FINAL REPORT:

Water Quality Offsets Framework

April 2015

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Please contact Western Water or the Smart Water Fund for further information about the Jacksons Ck case study.

Contents

Figures

Tables

Abbreviations

Alluvium	Alluvium Consulting Australia Pty Ltd
CAPIM	Centre for Aquatic Pollution Identification and Management
EPA	Environment Protection Authority
ERA	Environmental Risk Assessment
ERS	Emergency relief structure
LCCA	Life-cycle cost analysis
MJA	Marsden Jacob Associates
SEPP (WoV)	State Environment Protection Policy (Waters of Victoria)
TN	Total Nitrogen
WQOF	Water Quality Offset Framework
WW	Western Water

Glossary

Term	Definition
Base case	An option against which all offset actions are compared. In most cases this will be a default infrastructure option required to meet current environmental regulation.
Beneficial uses	Uses and values of water environments that communities want protected both now and in the future. Uses include: • Aquatic ecosystems, plants and animals • Water suitable for aquaculture and edible seafood • Water-based recreation (primary, secondary and aesthetic) • Water suitable for human consumption (after suitable treatment) • Cultural and spiritual values • Water suitable for industry and shipping

- Water suitable for agriculture

Currency	Parameter that is causing the impact and used to determine equivalency of an offset action (e.g. pollutant load)
Current condition	Description of the characteristics of the receiving system before impact of the offset action
Impact	Adverse effect of an activity with specific consequence to beneficial uses
Net environmental benefit	An improvement in condition as defined by the beneficial uses as result of an offset action
Offset action	An action to address an adverse environmental impact of resource use, a discharge, emission or other activity at another location to deliver net environmental benefit (EPA 2008)
Projected condition	Projected impact of an activity (e.g. discharge) on the characteristics of the receiving system
Risk assessment	Evaluation of risk level (high, moderate or minor) based on likelihood and magnitude of impact to beneficial uses
Time Bound	In this case refers to the offset action having a discrete time period after which it is assessed and reviewed
Waterway manager	Those responsible for waterway management in Victoria under the under the *Water Act 1989*, i.e. catchment management authorities and Melbourne Water in the Port Phillip and Westernport region

Introduction

This document presents a framework for offsetting water quality impacts of wastewater discharges into waterways. It is intended for adoption by the Victorian water industry.

Western Water and the Smart Water Fund led development of this framework during 2014/15, with support from Alluvium Consulting Australia (Alluvium), Marsden Jacob Associates (MJA), David Tiller (Karoo Consulting), Barry Hart (Waterscience) and Adrian Volders (Volders Consulting) and in close consultation with stakeholders from across the Victorian water industry and state government agencies, including the EPA.

Background

Managing Victoria's water environments
The State Environment Protection Policy (Waters of Victoria) – herein referred to as SEPP (WoV) – sets a policy framework for the protection of the uses and values of Victoria's fresh and marine water environments (EPA 2003). It is subordinate legislation to the *Environment Protection Act 1970*, which provides the overall legislative framework for protecting Victoria's environment.

As required by the Act, SEPP (WoV) defines **beneficial uses** – that is, the uses and values of the water environment that the community and government want to protect. These include:

- Aquatic ecosystems, plants and animals
- Water suitable for aquaculture and edible seafood
- Water-based recreation (primary, secondary and aesthetic)
- Water suitable for human consumption (after suitable treatment)
- Cultural and spiritual values
- Water suitable for industry and shipping
- Water suitable for agriculture

SEPP (WoV) includes **objectives and indicators** which describe the environmental quality required to protect beneficial uses and guidance to relevant authorities on how to protect and rehabilitate water environments so environmental objectives are met and beneficial uses are protected – the **attainment program** (EPA 2008).

It should also be noted that the *Environment Protection Act 1970* Sections 1B-1L outlines 11 **principles of environmental protection**, which form the basis of the SEPP (WoV).

- Principle of integration of economic, social and environmental considerations
- Precautionary principle
- Principle of intergenerational equity
- Principle of conservation of biological diversity and ecological integrity
- Principle of improved valuation, pricing and incentive mechanisms
- Principle of shared responsibility
- Principle of product stewardship
- Principle of wastes hierarchy
- Principle of integrated environmental management

- Principle of enforcement
- Principle of accountability

The Act provides the legal basis for statutory tools (e.g. wastewater discharge licenses) and enforcement action taken by EPA, and the SEPP guides these tools and enforcement actions (EPA 2008).

Risk assessment approach
Under SEPP, the EPA adopted a risk-based approach to the management and protection of Victoria's aquatic ecosystems. This was first articulated in *Guideline for Environmental Management: Risk-based assessment of ecosystem protection in ambient waters* (EPA, 2003).

Further guidance was provided in EPA Publication 1287 (July 2009): *Guidelines for risk assessment of wastewater discharges to waterways.* (Note: this is a central document and will herein be referred to as 'EPA's risk assessment guidelines.') Subsequently, EPA expanded the ERA approach to mixing zones (EPA 2010). The ERA approach is, therefore, the primary approach to assessing impacts to ecosystems and guiding the management of wastewater discharges. An ERA will inform all aspects of managing wastewater discharges, not only offsets.

There are three main phases of the risk assessment process outlined in this 2009 guideline:

- **problem formulation** – this includes identifying: the scope of the risk assessment; beneficial uses and values (identified though regional planning processes such as regional waterway management strategies and state, national and international designations such as Ramsar wetlands and heritage rivers) that need protection; potential threats to these values; factors influencing the likelihood of the risk occurring; and, the impacts from these;
- **risk analysis** – determines the probability and magnitude of an adverse effect with specific consequences occurring to beneficial uses and values; and
- **risk characterisation** – the evaluation and reporting of the problem formulation and risk analysis results for decision-making and risk management purposes.

This guidance is intended to support water corporations and others discharging wastewater to waterways to assess the nature and extent of impacts associated with such discharges. This can allow better decision making on the acceptability of current discharges and the need for treatment plant upgrades or other management actions. An application for a works approval, a licence review or the development of a corporate licence are some of the reasons why a risk assessment may be required.

It should be noted that this framework builds upon this approach but in no way replaces it. International reviews of offset schemes have concluded that they operate most effectively within a well understood regulatory framework that is supported by clear targets (Selman et al. 2009).

The problem formulation, risk analysis and characterisation phases described above are therefore still required **before offsets should be considered**.

The potential for offsets
In Victoria, the use of biodiversity, carbon and salinity offsets are well established and commonly used in practice. However a formal, widely accepted approach for managing water quality offsets does not exist.

Clause 26 of SEPP (WoV) introduced the concept of offset measures. It states: "Due to social and economic considerations, it may not always be practicable to fully implement the waste hierarchy (i.e. to fully avoid, re-use or adequately treat wastewater). In these circumstances, an off-set measure can be put in place to off-set actions that have the potential to degrade environmental quality (e.g. wastewater discharges) with actions which enhance environmental quality." (EPA 2003)

The EPA went on to explore the potential for environmental offsets further through EPA Publication 2002.3 (June 2008): *Discussion Paper – Environmental Offsets*. This paper defined an environmental offset as: "an

action(s) to address an adverse environmental impact of resource use, a discharge, emission or other activity at another location to deliver net environmental benefit."

It also proposed principles to guide EPA's consideration of offset proposals. This included that offsets must:

1. deliver net environmental benefit compared to actions that would otherwise be required.
2. be cost-effective and in proportion to the significance of the adverse environmental impact being addressed.
3. not facilitate or reward poor environmental management practices that pose significant risk or create inappropriate market distortions.

In line with point 3 above, the paper emphasised that environmental offsets are not intended to be a substitute for good on-site environmental practices. EPA did not anticipate environmental offsets will be used on a large proportion of sites. Where they are used, it is expected that environmental offsets will be one component of an overall strategy to ensure the best mix of economic, social and environmental outcomes from a development or activity (EPA 2008).

In 2011, the Victorian water industry and EPA produced a paper proposing a high level framework to fill the existing gap between the legislative ability of EPA to authorise the use offsets and the ability of water corporations to successfully make cases for the use of environmental offsets during EPA processes such as work approval applications and licence amendments (EPA and Victorian Water Industry 2011). This work was driven by the belief that an increase in the use of environmental offsets will provide the ability for the industry to provide lower community cost environmental management while still ensuring that environmental protection objectives are met.

Development of a water quality offsets framework for Victoria

During 2014/15 Western Water and the Smart Water Fund engaged Alluvium to support the further development of a water quality offsets framework (herein referred to as the WQOF or 'the framework').

Central to development of the framework was consultation with stakeholders from across the Victorian water industry and state government agencies, including the EPA. Another important part of the project was exploration of case studies, in particular that of Western Water's Gisborne Recycled Water Plant and the Jacksons Creek, into which the plant discharges.

A summary of the method used to develop the framework is outlined in Attachment A.

Framework Approach

The framework outlined in this document is intended to be a support tool for the Victorian water industry. It describes how a water corporation can assess and implement potential options for offsetting the water quality impacts of wastewater discharges into waterways.

Such offset options might be considered in instances where water corporations face a significant challenge in meeting existing or projected EPA discharge licence conditions or recognise a genuine opportunity to deliver a net environmental benefit at a lower community cost. In most instances this will be driven by the potential to defer capital expenditure on infrastructure upgrades that might otherwise help meet the licence conditions.

The framework was developed in close consultation with stakeholders from across the Victorian water industry and state government agencies, including the EPA (see Attachment A). It uses the EPA's proposed offset principles (EPA 2008), risk assessment guidelines (EPA 2009) and principles for environmental protection (*Environment Protection Act 1970*) as its basis (see Background).

Five phases are included in the framework, each with a distinct purpose and outcome (Figure 1). An explanation of the steps required in each phase is given in the sections below. The phases outline each of the tasks that a proponent will need to undertake in order to make a decision about whether offsets are an appropriate tool, and then how to evaluate various offset options.

Details of each of the Phases are in Figure 1 below and in more detail throughout the document. In summary however:

Phases 1 and 2 are intended to scope the issues regarding the licence or policy driver, the impacts on beneficial uses and the data required to guide decision making. These phases are based on the steps contained in EPA's risk assessment guidelines (EPA 2009). **These phases are not offsets specific**, they should be carried out to establish and understand the base case before offsets are considered. At the end of Phase 2 the proponent will have enough information to decide if offsets are a possible and/or desired path.

Phase 3 contains the development, analysis and evaluation of various offset options. Each option is compared against a number of criteria:

- Equivalence
- Alignment with management priorities
- Additional
- Timely
- Located appropriately
- Enforceable
- Verifiable
- Socially acceptable
- Least cost

These criteria are explained in Attachment B.

Phase 4 is carried out when a preferred offset option has been identified. It involves contractual arrangements between the proponent and the EPA, and usually a separate contract with the organisation delivering the works.

Phase 5 is aimed at reviewing the implementation and using that to inform the framework and future offsets.

Importantly, all offset actions under this framework will be considered '**time bound'**. The risk assessment process is required to be carried out again after a defined period and the offset will be reviewed.

The development of the framework was undertaken in parallel with a number of case studies. Four high level examples were used in the early stages of development to help test the concepts being discussed. Throughout the framework development a major case study was undertaken which looked at discharges from the Gisborne Recycled Water Plant on Jacksons Creek, north-west of Melbourne'. It should be noted that, as the case study was developed in parallel, it does not fit 'neatly' into the final framework. Despite this the example was central to the development of the final framework.

1.1 Recommendations for next steps

The development of the framework during this project has taken almost 12 months and has benefitted from substantial contributions from over 50 people in the industry. Prior to that there was significant effort put into offsets by the water industry, Melbourne Water and the EPA.

Importantly, it is recognised that this framework should (and will need to be) be improved over time. By building in lessons from past offsets, improving the understanding of the links between beneficial uses and water quality and in the confidence of the regulator in the process will be improved. **To achieve this there will need to be an ongoing role of maintaining the framework.** This is currently being investigated by the Smart Water Fund through discussions with industry bodies.

Discussions with the Smart Water Fund have also suggested that further consultation and promotion of the framework as it stands would be beneficial. This is currently being investigated but would involve agencies and individuals that have not been closely involved with the framework development.

To provide consistency the project steering group also recommends the creation of an **Offsets Technical Review Panel** which may be used by the proponents to ensure efficient use of resources, give guidance on any judgement-based decisions about impact on beneficial uses and to assist in the ongoing review of the framework. A draft Terms of Reference for this panel is provided in Attachment C.

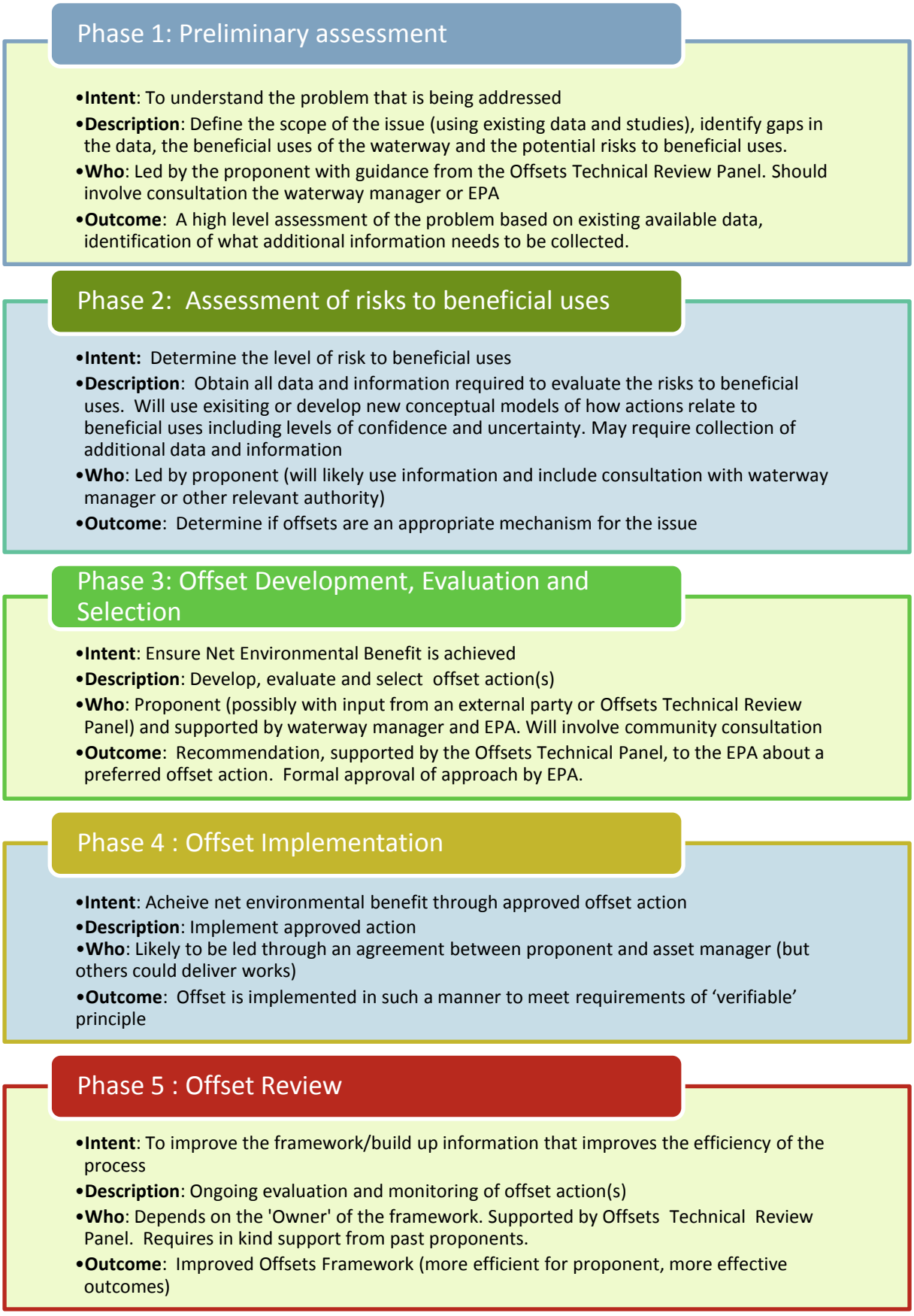

Figure 1. *Water Quality Offsets Framework Overview*

2 Phase 1: Preliminary assessment

Phase 1 involves a high level preliminary assessment of existing information to define the scope of investigation required. It is an opportunity for the proponent to invest a small amount of resources to understand the extent of work required and feasibility of developing an offset scheme. When Phase 1 is completed, the level of investigation required for risk assessment (Phase 2) should be clear. The EPA risk assessment guidelines refer to this as the 'problem formulation' stage. Preliminary assessment should answer the following questions.

- What is the licence or policy driver for the base case?
- Is the driver relevant to beneficial uses of the receiving water body?
- What are the beneficial uses and local values requiring protection?
- What are the potential threats to these uses and values?
- Would any of the known risks to beneficial uses be unacceptable in terms of Principles of Environment Protection (refer to 'Background' section)?
- What is the level of investigation required for risk assessment in Phase 2?

These questions are described further below and are summarised as steps in Figure 2.

Stakeholder and community consultation
Stakeholder and community consultation is recommended throughout the risk assessment process (EPA 2009). Engagement early in process in particular ensures that important beneficial uses and local values are identified, as well regional management needs and community priorities. Stakeholders may include industry representatives, EPA, relevant state agencies, technical experts, local government, adjacent landholders and community groups. At this stage, the engagement is most likely to focus on identifying and obtaining relevant literature and datasets, but it will also help with establishing relationships that will be important later in the process when it comes to evaluating the social acceptability of various offset options. Prematurely raising or attempting to gauge interest in potential offset options should be treated with caution however, as this could undermine the process and create unfulfilled expectations or unnecessary concern.

Collect existing data
No monitoring or collection of new data is required at this stage; however the proponent should collate all known relevant literature and datasets. This may include previous water quality sampling, investigations and reports, waterway strategies, community survey results, local media coverage and risk assessments. A review of this data is needed to address the following steps in this phase.

What is the licence or policy driver in investigating offsets?
The intent of the driver must first be identified to understand the issue (e.g. the purpose of the regulation may be to protect the environmental condition of downstream receiving waters, or to protect public health and safety in the local vicinity of the discharge).

Is the policy or licence relevant to beneficial uses as intended?
The regulation should also be relevant to beneficial uses. If the proponent can demonstrate that there is no relationship between the intent and the beneficial uses, then the proponent should have a discussion with the EPA about whether there is any need for action. It may be that rather than proceeding down the offsets path, the proponent could apply to the EPA to review the requirement for that particular case.

What are the beneficial uses and local values requiring protection?
This step should identify all beneficial uses and how they are impacted, at all relevant spatial and temporal scales, based on a conceptual understanding of the system.

For a wastewater discharge case study, this can extend from the point of discharge to any receiving bay or water body. Beneficial uses may be documented in waterway health strategies, and should be confirmed with the waterway manager, local government or other relevant authority (and if applicable the EPA).

Specific local values related to beneficial uses may include significant fish populations or popular recreational activities supported by the waterway in question. Many of these values are likely to have been identified already through regional planning processes such as regional waterway management strategies and state, national and international designations such as Ramsar wetlands.

The proponent should also develop a conceptual understanding of the system: what are the key stressors to beneficial uses (e.g. urban stormwater runoff, a treatment plant discharge, stock access to the waterway etc.) and factors that are likely to influence magnitude of risks to beneficial uses (e.g. climate and stream flow variability). In most cases the basis for this conceptual understanding will be contained in the relevant River/Waterway Health Strategy (although these may need to be adapted to suit the scale of the particular case). A conceptual model should represent relationships between stressors, factors that influence risks and beneficial uses (see EPA 2009).

Would any of the known risks be unacceptable in terms of the Principles of Environment Protection?
Based on a conceptual understanding of the system, the proponent will need to consider whether any of the risks to beneficial uses are unacceptable in terms of the Principles of Environment Protection in accordance with the *Environment Protection Act 1970* and SEPP (WoV). These principles are outlined in the 'Background' section. If there are any unacceptable known risks, (e.g. risks to a threatened species, risk to communities, acute lethality at point of discharge), the proponent should implement actions to meet requirements instead of investigating an offset scheme.

What is the level of investigation required for risk assessment in Phase 2?
Drawing on all the information collated from the questions above, the proponent should have an understanding of the level of investigation required in a Risk Assessment (Phase 2). In particular gaps in information should be identified that will help in developing a clearer conceptual understanding of the problem. The Offsets Technical Panel (see Attachments C and G) may help at this stage to determine the extent of data collection e.g. a compromise between undertaking specific studies and leveraging the panel's expertise may be needed to gain confidence on magnitude of risks to beneficial uses.

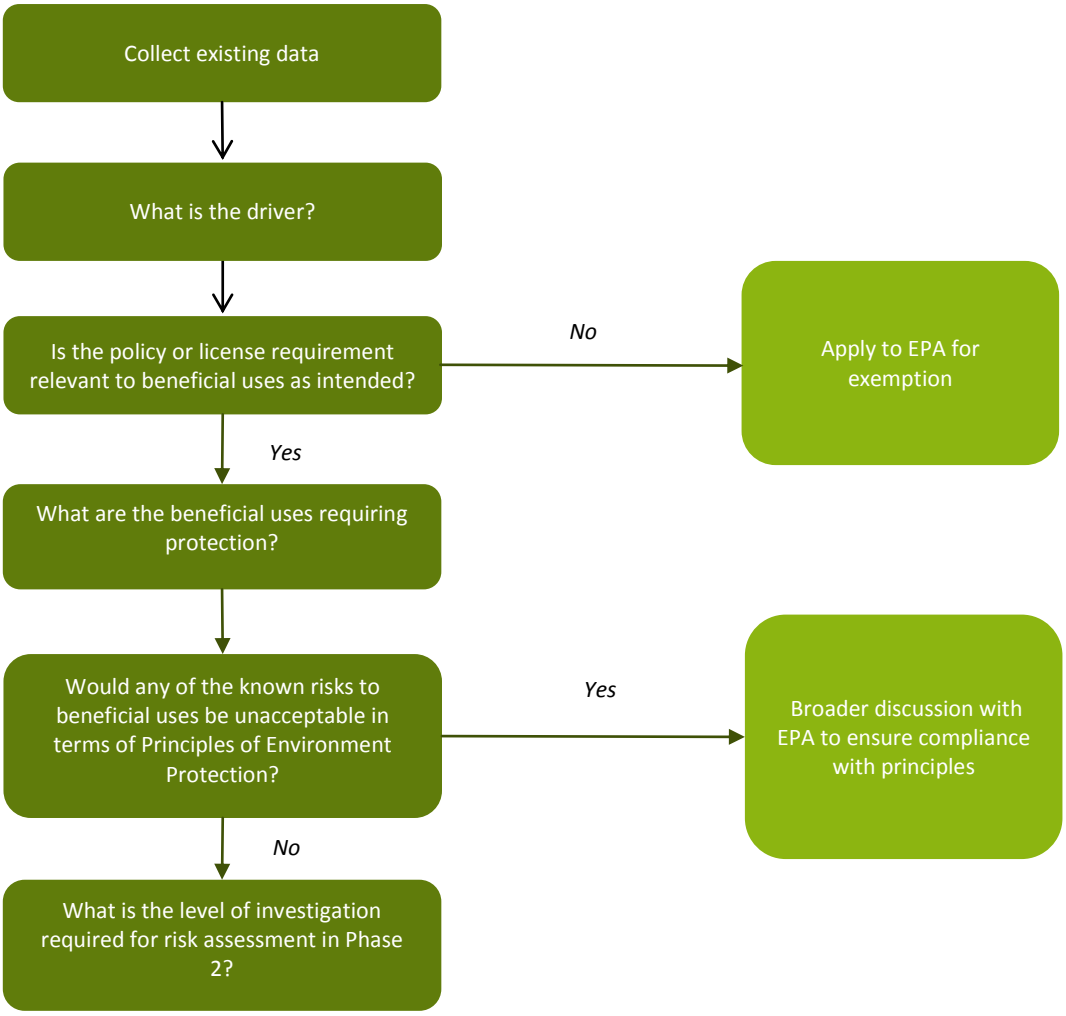

Figure 2. *Key steps in preliminary assessment*

3 Phase 2: Assessment of risks to all beneficial uses

In Phase 2, a risk assessment is undertaken to assess the magnitude of risks to all beneficial uses and local values based on the current situation. Figure 3 presents the steps involved in this phase. As with Phase 1, this phase is not unique to offsets – it is a direct application of the current EPA risk assessment process.

The proponent should refer to EPA's *Guidelines for risk assessment of wastewater discharges to waterways* (EPA 2009) for guidance on how to undertake a risk assessment. A risk-based approach is used for the protection of beneficial uses. This approach that is aligned with the SEPP (WoV). In particular, the guidelines' direction on 'risk analysis' and 'risk characterisation' (Section 3.2 and 3.3 respectively) sets out how risks to beneficial uses should be assessed.

Collect additional data
The proponent should collect additional data that is necessary to address the gaps in information and in conceptual understanding of the problem (as identified in Phase 1). This will enable the magnitude of risks to all beneficial uses to be assessed.

Evaluate risks to beneficial uses across temporal and spatial scales
To evaluate the risks to all beneficial uses across temporal and spatial scales, risks should be assessed (in terms of likelihood and consequence) and characterised in accordance with the method set out in the EPA's guidelines (EPA 2009). 'Uncertainty analysis', including knowledge gaps, assumptions made and data limitations should be incorporated in the risk assessment to ensure that limitations in science, data and understanding of the problem are not overlooked, as highlighted in the guidelines.

As much as possible these risks should be quantified and related specifically to the beneficial uses (for instance the increase in discharge, which may cause an increase in the period of time considered high risk for algal blooms, which may prevent recreational use of the waterway).

Select pathway and type of offset/s
Following the risk assessment, the proponent should select a particular pathway to follow and the type of offset/s to implement (Figure 3). Three possible pathways exist:

- Apply to the EPA for an exemption to the specific requirement. This is the case where the impact of the action is not impacting beneficial uses. The proponent should discuss the intent of the policy or licence with the EPA and apply for an amendment (it is acknowledged that this step is also in Phase 1).

- Offsets are not appropriate, so the proponent must meet the requirements. This is the case where the risk to at least one of the beneficial uses is judged as unacceptably high using the EPA's guidelines (EPA, 2009).

- Offsets are appropriate. The framework uses three basic types of offset analysis:

    1. **Same currency, same beneficial use**. When offset options are compared using a common parameter which acts on the same beneficial use (e.g. different methods of reducing nitrogen discharge in a catchment are assessed based on their impact on a downstream bay).

    2. **Different currency, same beneficial use**. When offset options are compared even though different parameters act on a given beneficial use (e.g. one option may increase flows to a flow-stressed system to the benefit of fish communities, another may decrease pollutant loads that affect water quality for those fish).

    3. **Different currency, different beneficial use**. The analysis considers options that act in different parameters as above but also considers different beneficial uses (e.g. one option may consider the impact of phosphorus on fish, another considers the discharge of metals on an irrigation off take).

The types increase in complexity from the first to the third. The framework has been designed so that the less complex offsets should be easier to demonstrate for the proponent as they are more certain and require less subjective judgement. By definition the more complex cases require a greater (and usually more expensive) demonstration of the benefits.

At the completion of Phase 2 there should be a sufficient understanding of the risks associated with the activity to scope offset options.

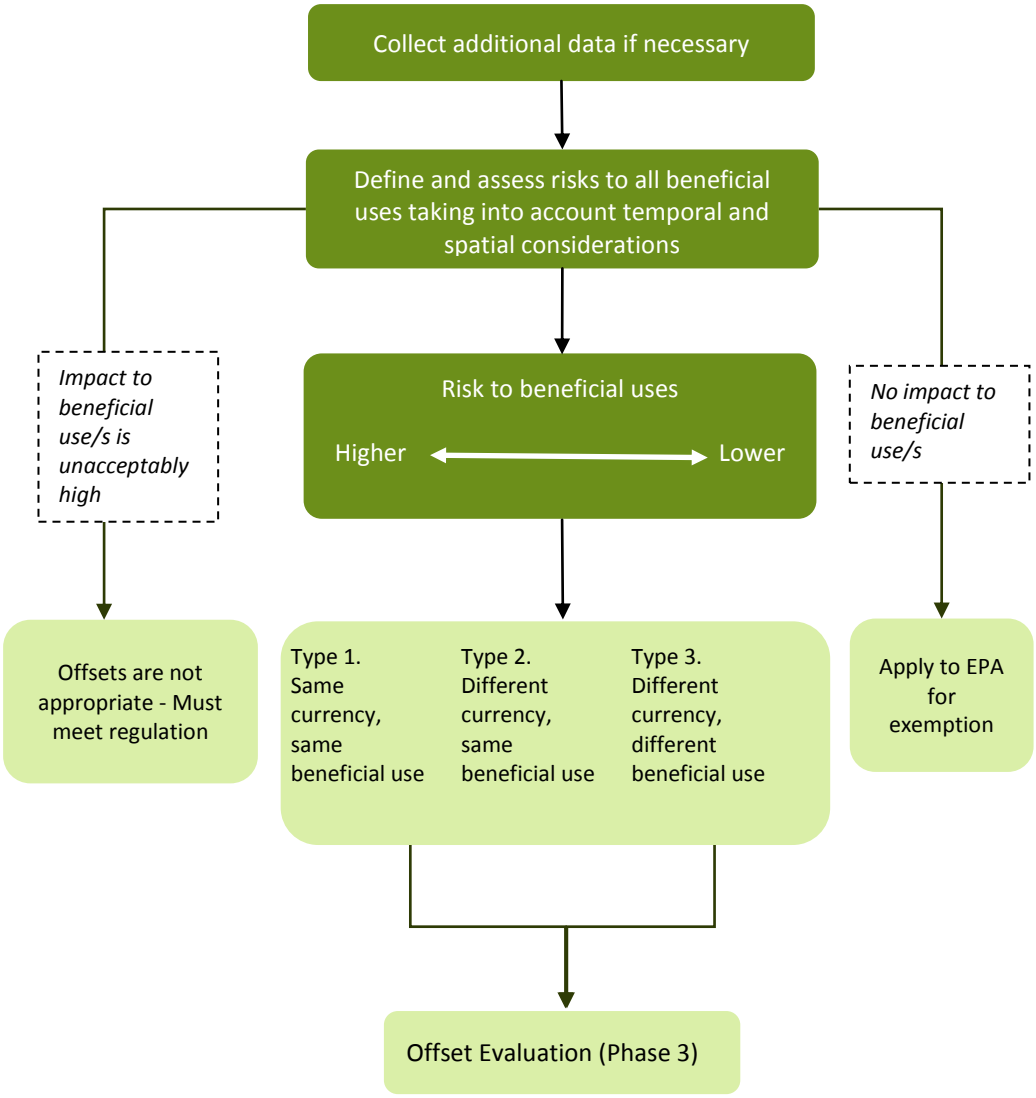

Figure 3. *Steps involved in Phase 2 to determine pathway and type of offset/s to evaluate further in Phase 3*

4 Phase 3: Offset evaluation

Phase 3 is used if the decision has been made that offsets are a feasible approach by the proponent. It sets out the steps required to compare a number of alternatives against a base case (which will usually be a response such as an infrastructure upgrade). This will determine whether an offset option can provide an equivalent or greater protection of beneficial uses (net environmental benefit), is socially acceptable and if it can be achieved at a lower cost.

To demonstrate **net environmental benefit** a series of criteria should be used:

- Equivalence
- Alignment with management priorities
- Additional
- Timely
- Located appropriately
- Enforceable
- Verifiable

An explanation of each of the above criteria is contained in Attachment B.

As described in Phase 2, there are three types of offsets that have been explored through this framework based on the currency (defined as the parameter that is causing the impact) and the beneficial use (as defined by the SEPP (WoV)). The three types are:

- Type 1: Same currency, same beneficial use
- Type 2: Different currency, same beneficial use
- Type 3: Different currency, different beneficial use

For each offset type, the criteria above should be used to demonstrate whether the offset action achieves a net environmental benefit. The exact manner in which each method is applied varies depending on offset types (see Table 1 and Table 2 for details).

Offsets will also be evaluated based on their **social acceptability** and to understand the **least cost** option.

Community consultation will be critical to understand the social acceptability of any potential offset options. Attachment D outlines a method approaching community consultation according to each offset type and based on the International Association of Public Participation (IAP2) framework. This includes who to target, when to consult, what level on the IAP2 spectrum to aim for and suggested consultation tools to employ.

A life-cycle cost analysis (LCCA) will also be required to determine the least cost option. The proposed methodology for this is described in Attachment E.

It is also possible to use a combination of the three offset types to protect beneficial uses. In all but the simplest situations a regulated activity will impact on several beneficial uses, and usually in different ways. For example, in the case of an Emergency Relief Structure (ERS) spilling more frequently than 1 in 5 years, actions may be implemented to offset the nutrient impact to the waterways by treating stormwater (same currency, same beneficial use) and improve the amenity of the waterway by creating a vegetated walking path (different currency, different beneficial use).

Ratios

Ratios are commonly used in the design of offsets schemes to manage issues of scientific uncertainty and therefore reduce assessment costs for the proponent (by avoiding costly scientific studies into each case). Based on this, and the development of the framework with the stakeholders group, ratios are proposed to address three different categories of uncertainty (see Attachment F for the assumptions behind these ratios). They are:

- The time to implement the offset option
- The uncertainty and reliability of the offset action proposed
- The location of the offset action relative to the impact

To use the ratios a figure is calculated for each of the categories (time, location, reliability) and these figures are multiplied together. The result is a factor that increases that amount of the offset action to take account for uncertainty and risk.

Table 1. Offset evaluation – Applying the set of criteria to each offset type

Same 'Currency', Same Beneficial Use	Different 'Currency', Same beneficial use	Different 'Currency', Different beneficial use
Example: Nitrogen discharge from a treatment plant is contributing to excess nitrogen loads (and increased risks of algal blooms) in a coastal embayment. Opportunities exist in the catchment to reduce nitrogen loads from other sources such as revegetation of riparian zones.	Example: Nutrients from a treatment plant are increasing the risk of algal blooms in a creek which threatens drought refuge for fish. Opportunity exists however to purchase temporary water rights for environmental flows which would reduce this risk and provide water for spring flushes to promote fish migration	Example: An ERS is considered low overall risk but still has social and some difficult to define environmental impacts on the local creek. The local community are in favour of building some wetlands that will provide some water quality benefit but also will provide habitat and amenity functions
Equivalence		
Demonstrated by modelling/measurement to predict the equivalent amount of the parameter (may include ratios for timeliness, uncertainty of offset action and/or location) Ratios for uncertainty/reliability of offset multiply the predicted output (i.e. kg pollutant/Ml) by the following factors: • High Reliability (high level of control, small variance in performance, established technology) (1:1) • Medium Reliability (control intermittent such as a constructed wetland, medium but well understood variance in performance, established technology) – (1.5:1) • Low Reliability (minimum control such as works requiring private landholder to maintain, high variance, novel technology) (2:1)	Risk based approach used (risk/impact assessment of the offset action compared to the risk of the base case) • Best available science used to quantify the impacts of specific actions on beneficial uses (i.e. FLOWS Studies, specific risk assessments, waterway strategies, threatened species recovery plans) • Build (or use existing) conceptual model of the local system to compare options • Predicted the impact on beneficial uses using a quantifiable method if possible (modelling to predict situations which will lead to WQ issues, catchment modelling/measurement to determine relative loads) • Technical panel and/or relevant subject experts as determined by beneficial uses (Experts selected by WW manager if needed) workshop to determine relative impacts of different offset options There is an expectation that quantifiable benefits to the beneficial use are demonstrated using an established method.	Risk based approach used (risk/impact assessment of the offset action compared to the risk of the base case) • Best available science used to quantify the impacts of specific actions on beneficial uses (i.e. FLOWS Studies, specific risk assessments, waterway strategies, threatened species recovery plans, surveys of local community,) • Build (or use existing) conceptual model of the local system to compare options • Predict the impact on beneficial uses using a quantifiable method if possible (modelling to predict situations which will lead to WQ issues, catchment modelling/measurement to determine relative loads) • Technical panel and/or relevant subject experts as determined by beneficial uses (Experts selected by WW manager if needed). Offsets are likely to be increasingly difficult to quantify as they use different currencies and act on different beneficial uses. This subjectivity will result in a responsibility on the proponent to demonstrate, monitor and report on outcomes.

Same 'Currency', Same Beneficial Use	Different 'Currency', Same beneficial use	Different 'Currency', Different beneficial use
Alignment with management priorities		
Offset action has been assessed (through equivalence) of addressing the exact impact of the base case so alignment with management priorities less important. Will be relevant if there are several offset options and there are multiple benefits of each option. In this case alignment with management priorities should provide extra weight	Important that offset actions are aligned to take full advantage of complementary actions	As with Type 2
Additional		
Needs to be additional to any funded works. Does not preclude offsets from piggybacking on other planned works. Consideration needs to be given if the offset action is a regulated activity or responsibility for another party. While in most cases this would not be available as an offset there may be exceptions if the risk to beneficial uses is demonstrated.	As with Type 1	As with Type 1
Measurable		
Will be situation dependant (i.e. a diffuse source of nutrients such as stormwater would be modelled, point source discharge could be measured) Offset proposals should include either: • Adequate demonstration of relevant scientific literature to give confirmation of the outcome (for approval by the offsets technical panel) • Details of a monitoring program to confirm results	As with Type 1	As with Type 1. It is likely that a higher level of monitoring will be required due to the subjective nature of the benefit

Same 'Currency', Same Beneficial Use	Different 'Currency', Same beneficial use	Different 'Currency', Different beneficial use
Timely		
The offset should be operating prior or at the same time as the impact. Ratios for timing multiply the predicted output (i.e. kg pollutant/Ml) by the following factors: • Before or at time of impact (1:1) • 0-3 years post impact (1.5:1) • 3+ years (2:1) All offsets will be time bound (usually over the same period as a water authority regulatory period)	Timeliness may or may not be an issue depending on the analysis of specific offset action. The ratios in the first column may be used if necessary but will be dependent on the specific circumstances All offsets will be time bound (usually over the same period as a water authority regulatory period)	Timeliness may or may not be an issue depending on the analysis of specific offset action. Ratios may be used if necessary but will be dependent on the specific circumstances. Given this scenario is likely to be difficult to quantify, the use of timeliness ratios is unlikely All offsets will be time bound (usually over the same period as a water authority regulatory period)
Located Appropriately		
As offset is dealing with the specific impact the location will already be determined. Ratios for location multiply the predicted output (i.e. kg pollutant/Ml) by the following factors: Immediate (within 2km downstream) or upstream location (1:1) Greater than 2km from site (1.5:1) >5km downstream of impact site (2:1)	As offset is dealing with the specific impact the location will already be determined. Ratios for location multiply the predicted output (i.e. kg pollutant/Ml) by the following factors: Immediate (within 2km downstream) or upstream location (1:1) Greater than 2km from site (1.5:1) >5km downstream of impact site (2:1)	As offset is dealing with the specific impact the location will already be determined. Ratios for location multiply the predicted output (i.e. kg pollutant/Ml) by the following factors: Immediate (within 2km downstream) or upstream location (1:1) Greater than 2km from site (1.5:1) >5km downstream of impact site (2:1)

Same 'Currency', Same Beneficial Use	Different 'Currency', Same beneficial use	Different 'Currency', Different beneficial use
Verifiable		
Should be verifiable to the satisfaction of both the proponent and the asset owner (often the waterway manager). Will be dependent on the actions taken but if possible should be undertaken based on accepted standard (i.e. Melbourne Water's wetland design guidelines or DSE/DEPI Waterway design manual) Offset evaluation should be undertaken at the end of the offset period (in preparation for next risk assessment). It should include: • Intent of the action • Success of implementation (for example did the vegetation establish, what was the survival rate) • Cost comparison (capital and ongoing) This information would be compiled and presented as part of the framework evaluation. Offset actions that do not conform to an accepted standard will require a greater degree of monitoring the results. A set of pre-determined KPIs must be identified as part of the offset nomination. These should relate to the implementation of the action (e.g. verify that it is built as planned) and its function (e.g. it worked as designed)	As with Type 1	As with Type 1

Same 'Currency', Same Beneficial Use	Different 'Currency', Same beneficial use	Different 'Currency', Different beneficial use
Socially acceptable		
Results are equivalent to the site and nature of the impact so consultation with community may be quite simple compared to other approaches. In some cases reference to previous consultation (such as that undertaken for a River Health Strategy) will be sufficient. If it occurs consultation is likely to be focussed on informing rather than gathering data to decide on result. The exception to this will be if there are several feasible offset options and there are multiple benefits of each. In this case community preferences should provide extra weight in determining the preferred action.	The level of consultation will be guided by assessment of offset options. Likely that community preference, through either direct surveys or through information from previous consultation into strategies, will provide weight for particular options. Consultation should be carried out when there is enough information about offsets options to have confidence in the technical feasibility and equivalence (i.e. don't get the community to comment on options that are unlikely to occur for other reasons).	The preferred offset option is likely to be very much influenced by the local community. Likely that community preference, through either direct surveys or through information from previous consultation into strategies, will provide weight for particular options. Consultation should be carried out when there is enough information about offsets options to have confidence in the technical feasibility and equivalence (i.e. don't get the community to comment on options that are unlikely to occur for other reasons).
Enforceable		
Will need two levels of contract. Exact form will depend on the regulatory/policy driver. 1. Contract between the EPA and the proponent specifying the length of the offset, the business case (as defined by this framework) and the offset action. 2. Contract between the proponent and the delivery of the works (may also include the asset manager if different).	As with Type 1	As with Type 1
Lifecycle Cost Analysis		
Costing of offset options will largely dictate result - offset should be the least cost for the community that achieves the same result. More complex if there are several offset options with multiple benefits where higher costs may be accepted for other benefits (which possible would attract other contributions).	Offset options demonstrate net environmental benefit (as informed by assessment above and by the offsets technical panel). Result is then dictated by whether LCC identifies one or more of offset options that are more cost effective than the 'base case'.	Offset options demonstrate net environmental benefit (as informed by assessment above and by the offsets technical panel). Result is then dictated by whether LCA identifies one or more of offset options that are more cost effective than the 'base case'.

As described previously, throughout the framework development a major case study was undertaken which looked at discharges from the Gisborne Recycled Water Plant on Jacksons Creek, north-west of Melbourne. A simplified version of this case study is presented below to show how two different offset types can each demonstrate a net environmental benefit. In the case study it is assumed that under current conditions (increased wastewater discharge as a result of population growth), the main risk is to platypus population from increased pollutant loads however this has been assessed as low risk (not 'no risk'). Two offset actions are discussed to reduce risk to platypus compared to the base case scenario (treatment plant upgrade): stormwater treatment of urban runoff in established areas and purchase of temporary water rights for environmental flow releases.

Current-projected condition	Offset type 1 (Same currency, same beneficial use)	Offset type 2 (Different currency, same beneficial use)
A wastewater treatment plant is currently licensed to discharge treated wastewater (Class B) but is required to reduce the length of the mixing zone over time. Population growth in the next 5 years is forecast to increase annual discharge, and therefore pollutant loads and concentration within the mixing zone. A treatment plant upgrade can be undertaken to improve discharge quality (base case scenario). Over the five year period the increase in loads is forecast to be an average of 192 TN kg/yr. The proximity of the mixing zone to an area prioritised for platypus suggests there is a risk. However, platypus are not generally considered to be sensitive to increased nutrient concentrations. The relevant River Health Strategy for the Waterway rates the confidence in Platypus response (measured by Catch per unit effort) to improved water quality as low. It rates the confidence in Platypus response to flow improvements as 'high'.	Stormwater treatment in neighbouring urban catchments can provide an equivalent reduction in nutrient loads (e.g. a stormwater quality assets of 1 ha can remove 192 kg TN). To manage uncertainty surrounding this offset action, the following set of ratios is proposed Time delay to identify suitable sites and to construct treatment (ratio for timing =1.5) Opportunities in surrounding urban areas may be close to beneficial use being impacted (e.g. Platypus) (ratio for location =1) Treatment effectiveness of stormwater treatment measures is well understood and the procedure to verify that is well established (i.e. MUSIC modelling) (ratio for reliability =1) Applying the set of ratios, the level of effort required in TN removal is 1.5 (1.5 × 1 × 1) × 192 = 288 kg	Opportunity exists to purchase temporary water rights for environmental flows particularly during low flow periods. This option will not offset pollutant loads but can reduce impact to platypus through flow improvement (which has been identified as key driver for platypus relevant strategy). A flow study can be undertaken to determine the amount of water needed to reduce risk to platypus (and thus reduce some of the subjectivity in this approach). The proponent should present the revised flow calculations (and how that influences critical flow components for Platypus) compared to the 'do nothing' case of an increase in pollutant loads.
	Likely to be acceptable as an offset based on the Net Environmental Benefit– requires confirmation by modelling. Feasible option – requires costing analysis	Likely to be acceptable as an offset based on the Net Environmental Benefit– requires confirmation by modelling. Feasible option – requires costing analysis

Table 2. Gisborne Recycled Water Plant case study – comparison of offset types

The outcome of Phase 3 is a submission to EPA containing a preferred offset option; approved by the Offsets Technical Panel if necessary and supported by evidence (as outlined by the framework). See Phase 4 below for details (see Attachment G for a summary of Organisational Roles and Responsibilities).

5 Phase 4: Offset Implementation

In Phase 4, the proponent will implement the preferred (and approved) offset action/s.

Prior to implementation, the proponent needs to seek approval of preferred offset action/s from the EPA. The proponent should gain endorsement on the preferred offset action/s from the Offsets Technical Review Panel (although in some simple cases this will not be necessary – at the discretion of the proponent). Once approval is gained, implementation should be undertaken with two levels of contract (exact form of which will depend on the regulatory/policy driver).

- A contract between the EPA and the proponent specifying the time period of the offset, the business case (as defined by this framework) and the preferred offset action/s
- A contract between the proponent and organisation delivering the works (may also include the asset manager if different).

Offset action/s should be implemented in a manner to meet requirements of the 'verifiable' principle i.e. implemented actions are verifiable to the satisfaction of the proponent, the asset owner (often the waterway manager) and the EPA. To be verifiable, offset actions should be implemented, as far as possible, based on accepted industry standards (e.g. Melbourne Water's wetland design guidelines or DSE/DEPI Waterway design manual).

If the project deviates from the standard methodology (i.e. the wetland is undersized for the catchment) there will be greater requirements on the proponent in terms of monitoring to demonstrate success.

6 Phase 5: Offset review

The proponent, with support from the Offsets Technical Review Panel (see Attachment G for a summary of Organisational Roles and Responsibilities), should review the implemented offset action/s on an ongoing basis (i.e. annually) and at the end of the offset period (expected to be five years). This is necessary to:

- To contribute to an evaluation process
- To gather data on the capital and ongoing costs
- To support the business case for a new or ongoing offset application after 5 years (or similar review period)
- Contribute to a knowledge base that will lead to an improved WQOF and thus improve efficiency of the process and effectiveness of outcomes.

At a minimum that review will contain:

- Details of how the capital and ongoing costs compared to the project budget
- Comparison with the project specification (as described in the verifiable principle and including pre-identified KPIs)
- Modelling or monitoring of outcomes (depending on the reliability of the technology used)

The information from the review will form a component of the next project proposal.

7 References

Alluvium 2014. Environmental Flow requirements of the Maribyrnong River System. Report prepared for Melbourne Water, February 2014

Environment Protection Authority (EPA) 2009. *Guidelines for risk assessment of wastewater discharges to waterways*. Publication 1287, July 2009.

Environment Protection Authority (EPA) 2003. *State Environment Protection Policy (Waters of Victoria).* Accessed November 2014.
http://www.epa.vic.gov.au/about-us/legislation/water-legislation/water-related-policies#seppwov

Environment Protection Authority (EPA) Victoria 2008. *Discussion paper: Offsets*. EPA publication no. 1202.3, June 2008.

Environment Protection Authority Victoria (EPA) 2010. *Guidelines for the determination and assessment of mixing zones.* EPA publication no. 1344.

Environment Protection Act 1970. (Vic). Accessed January 2015
http://www.legislation.vic.gov.au/Domino/Web_Notes/LDMS/LTObject_Store/LTObjSt2.nsf/DDE300B846EED9C7CA257616000A3571/367C2C1E3FA0677FCA257761001FCB97/$FILE/70-8056a172.pdf

Earth Tech 2006. *Environmental Flow Determination for the Maribyrnong River: Final Recommendations.* Report prepared for Melbourne Water, July 2006.

Environment Protection Authority and Victorian Water Industry 2011. *Environmental Offset Framework*. June 2011

GHD 2013. *Gisborne RWP Recycled Water Return to Stream Hydrology and Water Quality Impact Modelling.* Report prepared for Western Water Corporation, January 2013.

Government of Queensland 2012, *Water quality offsets discussion paper.* Draft for discussion only – not Government Policy, July 2012.

Government of Victoria 2007, *Environment Protection Act 1970*. Version No. 157, No. 8056 of 1970 Version incorporating amendments as at 16 March 2007.

Melbourne Water 2010. *Constructed Wetlands Guidelines.* April 2010.

Melbourne Water 2013. *Healthy Waterways Strategy.* Chapter 5 Maribyrnong catchment, November 2013.

Selman M, Greenhalgh S, Branosky E, Jones C and Guiling J 2009. *Water Quality Trading Programs: An International Overview*. World Resources Institute, Washington, March 2009.

Stephenson K, Aultman S, Metcalfe T, Miller A 2010. *An evaluation of nutrient nonpoint offset trading in Virginia: A role for agricultural nonpoint sources?* Water Resources Research, Vol. 46, 2010

Attachment A: Method used to develop framework

Table 3. Major activities in developing this framework.

Activity	Date	Participants	Outcomes
Literature review	April 2014	Matt Francey (Alluvium Consulting); Penny Clark (Alluvium); Leonie Duncan (Alluvium); David Tiller (Karoo Consulting), Adrian Volders, Barry Hart (Waterscience), Jeremy Cheesman (Marsden Jacob Associates)	A description of the common elements of offsets schemes used to inform the first stakeholders workshops
Meeting with CAPIM	March 2014	Anna May, Kate Berg Vin Pettigrove, David Feldman (UCI), Ashmita Sengupta (UCI), Lindsey Stuvick (UCI) Ian Rutherfurd, Nathan Delbridge,	Presentation by CAPIM about experimental methodology and interim results
Framework workshop #1	May 2014	Damien Connell (Smart Water Fund); Kate Berg (Western Water); Kate Simpson (EPA); Veronica Lanigan (DEPI); Phoebe Swift (Office of Living Victoria / Yarra Valley Water); Lesley Smith (City West Water); Sam Johnson (South East Water); Steve Shinners (Gippsland Water); Trish Grant (Melbourne Water); Erik Ligtermoet (Melbourne Water); Matt Francey (Alluvium Consulting); Penny Clark (Alluvium); Leonie Duncan (Alluvium); David Tiller (Karoo Consulting), Adrian Volders, Barry Hart (Waterscience), Jeremy Cheesman (Marsden Jacob Associates)	Agreement on: Overall Approach Set of criteria for offsets framework Issues that require technical investigation
Meeting with EPA	July 2014	Kate Simpson, Leon Metzling, Sam LeRay, Campbell Fitzpatrick, Dan Keely, Derek Hollander, Brett Light, Annette Jones, Carmel Vlacos, Tim Turnbell, Carolyn Francis (EPA Vic), Kate Berg (Western Water), Matt Francey, Penny Clark (Alluvium), David Tiller (Karoo Consulting)	General discussion on EPA's past and future approach to offsets
Meeting with CAPIM (Melbourne University), University of Irvine (USA), Western Water, Ian Rutherfurd, Nathan Delbridge (Melbourne University)	July 2014		Update on CAPIM work as well as related academic work doing on in the USA and at Melbourne University

Activity	Date	Participants	Outcomes
Stakeholder discussion paper (Development of case studies)	June-August 2014	Discussions with various water authority and EPA regional staff	Four short case studies that demonstrate the diverse applicability of the proposed framework. Case studies were used to inform the next Framework workshop
Framework Workshop #2	July 2014	Damien Connell (Smart Water Fund); Kate Berg, Anna May (Western Water); Brett Light (EPA); Lesley Smith (City West Water); Steve Shinners (Gippsland Water); Trish Grant, Erik Ligtermoet, (Melbourne Water); Nigel Simmonds, Belinda Garner (Wannon Water); Megan Kreutzer(Central Highlands Water); Matt Francey (Alluvium Consulting); Penny Clark (Alluvium); Leonie Duncan (Alluvium).	Agreement by key stakeholders on high priority questions, including: agreement of a three-phased process options discussed to demonstrate equivalence initial discussions about ratios A draft framework was produced post this workshop, with a summary of the parts of the WQOF that have been discussed and agreed to and what still needs to be resolved.
Community engagement (Jacksons Creek)	September 2014	Western Water customers Six members of the Macedon Ranges Community Reference Group; Kate Berg, Bethany Colban (Western Water); Leonie Duncan (Alluvium);Jeremy Cheesman (Marsden Jacob Associates)	Provided clear indication of which options the community prioritises and their willingness to pay for the outcomes Developed and refined an easy to implement survey methodology
Meeting to discuss in detail the Equivalence principle	November 2014	Anna May, Kate Berg (WW), Trish Grant, Erik Ligtermoet (Melbourne Water), Damien Connell (Smart Water Fund), Matt Francey, Harry Virahsawmy (Alluvium)	Discussion about the various methods of testing for equivalence
Meeting to discuss in detail the Equivalence principle	November 2014	Kate Berg (WW), Matt Francey (Alluvium) , Kate Simpson, Brett Light (EPA);	Refinement of the equivalence method
Jacksons Creek case study	November/December 2014		Testing of framework concepts (which were refined post the third framework workshop)
Framework workshop #3 (Third stakeholder workshop)	December 2014	Damien Connell (Smart Water Fund); Kate Berg, Anna May (Western Water); Kate Simpson, Brett Light (EPA); Veronica Lanigan (DEPI); John Theobald; Sam Johnson (South East Water); Sally Jungwirth (City West Water); Sally Crook (Yarra Valley Water); Trish Grant, Erik Ligtermoet (Melbourne Water); Belinda Garner (Wannon Water); Matt Francey, Harry Virahsawmy, Leonie Duncan	Endorsement of : Three stage process Risk based approach to equivalence The need for an Offsets Technical Panel to address the inevitable subjective issues and to provide evaluation of the framework

Activity	Date	Participants	Outcomes
		(Alluvium); Dave Tiller (Karoo Consulting); Jeremy Cheesman (Marsden Jacob Associates)	Steps to find a 'home' for the framework after this project

Attachment B: Net Environmental Benefits

According to SEPP (WoV), offset measures should offer either equivalent or greater protection of beneficial uses within impacted segment or segments. The policy also states that the EPA will work with stakeholders to provide guidance on developing and approving offset measures. In 2008 EPA Victoria published a position paper which described an environmental offset as, *an action(s) to address an adverse environmental impact of resource use, a discharge, emission or other activity at another location to deliver net environmental benefit*. The paper, importantly, lists criteria to achieve this. These criteria were discussed and refined during a series of workshops. Seven criteria (Table 4) were highlighted to be important in determining whether offsets achieve net environmental benefits.

Table 4. Definition of criteria

Principle	Explanation
Equivalence	Offsets have a similar impact on beneficial uses to the action being offset. Offset can achieve this by using the same currency (e.g. maintaining health of platypus by offsetting increased nutrient loads in wastewater discharge through a stormwater treatment offset) or a different currency (e.g. maintaining health of platypus by offsetting increased nutrient loads in wastewater discharge through increased releases of environmental water). In some cases ratios will be used to account for uncertainty in offset actions.
Alignment with management priorities	In order to ensure efficiency offset actions must be consistent with approved short and long term management priorities of the system.
Additional	Offsets are additional if they target priorities that are currently planned but not funded (including if they bring forward an action that is planned for funding in the future)
Timely	Offsets are time bound (i.e. they have time limits) so that they come to an end, can be reviewed (usually within a period aligned with mechanisms such as Water Plans e.g. 2013-2018). Offset actions should also provide the benefit at the same or similar time to the action increasing risk. Ratios will be used to account for discrepancies in offset lead time and delay in offsetting the impact (ratio for timing).
Located appropriately	Offsets address the impacts to beneficial uses at all geographic scales. Ratios will be used to account for discrepancies between the impact and offset sites (ratio for location).
Enforceable	Offsets are underpinned by an appropriate licence or contract (e.g. a licensed amendment or new contract)
Verifiable	Offsets use appropriate industry standards or practices to demonstrate outcomes. Monitoring requirements of the outcomes will be reflective of the degree of confidence in the technology or approach chosen

Attachment C: Technical Panel Terms of Reference

There was a level of support from participants at the workshop for an independent technical panel that can assist throughout the offset investigation. Such a panel can assist to make the problem formulation efficient, help to determine gaps in conceptual understanding of the system as a whole, and to improve the framework through lessons learnt from each offset project. It is anticipated that the proposed framework in this document will benefit from evaluation and adjustment based on the first real offset examples.

The technical panel should consist of people that have:

- Scientific background in aquatic systems
- No conflict of interest (their own research funding should not be dependent on outcomes of decisions)
- Experience in risk assessments
- An understanding of waterway management techniques

The technical panel will be funded by the proponent.

A draft 'Terms of Reference' for the Technical Panel is presented in Table 5.

Table 5. 'Terms of Reference' of Technical Panel

Phase	Element	Role of Panel	Expected time required
1 – Preliminary Assessment	Problem Formulation	Initial discussion with proponents to ensure proposal is consistent with the framework (optional depending on the complexity of the issue) Ensure the science supporting the proposal is relevant to and targeted at the beneficial uses	Half day/person
2 – Risk Assessment	Risk Assessment	Review of the risk assessment to ensure that the determination of impact on beneficial uses is appropriate	Half day/person
3 – Offset evaluation	Options Assessment	Review and recommendation on the 'Net Environmental Benefit'. In particular the panel will need to address questions of: • Equivalence in more complex situations • Verifiable – offset actions that do not conform to an accepted standard will require a greater degree of monitoring the results • Additionality – Should offsets be accepted if they 'regulated' actions such as the cleanup of dry weather spills. There will be considerable grey areas in deliberations on this topic	Day/person
5 – Offset review	Review	Review of the offsets implementation at set periods (suggest after 1 year and 3 years)	1-2 Days/Person

Produce short report which recommends changes to the framework

Attachment D: Community Consultation

Community consultation can play an important role in developing and evaluating offset options (Phase 3). Effective consultation can lead to better project outcomes, better relationships with community, increased understanding of community issues, and better partnerships and networks. The first step is to define the community. Broadly speaking, this will be anyone likely to be interested in or affected by any of the potential offsets. This may include: water customers (potable, recycled and diversion licensees), recreational users (e.g. fishers, rowers, walkers, bird watchers), traditional owners, local residents, adjoining landholders, and environment / community groups (e.g. Waterwatch volunteers, Friends of groups, creek management committees, Environment Victoria, Native Fish Australia).

The community consultation guidelines in the Table 6 below are based on International Association of Public Participation IAP2 framework. The IAP2 framework uses a spectrum to determine the scope, tools and techniques for conducting community engagement depending on whether the aim of consultation is to inform, consult, involve, collaborate, or empower. The IAP2 Toolkit available at the IAP2 website includes example tools that you can use to develop your community consultation plan. The Victorian Department of Primary Industries Effective Engagement web pages[1] include community consultation tools developed for Victorian communities based on the IAP2 framework.

Table 6. Community consultation

Offset type	Same 'Currency', Same Beneficial Use	Different 'Currency', Same beneficial use	Different 'Currency', Different beneficial use
Example	Example: Nitrogen discharge from a treatment plant is contributing to excess nitrogen loads (and increased risks of algal blooms) in a coastal embayment	Example: Nutrients from a treatment plant are increasing the risk of algal blooms in a creek which threaten drought refuge for fish. Opportunity exists however to purchase temporary water rights for environmental flows which would reduce this risk and provide water for spring flushes to promote fish migration	Example: An ERS is considered low overall risk but still has social and some difficult to define environmental impacts on the local creek. The local community are in favour of building some wetlands that will provide some water quality benefit but also will provide habitat and amenity functions
Socially acceptable			
Summary	Results are equivalent or better at the site and the nature of the impact, so consultation with community can be quite simple compared to other approaches. Consultation is likely to be focussed on informing rather than gathering data to decide on result.	Level of consultation required will be guided by assessment of offset options. Likely that community preference will provide weight for particular options.	Level of consultation required will be guided by assessment of offset options. Likely that community preference will provide weight for particular options. Because the offset delivers different beneficial outcomes community acceptance and values will generally have more weight than a different currency, same beneficial use (outcome)

[1] http://www.dse.vic.gov.au/effective-engagement

	The exception to this will be if there are several feasible offset options and there are multiple benefits of each. In this case community preferences should provide extra weight		offset evaluation.
Suggested IAP2 Spectrum Participation Level	Inform – provide balanced and objective information to assist the community to understand the problems, alternatives and actions the proponent is taking Consult – obtain feedback on analysis, alternatives and or decisions	Consult – obtain feedback on analysis, alternatives and or decisions	Involve – work directly with the public throughout the process to ensure that public issues, values and concerns are understood and considered when choosing the offset
Promise to the public	Inform - 'We will keep you informed' Consult – 'We will keep you informed, listen and understand your preferences, and provide feedback on how your input influenced our decision'.	Consult – 'We will keep you informed, listen and understand your preferences, and provide feedback on how your input influenced our decision'.	Involve – 'We will work with you to ensure that your issues, values and concerns are understood and reflected in the offsets developed, and we will provide feedback on how your input influenced the decision'.
When to consult and objective	Phase 1 – Preliminary assessment • inform / identify beneficial values of high priority to the community Phase 3 – Offset evaluation • obtain community feedback on analysis, alternatives around the proposed offset measures	Phase 1 – Preliminary assessment • inform / identify beneficial values of high priority to the community Phase 3 – Offset evaluation • obtain community feedback on analysis, alternatives around the proposed offset measures	Phase 1 – Preliminary assessment • identify beneficial values of high priority to the community • understand community acceptance, issues, concerns of non-like-for-like trade offs • understand how community concerns and issues may be addressed within the offset framework Phase 3 – Offset evaluation • obtain community input on the offset alternatives, identify, quantify and document acceptance, concerns, issues
Example community consultation tools	Inform – fact sheets, websites, presentations to special interest groups Consult – public comment, open forums, focus groups, surveys, public meetings, Willingness to Pay	Consult – public comment, open forums, focus groups, surveys, public meetings, Willingness to Pay studies	Involve – deliberative polling, beneficial value and offset option surveys, public meetings, workshops, sentiment monitoring

	studies		
General guidelines	Inform • Know who you are trying to reach and how they are most likely to access and understand the information. • Ensure information provided is high quality, consistent, timely, appropriately targeted and easily understood by your target audience(s) Consult • Ensure the purpose of consultation is clear, including what is being consulted on and what is non-negotiable. • Know who you are trying to consult, the most effective way to reach them and get a response. • Allow enough time for a response to consultation requests. • Coordinate requests so that, where possible and appropriate, you ask for views once, not several times. • Provide feedback on the results of consultation. • Ensure and demonstrate that the views of those consulted are taken into account in the outcome. • Present all information simply and clearly. • Ensure adequate resources are allocated to the process	Consult • Ensure the purpose of consultation is clear, including what is being consulted on and what is non-negotiable. • Know who you are trying to consult, the most effective way to reach them and get a response. • Allow enough time for a response to consultation requests. • Coordinate requests so that, where possible and appropriate, you ask for views once, not several times. • Provide feedback on the results of consultation. • Ensure and demonstrate that the views of those consulted are taken into account in the outcome. • Present all information simply and clearly. Ensure adequate resources are allocated to the process	Involve • Ensure all relevant people are given the opportunity to be involved. • Ensure you maintain a commitment to enabling their involvement in the process (have equity/access issues been considered that ensure that individuals are not unknowingly disadvantaged?). • Consider carefully what processes and/or structures are appropriate for the purpose and who is to be engaged. • Avoid misunderstanding and ambiguity by clearly establishing the basis for membership of bodies such as boards or committees (e.g. skills vs representation), the decision-making processes (e.g. voting vs consensus) and roles and responsibilities at the outset.

Attachment E: Life-cycle Cost Analysis

Objective

Water quality offsets should be cost-effective – that is, they should provide equivalent or greater protection of beneficial uses (net environmental benefit) at lower cost than the base case scenario. Life-cycle cost analysis (LCCA) supports decision makers in identifying the cost effectiveness of the base case and offset options.

This Attachment provides guidance on how to undertake a LCCA for water quality offset evaluation. We outline how to develop a lifecycle costing framework that considers the financial, social and environmental implications of water quality investments in Victoria by:

- Estimating the water quality impacts of the business as usual (BAU) scenario and offset options considered
- Estimating other community and environmental benefits associated with the BAU scenario and offset options
- Using a discounted cashflow model to determine the net present value of each option
- Undertaking sensitivity testing to identify the most critical factors in determining the outcomes
- If necessary, undertaking further analysis, such as threshold analysis or real options analysis, to identify the preferred offset option.

Life-cycle Cost Analysis

Lifecycle Cost Analysis supports decision makers in evaluating and identifying the most cost effective and beneficial investment options, taking in to account all costs and benefits over the life of the option and the scalability of investments. Key components of an LCCA are the:

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

Cost benefit analysis

The most robust method for examining the economic viability of the BAU and offset options is to consider the marginal value of the scheme using a cost benefit analysis (CBA) framework. CBA is the most comprehensive of the economic appraisal techniques and is the preferred method of analysis for most State and Commonwealth agencies.

A CBA supports decision makers in determining the most cost effective option taking in to account all costs and benefits over the life of the options. This includes not only to cost of implementation, operation and maintenance of the options, but also the cost to the community and other agencies or businesses.

The CBA identifies the economic benefits and costs of the investment options to Victoria, including the water business, Councils, other business and community, based on an assessment of market and non-market economic benefits and costs.

Detailed guidance on how to complete a CBA for Victorian water investments are set out in the Department of Environment, Land, Water and Planning draft *Investment lifecycle guidelines – water supplement*.

Threshold analysis

Not all costs and benefits can be readily quantified and valued. Where it is not possible to quantify all of the costs and benefits, a best judgement assessment of the unquantified factors may be required to make a final assessment. In these cases, a 'threshold analysis' can be useful and can be used in conjunction with the CBA.

A threshold analysis does not seek to quantify the remaining costs and benefits, but involves a subjective comparison of the 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?'*

Steps in a LCCA Analysis

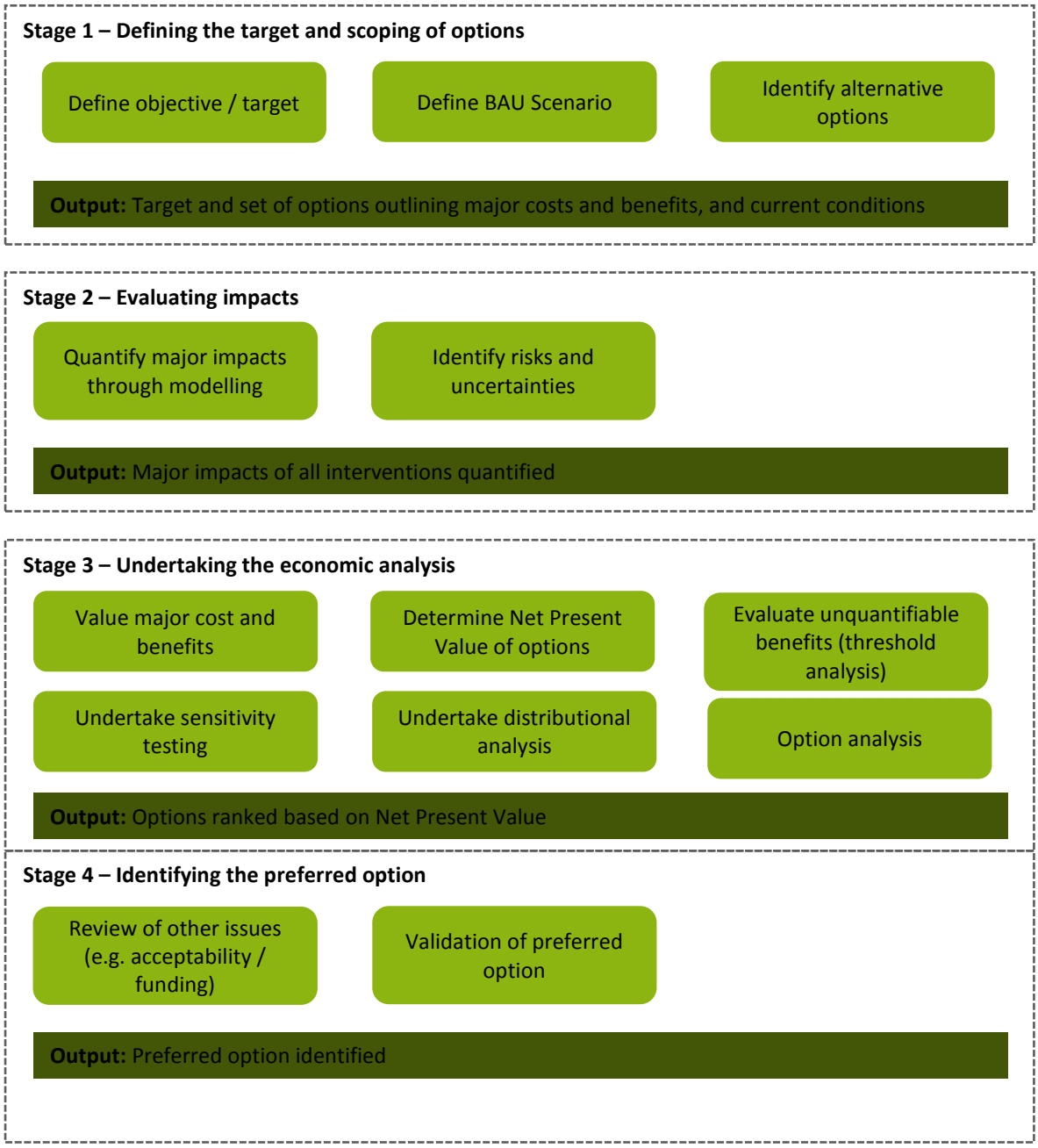

Figure 4. *Summary of stages and tasks*

Defining the target and scoping of options

An important first step before the scoping of options is the clear definition of a measurable target / objective. Options can then be developed on the basis of this target and measured against it. For example, the target may be expressed as a reduction in the size of the mixing zone or nutrient objectives for a particular catchment.

Key elements in defining target and scoping of options are:

- Clearly define the area affected and beneficial uses
- Clearly define the BAU scenario. For example, it needs to be defined which infrastructure and other measures are currently in place and which future interventions will occur under the BAU scenario, such as an upgrade of the treatment plant or additional reuse of recycled water system.
- Clearly define all options: All offset options to be assessed in the LCCA need to be clearly defined including the type of infrastructure, major expected benefits and the current condition to which all options will be compared. In defining the alternative options it needs to be clear, which BAU scenario works do also occur under the option and which BAU scenario works are replaced (or can be scaled up/ down) through the implementation of other works (e.g. construction of a wetland may result in a deferral of the treatment plant upgrade).
- The current conditions and assumptions applicable to all options need to be transparent and clearly defined. This includes for example, the rate of development and associated increases in stormwater flows, waste water treatment plant inflows and water demand. The BAU scenario and alternative options need to reflect existing regulatory requirements and environmental regulations over the evaluation period (unless definite future changes are known), including planning and development requirements.
- Define a common unit of measurement or units of measurement (currency) (e.g. nutrients (mg/L). Where more than one currency is used, a ranking and rating approach needs to be agreed for the analysis.

  Identify all the costs and benefits of each options (see also Table 7). Ideally, this involves linking the change in currency under the BAU and option to changes in beneficial uses, and other impacts that aren't identified beneficial uses. This understanding should be established during Phase 2: assessment of risk to all beneficial uses and the first part of Phase 3: Offset evaluation where required.
- Understand the limits of supply and the scalability of each option (e.g. reuse of recycled water to reduce discharge depends on demand for recycled water; the construction of a number of wetlands can be sequenced over time).
- It is important to establish robust and defensible estimates for the largest uncertainties associated with the analysis, such as water quality impacts under the BAU and alternative offsets as well as other benefits and costs associated with the options. Some works may deliver the desired outcomes with greater certainty than others.

Table 7. Examples of common cost and benefits in the LCCA of water investments

Costs or benefits	Economic Analysis
Costs	Capital expenditure (incl. project planning and delivery)
	Operation and maintenance costs (incl. staff, materials, energy)
	Renewal and disposal cost
Costs	Land (opportunity) cost associated with major assets (e.g. wetlands/open water storages)
	Institutional and regulatory requirements and administrative costs
Benefits	Changes to beneficial uses (see Glossary for a list of EPA beneficial uses)
	Reduced pollution (nitrogen and phosphorus) in waterways and the Bays
	Improved environmental flow regimes in waterways
	Changes in flooding incidence and / or severity
	Reduced potable water consumption
	Deferred / avoided infrastructure

Source: Marsden Jacob, based on Commonwealth Handbook of Cost Benefit Analysis (2006), and Office of Living Victoria (2013).

Estimating costs and benefits

For some offset options the costs or benefits will be relatively easy to identify. For example it's relatively straightforward to estimate engineering costs for upgrading a waste water treatment plant or extending a recycled water network. Standard lifecycle cost estimates are available for some works. Melbourne Water provides *Water sensitive urban design Life cycle costing data* for works such as wetlands, raingardens and tree pits[2]. At a minimum the analysis needs to consider:

- the capital costs for works undertaken as part of the BAU scenario and interventions, as well as the asset life;
- any renewal costs over the evaluation period; and
- operational and maintenance costs.

Where the cost or benefits are non-financial (e.g. improvements in riparian vegetation), the value can often be measured with reference to individual preferences within the affected community. The foundation concept of all economic evaluation of projects or proposals is the concept of willingness to pay (the maximum amount that an individual is prepared to pay to gain the outcomes that they view as being desirable), and the related concept of willingness to accept (the minimum amount that an individual is prepared to accept as compensation to forego an outcome that they view as being desirable). Broadly, the concept of willingness to pay relates to the benefits of a policy or program and willingness to accept relates to the costs of a policy or program.

The Department of Environment, Land, Water and Planning draft *Investment lifecycle guidelines – water supplement* provide guidance on how to estimate economic benefits based on willingness to pay concepts.

Sensitivity analysis

Sensitivity analysis of key assumptions and parameters for all options (incl. BAU scenario) is important to allow judgments to be made as to the most critical factors in determining the outcomes.

In particular, the sensitivity analysis should examine (separately) changes to capital and operating costs, flood damage cost, nitrogen removal costs, any other major cost or benefit item and the discount rate.

[2] Available at: http://www.melbournewater.com.au/Planning-and-building/Forms-guidelines-and-standard-drawings/Documents/Life%20Cycle%20Costing%20-%20WSUD.pdf

Distributional analysis
A CBA does not specifically address matters of equity or perception, including political sensitivity, moral obligations or cultural issues. Where applicable, these issues must be subjectively assessed by decision makers and weighed against the economic impacts.

In particular, matters of equity can be addressed through a distributional analysis, where the direct cost of each option is attributed to stakeholders on the basis of what we assess as first round impacts.

Option analysis
The CBA can be extended by examining the option value inherent in the interventions.

Sequencing of options and the value of flexibility can be important to a project because future development rates and climatic scenarios are not known with certainty. The options based approach uses decision trees to calculate the expected value of projects based on the probability of different outcomes occurring (for example high development growth rates versus lower than anticipated growth rates, or wetter or drier climate sequences).

Options analysis has shown that option based approaches generally favour smaller and middle sized interventions that are scalable to key uncertainties (for example scalable to rates of development change over a planning horizon). This type of approach results in Council making 'minimum regret' investments, because it avoids large fixed cost investments that have the potential to become stranded assets.

Option analysis is often supported through the use of specific software, such as Palisade's Precision Trees and @Risk software.

Identifying the preferred option

Once the economic analysis is completed, results are combined with the Net Environmental Benefits criteria and the results of community consultation to determine the preferred option.

Attachment F: Proposed ratios

The review of national and international offset schemes undertaken for the framework looked specifically at the development of ratios. Ratios are commonly used in the design of offsets schemes to manage issues of scientific uncertainty and therefore reduce assessment costs for the proponent (by avoiding costly scientific studies into each case). Based on this, and the development of the framework with the stakeholders group, ratios are proposed to address three different categories of uncertainty. They are:

- The time of implementation of the offset option
- The uncertainty and reliability of the offset action proposed
- The location of the offset action relative to the impact

In almost all cases reviewed the value of the ratio was a negotiated outcome between the scheme administrator and proponents. The only exceptions to this were single currency where extensive modelling of a single parameter (for instance nitrogen) had been undertaken and uncertainties estimated.

We have proposed a simple set of factors for each category. That includes a base case of a 1:1 when there is high certainty up to a 2:1 for a highly uncertain impact on beneficial uses (Table 8). The factor for each of the three categories is multiplied to achieve an overall uncertainty factor (Table 9).

Table 8. Proposed factors for location, reliability of action and timing

Location		Timing		Reliability of action (based on leve nature of technology (novel/estab results)
Immediate or upstream location	1	Before or at time of impact	1	High certainty
Greater than 2km from site	1.5	0-3 years post impact	1.5	Medium certainty
>5km downstream of impact site	2	3+ years	2	Low certainty

When uncertainty factors are multiplied for the three categories this gives a minimum ratio of 1:1 and a maximum of 8:1 (for an offset action greater that 5km from impact site, 3+ years after impact and using a technology with high uncertainty).

Table 9. Combination of uncertainty for location, timing and reliability

Offset location	Timing of offset benefit	Reliability of offset action		
		Low	Med	High
>5km downstream of impact site	3+ years	8.0	6.0	4.0
	0-3 years post impact	6.0	4.5	3.0
	Before or at time of impact	4.0	3.0	2.0
Greater than 2km downstream	3+ years	6.0	3.4	2.3
	0-3 years post impact	4.5	3.4	2.3

from site	Before or at time of impact	3.0	2.3	1.5
Immediate or upstream location	3+ years	4.0	3.0	2.0
	0-3 years post impact	3.0	2.3	1.5
	Before or at time of impact	2.0	1.5	1.0

The ratios are applied to the 'currency' of the offset as shown in the example below:

- The base case requires a pollutant reduction of 500kg of suspended solids
- A wetland is constructed at the site of the impact – therefore the location factor is 1.
- The wetland is completed 2 years after the assessment period begins (as defined by the regulation) - the timing factor is 1.5
- The wetland is considered established technology but has a lesser degree of control compared to the base case, and has a moderate level of variance reported in published studies of performance – therefore a reliability factor of 1.5
- The overall uncertainty factor is 1 x 1.5 x 1.5 =2.25 (rounded to 2.3)

Therefore the wetland should be sized to achieved a load reduction of 500kg x 2.3 = 1150kg

It is envisaged that these ratios will be one of the key aspects of the Offsets Framework that are reviewed over time based on both actual examples and an improvement in the science and management surrounding their performance

Attachment G: Organisational Roles and responsibilities

Table 10. Organisational roles and responsibilities

	Overall framework	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Framework holder	Appointing (but not funding) the offsets Technical Panel Providing governance over framework updates Maintaining and updating the overall framework	Supplying details of approved Offsets Technical Panel to proponents	NA	NA	NA	Updating framework based on new information and suggested improvements
Proponent	NA	Preparing Phase 1 documentation Engaging Offsets Technical Panel to assist in project scoping	Undertaking Risk Assessment	Consultation with other agencies to determine options Undertake technical work to predict the impacts of each option on beneficial uses Engage Offsets Technical Panel to assist in offset evaluation Present Offsets case and recommendation to EPA Form contractual arrangement with EPA to formalise the delivery of the offset	Form contractual arrangement with the 'deliverer' of works – could be waterway manager, local government, community groups, private landholders	Undertake offset evaluation to be presented as part of review/next project formulation
EPA		NA	Approve Risk assessment (when it falls under current EPA process)	Form contractual arrangement with proponent to formalise the delivery of the offset	NA	Awareness but no active role
Waterway Manager (or other asset owner) Note: Melbourne Water have been the only	Awareness but no active role	Supply data/conceptual models/relevant reports Involvement in	NA	Possible involvement in option definition If they are the 'asset owner'	Possibly deliver works as per contract with proponent	Awareness but no active role

	Overall framework	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
'Waterway Manager' involved in the development of the framework. Further consultation with waterway managers regarding the framework would be beneficial.		the problem formulation (as they are likely to have the best knowledge of the receiving water body) Supply waterway strategy and data		there will need to be a formal acceptance of the ownership and future maintenance requirements		
Implementation agency/landholder	NA	NA	NA	Possible involvement in option definition	Deliver works as per contract with proponent	NA
Offsets Technical Panel	Periodic engagement to review and update framework	Engaged by proponent to assist in project scoping (depending on the complexity of the issue)	NA	Engaged by proponent to assist in scoping and offset evaluation	NA	Periodic engagement to review and update framework based on examples