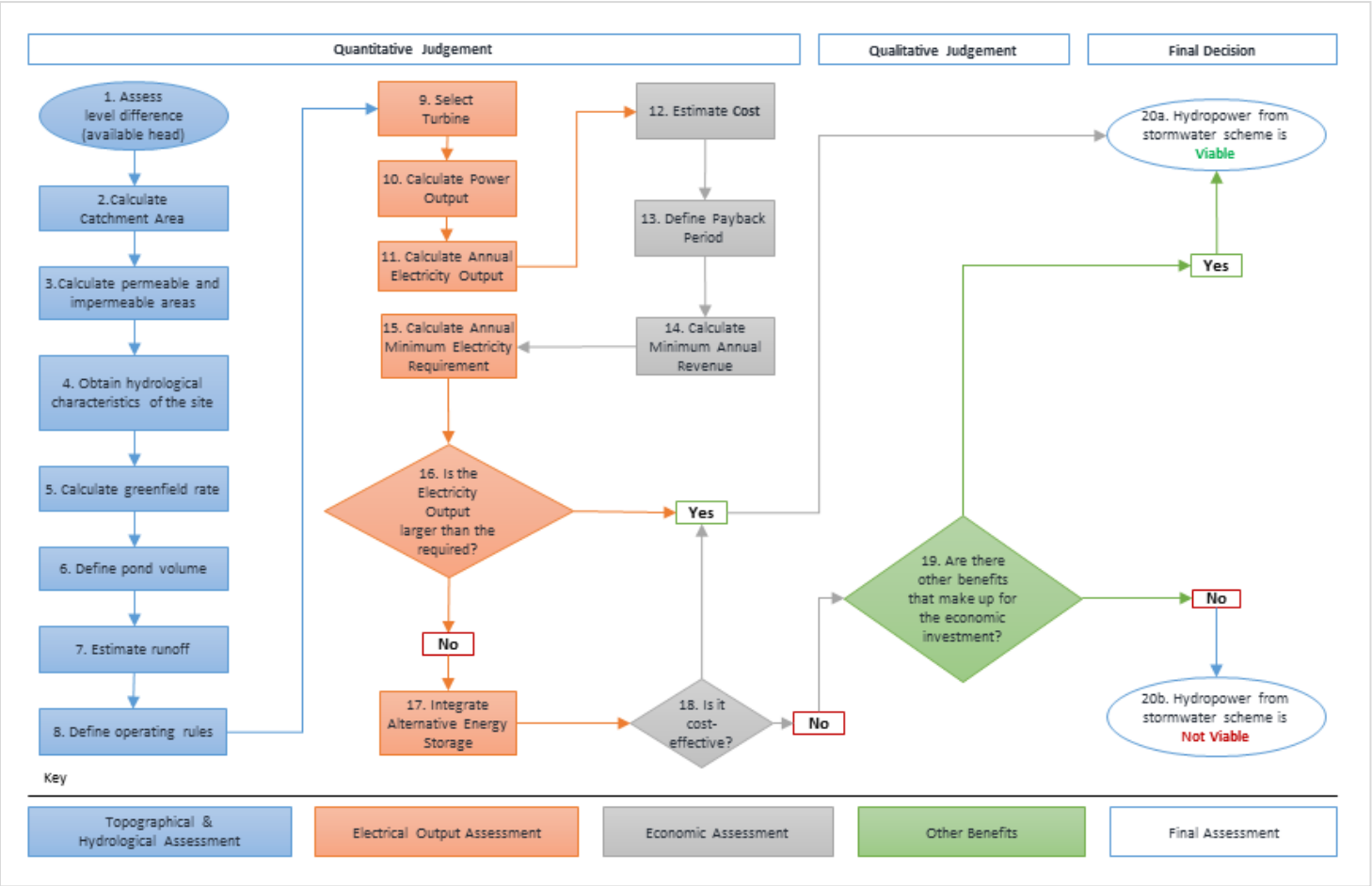

Figure 3: Microhydropower assessment flow chart for a SuDS pond installation based on the analysis of the technical and economic characteristics of the project and of other possible associated benefits.

Is it economically feasible?

Stormwater interception and storage in an attenuation pond deals with the problem of rainfall intermittency by dissociating rainfall from discharge, thus allowing optimal system design and cost reduction. A significant hydraulic drop is critical to the economic feasibility as it allows the installation of lower system capacity. System costs should be compared to the discounted annual revenue (function of the feed-in tariff and offset value set by government). Finally, the payback period can be calculated to evaluate the economic feasibility. In some cases when the scheme is not deemed as cost effective, stakeholders involved in the decision-making might decide that other benefits can make up for the economic assessment.

This factsheet was produced based on the journal article: Costa, J., Fenner, R. and Kapetas, L. (2018). "A screening tool to assess the potential for energy recovery from stormwater runoff discharge" (in review)

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