Source Catchments Investment Analysis

Alluvium plays a key role in supporting Water Authorities to advance the understanding of source catchments as water quality treatment assets. Our work helps authorities to understand the effectiveness of catchment intervention measures and cost benefit considerations compared to more traditional water quality treatment processes.

Source water protection programs are essentially catchment management programs with the specific goal of protecting drinking water supplies. In recent years, it has been more widely recognized that source water protection is a critical first step in the multiple-barrier approach to providing safe drinking water.

In an economically regulated environment where consumer affordability is paramount and where the regulator puts the burden of proof on the water provider to illustrate successful mitigation of water quality risk, there are two critical challenges:

a. How can a sound business case be made for investment in catchment management as a water quality 'treatment' option, using best practice approaches in triple bottom line cost benefit evaluation?

b. How can it be demonstrated, in the geographic context of the catchment under consideration, that mitigation measures can be successfully implemented and water quality improvement is achieved?

With these two critical challenges in mind Alluvium was engaged by WSAA and WRF (via Seqwater) to undertake this key project to help advance the understanding.

This was an international project where we undertook a high level assessment of key lessons learnt from catchment management initiatives and programs in the United States and Australia. Supported by Jeremy Cheemsan (MJA) and Adrian Volders (Volders Consulting), this work had to consider the large divergence in local policy and planning instruments and organisational culture.

The project developed a Catchment Management Investment Standard to assist water utilities to build stronger business cases for catchment management as a viable alternative to more traditional, capital intensive investments. investments.

Key to the project was the Catchment Investment Assessment Tool (CIAT). The CIAT was developed for authorities who need to demonstrate that catchment management activities deliver social, economic and environmental benefits, and that these benefits have economic value. The CIAT can also be used to understand the financial costs of implementing the catchment activities and support water utilities and catchment managers across Australia to make a stronger business case to decision makers (and regulators) for catchment management as a viable alternative to more capital intensive (traditional) investments, especially in impaired multi-use catchments.

The analysis tool helps Water Authorities to help quantify a wide range of financial, economic, social and environmental benefits and costs of source catchment investments. It is designed to be an easy to use, excel-based system that can be customised to assess alternative source catchment investments.

Key components of CIAT are the:

- cost of implementation, operation and maintenance of each option
- cost to the community and other agencies or businesses
- environmental and community impacts

The project assessed a wide range of benefits and types of investment assessment.

Table 1. Examples of benefit drivers for source water catchment management (an investment drivers evidence base)

Service	What well managed source catchments do	Service Unit of Measure	Example of the economic or financial benefit value
Water purification	By reducing soil erosion, forest and grassland cover decreases the sedimentation and dissolved load in surface runoff and interflow. Well-developed understory or litter layers reduces soil erosion and can improve soil fertility This reduces dead to active storage in dams and reservoirs. Reduced sedimentation in source water also prevents sediment build up in reservoirs over time, thereby maintaining critical water storage capacity and reducing dredging costs.	TN, TSS, TP tonnes per annum entering waterways Pathogen load	Reduce fixed and variable costs of built infrastructure needed to improve water quality and/or maintain infrastructure assets Avoided cost of dead dam storage due to sedimentation build up
Water supply regulation	Runoff, lateral subsurface flow, and groundwater recharge maximized for productive uses and domestic supply at supply points The better infiltration and water storage capacities of the surface layers of soils may result in higher levels of flow, i.e. net of evapotranspiration.	ML of runoff from land area within source catchment	Avoided cost of alternative supply (for example the cost of supply through desalination) Avoided cost of supply augmentation resulting from lower catchment supply.
Flood control/protection	The effect of forested watersheds on the hydrological cycle varies. Stormflow and evapotranspiration are the two most important components of the hydrological system affected by forests Catchment activities may contribute towards land management that delivers flood control outcomes. These may reduce flood damage and the need to invest in flood mitigation works	Property and infrastructure at risk	Value of property and infrastructure at risk without catchment management Defensive expenditure estimate to avoid flood impacts
Carbon storage	Vegetation sequesters carbon stocks Increasing health and extent will generally increase carbon sequestration capacity, depending on vegetation system, condition and location	Tonnes of carbon stored	Economic value of tradable carbon permits
Air quality	Vegetation improves air quality by sequestering pollution Increasing health and extent will generally increase sequestration capacity, depending on vegetation system, condition and location	Removal of pollutants including CO, O3, NO2, PM 10, PM2.5, SO2 and reduction in VOC's	Economic cost of air pollution

		Interception of particulate matter (PM)	
Amenity and liveability	Catchments can contribute amenity, liveability and/or recreation. Reduced accessibility or quality of the catchment may reduce visitation numbers, frequency, duration or spend	Visitation estimates	Customer willingness to pay for improved environmental condition/amenity

Types of Investment Assessment

When you start your catchment investment assessment you should know the type of investment assessment you want to undertake. Each will give different answers and needs different information to complete them.

Approach	Description
Benefit Cost Analysis (BCA)	The most robust method for examining the economic viability of the business as usual (BAU) and source catchment management investments is to consider the marginal value of the investment and alternatives using a BCA framework. BCA is the most comprehensive of the economic appraisal techniques and is the preferred method of analysis for most State and Commonwealth agencies responsible for economic management. The BCA identifies the economic benefits and costs of the investment options to the population who are impacted by the investment. Those impacted might include water business, councils, other business and community, based on an assessment of market and non-market economic benefits and costs.
Cost-effectiveness analysis (CEA)	CEA is an alternative to BCA where the output of a project is not readily measurable in monetary terms (using either actual or proxy values). CEA compares the costs of different project options with the same or similar outputs. For example, if the primary purpose of a source catchment investment is to avoid discharges to an environmentally sensitive river, but the benefits were not considered quantifiable by decision makers, then the CEA technique would compare the cost of the source catchment investment with the cost of alternative (downstream) treatment methods. CEA is a well-accepted alternative to BCA when the major benefits cannot (or will not) be quantified, however it is generally considered a 'second best' alternative if the benefits can be quantified and included in a BCA.
Threshold Analysis	In some cases, not all costs and benefits of source catchment initiatives can be readily quantified and valued. Where it is not possible to quantify all of the costs and benefits, non-quantified costs and benefits should be clearly defined and an assessment of the unquantified factors made against the quantified net benefits. This type of 'threshold analysis' can be useful for decision making, and is often used in conjunction with BCA. A threshold analysis does not seek to quantify the remaining costs and benefits, but involves comparing the documented but unquantified costs and benefits against the quantified net present value result. Threshold analysis generally seeks to answer the question *'is the unquantified benefit enough to outweigh the quantified cost?'*
Risk and Uncertainty	As with any forward-looking assessment, water investments involve risk and uncertainty. These must be taken into account in Investment Assessment. Some source catchments options such as wetlands and riparian works may involve more risk and uncertainty due to a greater experience with conventional water treatment. For example, wetlands are generally at greater risk of impairment due to extreme natural events, and riparian vegetation are also generally at more risk of failure than conventional treatment, which means their water quality management benefits can also be more at risk. Risk and uncertainty should be accounted for in catchment investment evaluations. Evaluations should include a certainty equivalent to reflect the level of confidence in the estimate, and sensitivity testing on assumptions around system performance, costs and benefits over time.

Financial analysis	Financial analysis involves evaluating a source catchment investment by looking at the affordability of options from a budgetary perspective for the organisation and the government as a whole. In a financial analysis you include direct financial and accounting impacts of the investment including any revenue from things like user charging. Capital and operating costs are separately analysed. Financial analysis alone is typically insufficient for an economic appraisal as it examines a project only from the narrow perspective of the entity undertaking the project. A traditional financial analysis does not take account of effects on other enterprises or individuals nor does it consider the opportunity cost when the price of a good or service is not a good indicator of the real value.
Economic analysis	Economic analysis is fundamentally different from financial analysis, but includes many similar components. Economic analysis evaluates the relative contribution of source catchment option(s) to net social welfare compared to a base case. In economic analysis you include all allocative resource flows including non-monetised costs and benefits. In the Steps in Catchment Investment section of this document (Section 3) some practical examples of these costs and benefits are provided. Economic analysis is preferred to financial analysis when you need to know whether the source catchment investment is benefiting society overall.