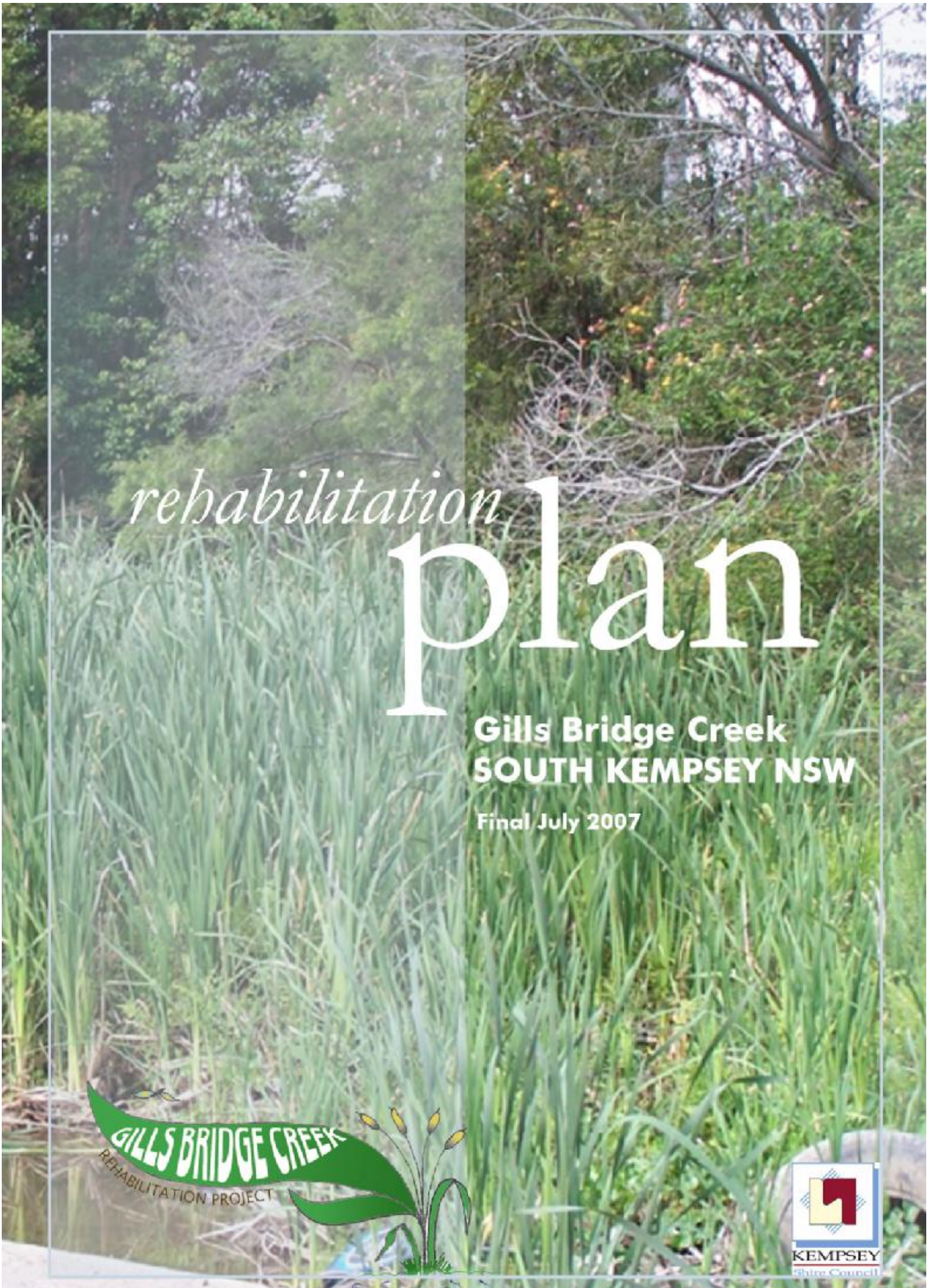

rehabilitation plan

Gills Bridge Creek
SOUTH KEMPSEY NSW

Final July 2007

GILLS BRIDGE CREEK
REHABILITATION PROJECT

KEMPSEY
Shire Council

Rehabilitation Plan
Gills Bridge Creek, South Kempsey, NSW

Prepared by Kempsey Shire Council.

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1.0 INTRODUCTION

Kempsey Shire Council (KSC) has been investigating the potential contamination and degradation of Gills Bridge Creek, South Kempsey, NSW, with an aim to develop a rehabilitation plan for the Creek.

1.1 Background

The visual appearance of Gills Bridge Creek has been declining for a number of years, while basic water quality monitoring has indicated some impacts from the surrounding urban, commercial and industrial environment. Council and the community have recognised the declining health of the Creek and the need for a Rehabilitation Plan to be developed.

1.2 Aim

The Gills Bridge Creek Rehabilitation Plan aims to set a framework for preserving and enhancing existing assets of the creek, such as remaining segments of intact native riparian vegetation and aquatic habitats, and to rehabilitate degraded ecological assets, such as water quality and the extent of weed coverage. In doing so, the project aims are to describe and set in place measures to improve and sustain the ecological condition of the Creek, while encouraging a Total Catchment Management (TCM) aware, involved and practising community.

1.3 Objectives

The objectives of the rehabilitation plan are to:

1. **Improve water quality and flow regimes;**
2. **Protect and where possible regenerate native riparian vegetation;**
3. **Improve and sustain aquatic and terrestrial ecological habitats;**
4. **Increase bank stability and decrease erosion;**
5. **Manage, control and where possible reduce the area and extent of weed species; and**
6. **Raise community awareness of total catchment management (TCM) principles.**

1.4 Constraints

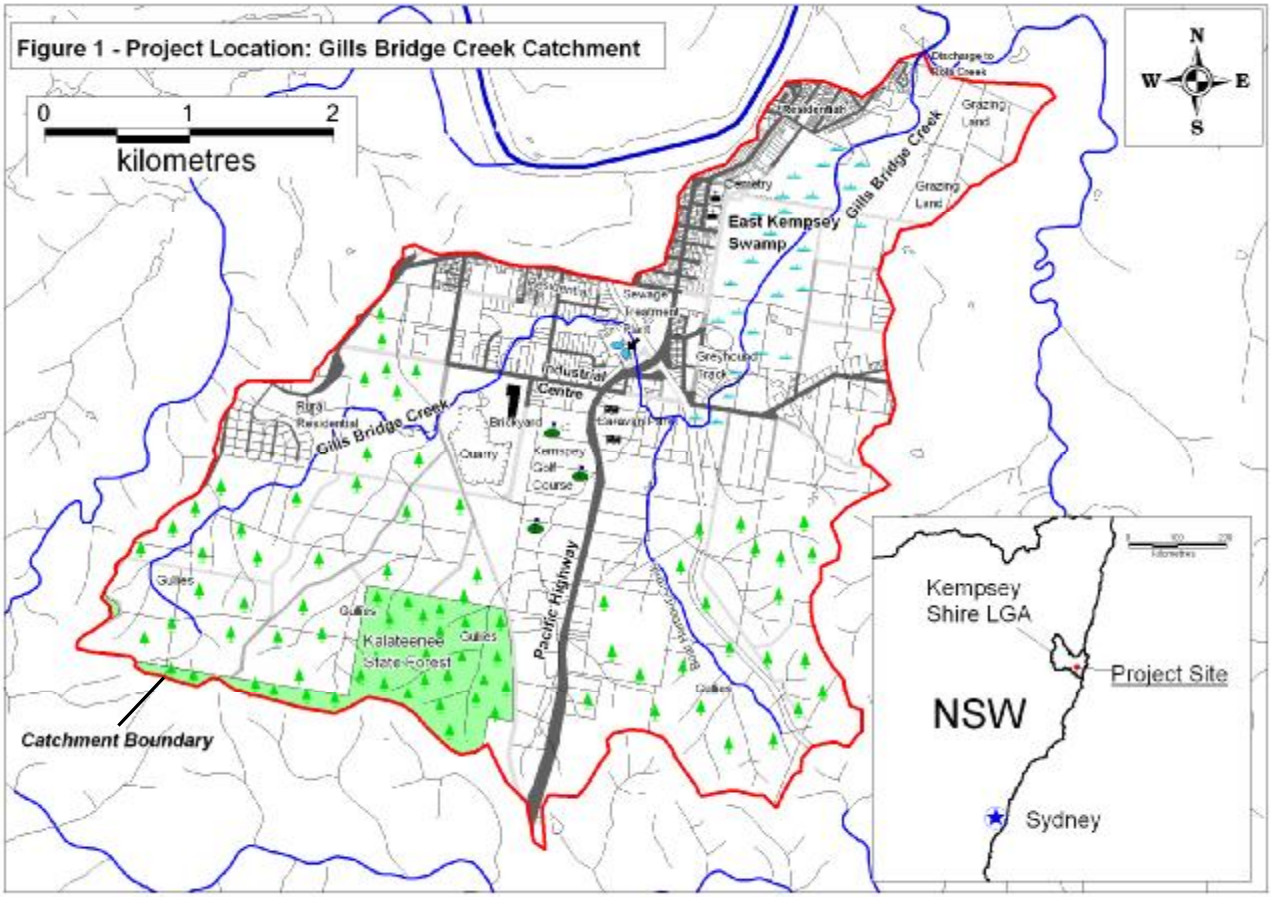
An important part of any rehabilitation plan is to identify and describe the constraints of the project, including resources (both budgetary and human), access to land parcels and timeframes. Cost estimations for the strategies and actions recommended in this Rehabilitation Plan are outlined in section 4.4.1. In order to implement all of the recommended actions, funding resources, additional to those currently estimated in Council's long term budget, will be required. To this end Council has applied for grant funding through the Department of Environment and Climate Change's (DECC) Environmental Trust - NSW City and Country Environmental Restoration Program. If Council's application is unsuccessful then the full list of strategies, actions and associated timeframes will need to be reviewed and revised to reflect Council's capacity to implement them. Furthermore, if unsuccessful during this funding round, Council will pursue future opportunities for grant funding as well as corporate sponsorship to assist in the implementation of the recommended actions of this Plan.

Constraints are discussed in more detail in Section 4.4.1, which describes the feasibility of the recommended strategies and actions.

2.0 SITE IDENTIFICATION

2.1 Location

The Gills Bridge Creek Catchment is a sub catchment of the broader Macleay River Catchment. It is located in the southern to central portion of the Kempsey Shire Local Government Area (LGA) on the Mid North Coast of NSW (see Figure 1 below).



The main arm of Gills Bridge Creek originates from the headwaters in elevated terrain (up to 100 mAHD) located approximately 5 kilometres to the south west of the Kempsey CBD. The creek then flows through the main industrial area in South Kempsey and into East Kempsey Swamp, before discharging into Pola Creek, approximately 2km east of the Kempsey CBD. Gills Bridge Creek flows through, or adjacent to, a number of different land use zones including rural, residential, industrial and a special uses zone designated for the South Kempsey Sewage Treatment Plant, and as such is exposed to a wide range of potential impacts from human activities.

2.2 Catchment Land Use

The Gills Bridge Creek catchment encompasses approximately 17.31 km^2 (1,731 ha) and contains a number of various land use zonings within the catchment. The majority of the southern half of the catchment is zoned rural, although much of this land remains vegetated with scattered to semi-dense timber and consists of scrubland, open woodland and open forests, including a portion of Kalateenee State Forest. The headwaters of Boat Harbour and Green Wattle Creek (major tributaries of Gills Bridge Creek) and other smaller

unnamed tributaries of Gills Bridge Creek are also located in the southern half of the catchment. These headwater tributaries flow intermittently and are often reduced to 'chains of ponds' or are completely dry during extended periods without rain. A substantial portion of land within this southern part of the catchment has been identified for industrial land release.

Land adjacent to each side of the Pacific Highway, in the southern half of the catchment, has been cleared or partly cleared and includes industrial and special business land use (accommodation facilities).

The central portion of the catchment includes the main industrial centre of South Kempsey and Kempsey Golf Course. Residential land uses, including schools are also present within this portion of the catchment. Other significant land uses in this portion of the catchment include the South Kempsey Sewage Treatment Plant.

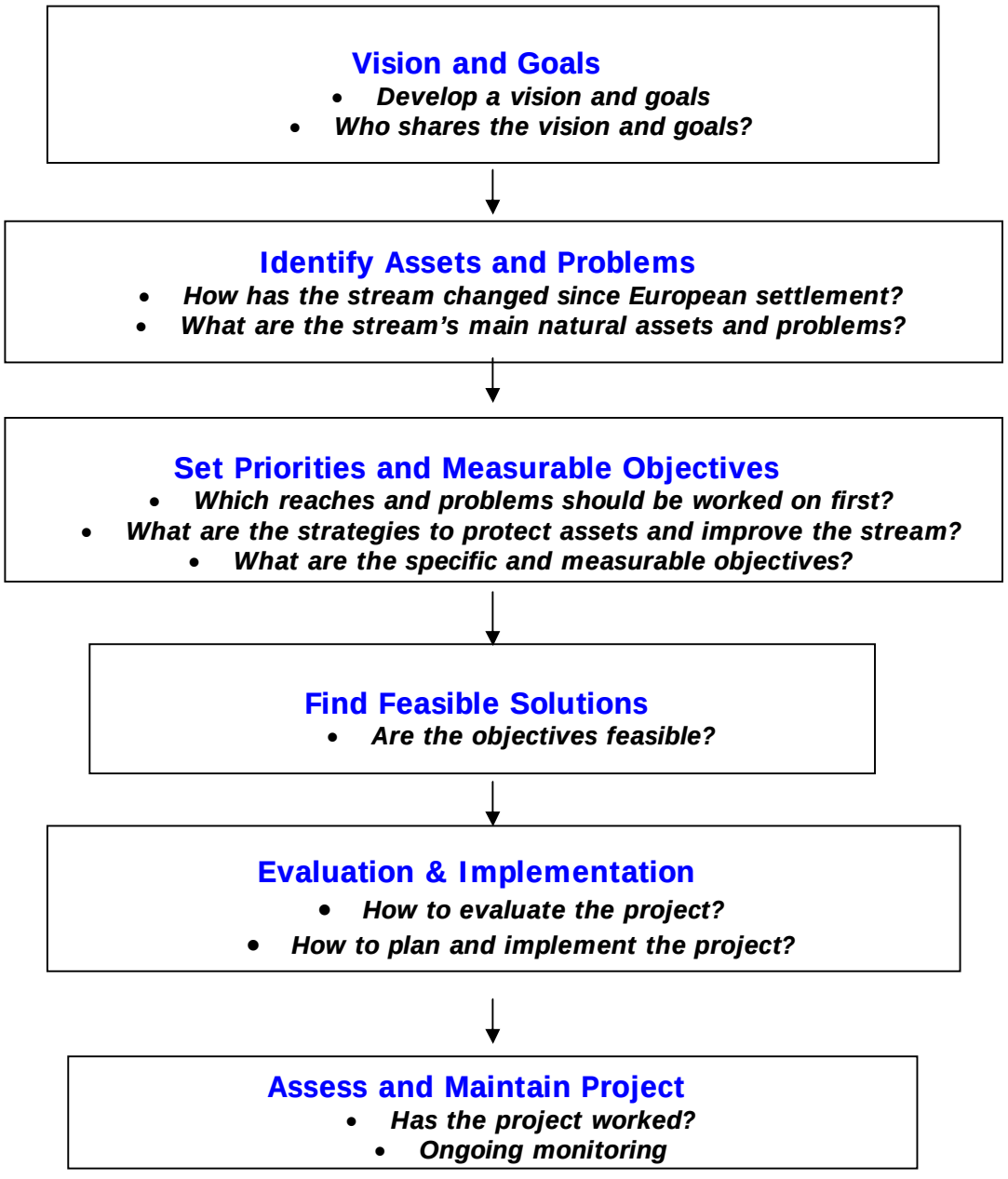
The north eastern portion of the catchment is characterised by low-lying marshland and swampland and is predominately used as grazing land. Some residential land use is also located on higher elevations within this reach.

3.0 SCOPE OF WORKS

The scope of works proposed to be undertaken during implementation of this rehabilitation plan have been loosely based on the recommendations from the manual produced by Rutherfurd et al (2000), *A Rehabilitation Manual for Australia Streams (Volumes 1 & 2)*, Cooperative Research Centre for Catchment Hydrology and Land and Water Resources Research and Development Corporation (2000). The manual provides a means of thoroughly planning the rehabilitation process from the very beginning, when setting visions and goals through to the implementation and evaluation stage at the end of the project.

The flowchart presented below provides a project outline of the broad steps to be taken during the rehabilitation plan. Each of these broad steps has then been divided into a number of smaller steps, which provide more detailed directions for achieving the rehabilitation plan.

Project Outline



4.0 VISION AND GOALS

4.1.1 Develop a vision and goals

It is important to define a goal or vision for a stream rehabilitation project at the very beginning because such a goal provides a foundation or reference point. This is particularly important as most rehabilitation projects last for many years and therefore it is critical to describe the underlying motivation that sustains the effort.

Ideally, ecosystem restoration seeks to return as many aspects as possible, if not all to pre-disturbed natural conditions. However, historical efforts at ecological restoration have shown that restoring ecosystems to pre-disturbed conditions is extremely difficult and rarely achieved (SHRG 2004).

Following consultation with Council's internal Strategic Planning Group and external consultation with local landholders, the following vision and goals were developed for Gills Bridge Creek:

Vision

"The future state of Gills Bridge Creek is envisioned to be a revitalised water body flowing through regenerated natural habitats and human communities. In its upper reaches the creek will pass through a mix of open forests and cleared semi-rural land before reaching the industrial centre of South Kempsey. Here it is envisioned the creek will once again flow unrestricted, under the shade of trees providing a buffer from industrial and urban activities surrounding it, before merging into wetlands of East Kempsey Swamp supporting an array of native flora and fauna"

Goals

1. **Improve water quality and flow regimes to provide a more inhabitable environment for native aquatic flora and fauna species.**
2. **Regenerate native riparian vegetation and natural habitats within and surrounding the creek to encourage the return of native terrestrial and aquatic fauna and provide a buffer zone from the industrial and urban activities of the catchment.**
3. **Educate local community and industrial businesses in the catchment on Total Catchment Management (TCM) and how to minimise and eventualluy eliminate detrimental impacts to the creek.**

It should be noted here that although a vision and/or goals are designed to be a guiding influence, keeping the project on track, they are not set in stone and should be reviewed and revised, if necessary, after proceeding onto future steps.

4.1.2 Who shares the vision and goals?

Streams are often the focus of competing values, where the many utilitarian values of streams (such as flood control, water supply, waste disposal and erosion control) might conflict with the environmental values of the stream. It is therefore important to identify potential stakeholders early in the planning stage of preparing the rehabilitation plan.

In early 2006, Council undertook an initial period of consultation with the local community to gain an appreciation for the potential stakeholders and in particular those stakeholders who expressed an interest in the rehabilitation of Gills Bridge Creek.

The following list of stakeholders were identified through this initial Consultation period:

- **Landholders**
- **Boral Resources**
- **Boral Country Concrete and Quarries**

- **Kempsey Shire Council**
- **Macleay Landcare Network**
- **Government Agencies (NRCMA, DEC, DPI)**
- **Macleay Vocational College**
- **Melville High School**
- **South Kempsey Primary School**
- **East Kempsey Primary School**
- **Conservation Volunteers Australia**
- **Greening Australia**

This is by no means an exhaustive list of stakeholders, with many more expected to be identified throughout the project.

4.2 IDENTIFYING ASSETS AND PROBLEMS

The potential for successful rehabilitation of the Gills Bridge Creek environment is fundamentally dependent on identifying which components and what processes are being affected, what measures are required to remove or manage the influences that have led to or resulted in the degradation, what level of rehabilitation is desirable and what spatial and temporal scales are to be considered.

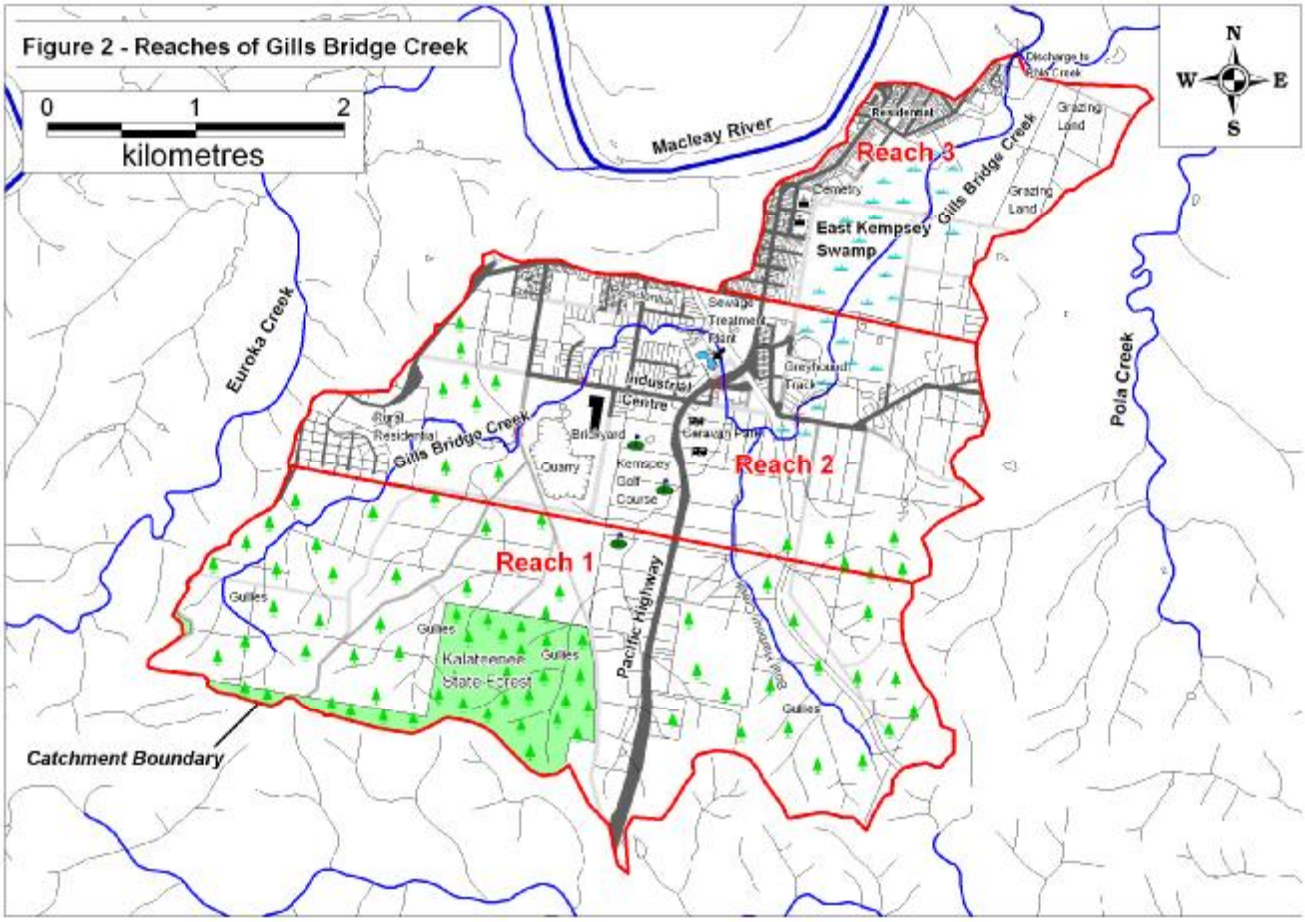
4.2.1 How has the stream changed since European settlement?

Compilation of data and information is required to develop a detailed picture, or 'template', of the goal condition of the Creek. This is achieved through the use of historical records, stream remnants that are still in good condition today and generic models of healthy streams.

The first task undertaken was to break the creek into reaches based on natural attributes and surrounding land uses. The catchment was subsequently broken into 3 main reaches, based on stream orders as proposed by Strahler (1964):

- **Reach 1 – Predominately comprising the upper sections of the catchment, with 1st order streams (headwaters) of the main arm and tributaries of the creek. Reach 1 is largely undeveloped with land uses including rural grazing and forestry.**
- **Reach 2 – Comprises the central portion of the catchment, with both 1st and 2nd order streams and is characterised by a mix of residential, commercial and industrial land uses.**
- **Reach 3 – Lower portion of the catchment, comprised mainly of a 3rd order stream, incorporating the wetland system of East Kempsey Swamp. This reach is characterised by predominately rural land use with some residential land use.**

Refer to *Figure 2* for breakdown of catchment into reaches.



The second task undertaken was to develop a template of what the stream should look like (used to look like) for comparison with what the stream actually looks like. This task required the collection of, historical information, such as past aerial photos, on-ground photos, past Council reports, information supplied with historic development applications and recollections of landholders. A field inspection program was then undertaken to provide an assessment of the current condition of the creek. To provide some consistency between what was being assessed from historical information through to the current condition of the creek, the same seven variables: animals and plants; vegetation; flow; connection along the stream; connection across the floodplain; water quality; and structural complexity, were measured.

It should be noted that the field inspection program was by no means a comprehensive assessment of all seven variables, as such an assessment would have required resources and expertise beyond those available to Council at the time of preparation of this plan. Nevertheless, Council undertook a detailed visual inspection of various segments of the Creek where access was readily available. The field inspection program was undertaken from April to December 2006.

Table 1 **identifies the template condition of the creek (what the creek used to look like) in comparison with the current condition of the creek, based on the seven variables listed above.**

Table 1 - Template Vs Current Condition

Reach	Template Condition	Current Condition
Reach 1 **Upper Catchment – multiple incised gullies forming the intermittent headwaters of the creek, flowing through partly forested rural land.**	**1. Most likely supported a high diversity of aquatic invertebrate and vertebrate species, however, no reports of fish ever being caught. Riparian area and surrounding woodland likely to have supported a range of mammals (including macropods), birds and reptiles.** **2. Dense riparian vegetation most likely consisting of flooded gum, blackbut, acacia and vines and creepers, merging into the open woodland of the surrounding slopes.** **3. Natural flow regime, including periodic floods and substantially reduced flows during dry periods.** **4&5. Longitudinal connection good, although it is likely that the creek may have been reduced to chains of pools during dry times, due to the intermittent nature of this reach. Lateral connection with river flats would have been good.** **6. Water quality expected to have been good, although may have suffered from low dissolved oxygen content when water became stagnant during dry periods.** **7. Stable and complex channel, with pools, riffle, macrophytes and woody debris. Hydraulic and substrate variation.**	**1. No information on current population or distribution invertebrate species, but habitat would suggest they do exist. No records of fish caught in reach. Sightings of macropods (kangaroos and wallabies) along riparian zone and surrounding woodland common.** **2. Riparian vegetation is generally good along most drainage lines. Consists mainly of immature and semi-mature natives, such as flooded gum, blackbut. Very few large (old growth) trees. Some invasive weeds, such as lantana, are present.** **3. Relatively natural flow regime.** **4&5. Longitudinal connection is relatively good, although the creek is known to develop into isolated or chains of pools, particularly during dry periods. Lateral connection with river flats is relatively good.** **6. Appears to be highly turbid in some areas. A black staining of the water is also evident in isolated pools where the water is not turbid. Further water quality results to be analysed.** **7. Main channel appears to be somewhat unstable, incised and has some actively eroding banks. Some gullying is also present and has most likely delivered sediment to the main channel. Channel complexity remains fairly high, with snags, woody debris and hydraulic and substrate variation.**

Note: The numbers in each of the columns "template and current condition" refer to the seven stream attributes to be compared: (1) animals and plants, (2) riparian vegetation, (3) flow regime, (4&5) flow connection, (6) water Quality and (7) geomorphic stability and in-channel complexity.

Table 1 Cont'd

Reach	Template Condition	Current Condition
Reach 2 **Central Catchment – feeder channels merge into main channel of creek, which flows through a highly modified industrial and residential landscape.**	**1. Macrophytes, invertebrate and a number of frog and small fish species present. Riparian area and surrounding woodland likely to have supported a range of mammals (including macropods), birds and reptiles and bats.** **2. Riparian vegetation likely to have consisted of flooded gum, blackbut, melaleuca and possibly an understorey of acacia, with a variety of vines and creepers.** **3. Natural flow regime, including periodic floods and substantially reduced flows during dry periods.** **4&5 Longitudinal connection good, although as with Reach 1, it is likely that the creek may have been reduced to chains of pools during extended dry periods. Lateral connection to the floodplain expected to have been good.** **6. Water quality expected to have been good.** **7. Stable and complex channel, with pools, riffle, microphytes and woody debris. Hydraulic and substrate variation.**	**1. Large concentration of macrophyte reeds (most notably Typha species) present. No information on invertebrate species diversity. A variety of species of frogs have been recorded, included the uncommon frog, *Mixophytes fasciolatus.* No fish species present. Four threatened species of Microchiropteran bats – Hoary Bat, Eastern Freetail Bat, Little Bent-Wing Bat and Common Bent-Wing Bat have been recorded in the remanent riparian vegetation in some areas along this reach.** **2. Riparian vegetation, although thin, is in quite good condition along many parts of this reach, consisting of flooded gum and blackbutt, with understoreys of wattles, cheese trees, melaleucas and black oaks. Weeds such as lantana are abundant in more open sections.** **3. Flow regime has been substantially modified in this reach, with increased areas of impervious surface and numerous inputs from stormwater drains, increasing flow volumes. An apparent constructed weir adjacent to South Street bridge crossing is also altering flow regimes.** **4&5. Longitudinal connectivity is reduced in this reach as areas of accumulated sediment, often with thick red beds reduce free flow in the creek, particularly during dry periods. Latitudinal connection with the floodplain is also restricted, due to infilling practices and reclaimed land in some areas adjoining the creek, which would have once been part of the floodplain environment.** **6. Water quality is poor, with consistently high turbidity levels, and elevated concentration of faecal coliforms and some heavy metals, particularly following rain events. Further water quality results to be collected and analysed.** **7. Channel suffers from instability and erosion. Channel complexity remains relatively high with wood debris and snags, although channel substrate appears more universal.**

Note: The numbers in each of the columns "template and current condition" refer to the seven stream attributes to be compared: (1) animals and plants, (2) riparian vegetation, (3) flow regime, (4&5) flow connection, (6) water Quality and (7) geomorphic stability and in-channel complexity.

Table 1 Cont'd

Reach	Template Condition	Current Condition
Reach 3 **Lower Catchment – predominately single channel meandering through floodplain, wetlands and grazing land. Highly modified and regulated section as part of flood mitigation measures.**	**1. Macrophytes and aquatic invertebrate species expected to be plentiful in creek and surrounding wetlands, which would have also supported a diverse range a fish, frog, reptile and bird species. Mammals (including macropods) would also have been present.** **2. Riparian vegetation would have consisted of predominately flooded gum and blackbut.** **3. Natural flow regime would have been slow and even non existent during extended dry periods. This reach would have been subjected to extensive flooding during wetter periods, naturally altering the course of the main channel.** **4&5. Longitudinal connection would have been less obvious than in the previous two reaches, as the there would have been a less well defined main channel, but rather a series interconnecting channels meandering through the floodplain. Latitudinal connection with the floodplain would have been good.** **6. Water quality expected to have been good, although stagnant water conditions may have arose when certain pools were isolated from the main channel during extended dry periods. There may also have been a natural increase in acidity following the first rains after an extended dry period when rising groundwater interacted with potential acid sulphate soils.** **7. Unstable but highly complex channel (or series of interconnecting channels), with pools, macrophytes, snags and woody debris.**	**1. Far less abundance of macrophytes. Likely some aquatic invertebrate and vertebrate species are present. Waterfowl and ibis (birds) noted, but no native mammals observed. Cattle and other livestock have unrestricted access to the banks along much of the creek in this reach.** **2. Riparian vegetation quite poor along most of the main channel, with pastoral grasses such as kikua and water kooch extending to water edge. An isolated section of remnant riparian vegetation consisting of predominately flooded gum is located within the wetter portion of this reach.** **3. Flow regime has been substantially altered, with construction of flood mitigation drainage channel, which has concentrated and increased flow to this channel.** **4&5. Longitudinal connection has possibly been increased through construction of flood mitigation drainage channel, however, this has reduced latitudinal connectivity with the floodplain and surrounding wetlands.** **6. Water quality expected to be poor, most likely with high turbidity and a high nutrient load. Further water quality results to be collected and analysed.** **7. Low level of channel complexity in this regulated section of the creek. Drainage channel has been constructed as part of flood mitigation measures in the area. Very few pools with macrophytes, snags or woody debris.**

Note: The numbers in each of the columns "template and current condition" refer to the seven stream attributes to be compared: (1) animals and plants, (2) riparian vegetation, (3) flow regime, (4&5) flow connection, (6) water Quality and (7) geomorphic stability and in-channel complexity.

4.2.2 What are the stream's main natural assets and problems?

Where some aspects of the stream are similar to the template (eg.water quality that is better than national standards, or original intact native vegetation communities) then that component of the stream is described as an ecological 'asset'. The processes that are degrading or threatening the stream's assets should also be identified (these processes are loosely defined here as 'problems').

Table 2 **shows the assets identified in each reach, those assets which have been or are being degraded over time and the problems most likely to be causing this degradation. This information is also displayed visually in** ***Figure 3.***

Table 2 – Assets and Problems

Reach	Assets	Degraded Assets (Problems) & Trajectory	Management Practices Leading to Problems
Reach 1	• Intact riparian vegetation is relatively good • Relatively natural flow regime.	• Channel instability – *Stable to Deteriorating* • Bank erosion - *Deteriorating* • Water Quality – *Deteriorating* • Aquatic Biodiversity - *Unknown*	Unstable eroding channel due to: • Clearing of vegetation. • Increased runoff. • Competition from weeds. Poor Water Quality Potentially from: • Runoff from grazing land • On-site sewage management practices
Reach 2	• Isolated sections of good riparian vegetation.	• Reduction of trees in riparian zone – *Deteriorating* • Poor water quality – *Deteriorating* • Sedimentation – *Deteriorating* • Flow regime modified – *Stable* • Threatened Species – *Deteriorating* • No fish – *Stable* • Aquatic Biodiversity - *Unknown*	Degraded riparian zone due to: • Competition from weeds • Vegetation clearing • Illegal dumping of rubbish Poor water quality potentially from stormwater runoff from industrial land. Sedimentation problems emanating from uncontrolled stormwater runoff from industrial premises. Flow regime modified due to: • Increased impervious surface area. • Engineering/structural changes. • Threatened species resulting from habitat loss. Threatened species resulting from habitat loss
Reach 3	• Macrophytes remain along some sections.	• Little Riparian vegetation – *Stable to Deteriorating* • Flow regime substantially modified – *Stable* • Water Quality expected to be poor – *Stable* • Low level of channel complexity – *Stable* • Aquatic Biodiversity - *Unknown*	Degraded riparian zone due to: • Cattle trampling. • Vegetation clearing Flow regime modified by artificial construction of channels. Water quality expected to be impacted by excess nutrients. Low habitat complexity due to: • Channelisation (Flood Mitigation) • Desnagging • Cattle trampling • Bank erosion

4.3 SETTING PRIORITIES AND MEASURABLE OBJECTIVES

4.3.1 Setting priorities - Which reaches & problems should be worked on first?

In many cases, it is easy to assume that the most obvious problem in the area most severely affected should be attacked first. However, much of the literature pertaining to rehabilitating natural areas, including Rutherfurd et al. (2000) argues that it is far more efficient to preserve streams and reaches that are still in good condition, rather than concentrating on fixing what is already degraded. Priorities should be based on how to save the most biodiversity.

From the data and information gathered during the desktop study and field inspection it was possible to assign a priority ranking for each reach.

***Table 3* provides a priority ranking and category of each reach with associated problems in order of priorities.**

Table 3 – Priority Ranking of Each Reach

	Reach Priority (1 being highest)	Priority Category*	Description of Reach	Problems in order of priority per reach and links between problems (in brackets)
PROTECTION	1. Reach 1	Category 2: Local Conservation Value	The integrity of the stream morphology and remaining vegetation identify this reach as being of Local Conservation Value. Major threats are encroaching development and on-site sewage management practices, as well as continuing grazing and weed infestation.	1. Encroaching development (2)
				2. Water Quality (1&3)
				3. Stock grazing riparian zones (4)
				4. Weed Infestation (3)
				5. Aquatic Habitat Degradation (1-4)
IMPROVEMENT	2. Reach 2	Category 3: Protecting and improving deteriorating reaches	Isolated segments of relatively good riparian vegetation remain. Frog species present and four species of threatened microchiropteran bats recorded in riparian vegetation. This reach is impacted by a modified flow regime, poor water quality and channel instability and erosion.	1. Degraded riparian zone (2)
				2. Weed infestation (1)
				3. Sedimentation (1&4)
				4. Water quality (1&3)
				5. Aquatic habitat degradation (1-4)
	3. Reach 3	Category 6: Improve moderately damaged reaches	Riparian vegetation is in poor condition along most of reach. Flow regime substantially modified and reduced connection with floodplain and surrounding wetlands. Water quality marginal to poor and low level of channel complexity. Several of these problems will be addressed when protecting reach 2.	1. Grazing of riparian zone (2)
				2. Weed infestation (1)
				3. Water quality (1)
				4. Channelisation and low channel complexity
				5. Aquatic Habitat Degradation (1-4)

Notes: * Reach priority categories based on preserving and protecting reaches that are in good condition as the highest priority as per the technical guide, A Rehabilitation Manual for Australia Streams, produced by the Cooperative Research Centre for Catchment Hydrology and Land and Water Resources Research and Development Corporation (2000)

4.3.2 What are the strategies to protect assets and improve the stream?

The purpose of this step is to identify the range of possible solutions to the highest priority problems. It should be emphasised that strategies to protect assets need as much thought as strategies to fix problems and repair damage and that almost every project should include some strategies for changing human behaviour.

To achieve successful rehabilitation outcomes and protect intact environments, selected strategies must be built on strong conceptual foundation and it must recognised and acknowledged that there is a very close relationship between understanding ecological processes and successful rehabilitation outcomes.

4.3.3 What are the specific and measurable objectives?

Specific and measurable objectives are required to be developed to build upon the general strategies. The objectives should be a clear, precise, and provide a measurable statement of what is to be achieved in attempting to fix the top priority problems identified when setting priorities in section 4.3.1. The central consideration should be to predict the likely outcomes of specific rehabilitation action by basing those predictions on applied science-based ecological principles that guide processes and activities toward ecosystem sustainability.

Table 4 **provides a list of general strategies and associated specific and measurable objectives.**

Table 4 – Possible Strategies and Measurable Objectives

Reach 1 – Highest Priority		
Problems in order of priority and links between problems (in brackets)	**Possible Strategies**	**Specific & Measurable Objectives (Actions)**
1. Encroaching development (2).	Ensure compliance of existing development and undertake strategic planning for future developments.	1.1 Ensure ongoing compliance of DA's with relevant local planning instruments.
		1.2 Undertake a Local Environmental Study (LES) for proposed rezoning of approximately 82ha of land for industrial use in this reach. Ensure environmental protection (buffer) zones for the Creek and tributaries are included.
2. Water Quality (1,4).	Continue on-site sewage (OSM) management program.	1.3 Inspect and evaluate condition of all OSM systems in this reach by end of year 1.
	Water quality monitoring.	1.4 Obtain background and ongoing water quality data & evaluate results against standards.
3. Stock grazing riparian zones (4).	Undertake vegetation survey and fence off priority areas for rehabilitation.	1.5 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation by end of year 1.
		1.6 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.
		1.7 Engage contractor to implement riparian revegetation program in year 2. Vegetation coverage of these areas should have increased by 15-30% by year 5.
4. Weed Infestation (3).	Undertake vegetation survey to identify priority areas for weed removal / eradication.	1.8 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation by end of year 1.
		1.9 Engage contractor to undertake weed removal / eradication program in year 2. Cover of weeds reduced to between at least 20 and 30% of pre-treatment cover by year 5.
5. Aquatic habitat degradation (1-4).	Survey and classify diversity of biota activity.	1.10 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.
		1.11 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.

Table 4 Cont'd

Reach 2 – Medium Priority		
Problems in order of priority and links between problems (in brackets)	**Possible Strategies**	**Specific & Measurable Objectives (Actions)**
1. Degraded riparian zone (2).	Undertake vegetation survey and identify priority areas for rehabilitation.	2.1 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation, by end of year 1.
		2.2 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.
		2.3 Engage contractor to implement revegetation program in year 2. Vegetation coverage of these areas should have increased by 15-30% by year 5.
2. Weed infestation (1).	Undertake vegetation survey to identify priority areas for weed removal / eradication.	2.4 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation, by end of year 1.
		2.5 Engage contractor to implement weed removal / eradication program in year 2. Cover of weeds reduced to between 30 and 50% of pre-treatment cover by year 5.
3. Sedimentation (1&4).	Investigate the possibility of constructing retention ponds / swales to aid in the natural retention of stormwater pollutants.	2.6 By end of year 1 engage consultant to undertake stormwater modeling of Gills Bridge Creek Catchment to identify potential areas for natural retention and treatment of stormwater pollutants.
4. Water quality (1&3).	Undertake environmental review and education program for the industrial & commercial premises.	2.7 By end of year 1 undertake cooperative environmental reviews of industrial & commercial premises and provide advice on environmental management by end of first year.
		2.8 Undertake follow up environmental review inspections from years 2 to 5.
	Continue on-site sewage management (OSM) program.	2.9 Inspect and evaluate condition of all OSM systems in this reach by end of year 2.
	Water quality monitoring.	2.10 Obtain background and ongoing water quality data & evaluate results against standards.
5. Aquatic habitat degradation (1-4).	Survey and classify diversity of biota activity.	2.11 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.
		2.12 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.

Table 4 Cont'd

Reach 3 – Lowest Priority		
Problems in order of priority and links between problems (in brackets)	**Possible Strategies**	**Specific & Measurable Objectives (Actions)**
1. Degrdaded riparian zone (2).	Undertake vegetation survey and fence off priority areas for rehabilitation and /or protection.	3.1 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation, by end of year 2.
		3.2 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.
		3.3 Engage contractors to implement revegetation program in year 3. Vegetation coverage of these areas should have increased by 15-30% by year 7.
2. Weed infestation (1).	Undertake vegetation survey to identify priority areas for weed removal/ eradication.	3.4 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation, by end of year 2.
		3.5 Engage contractor to undertake weed removal / eradication program in year 3. Cover of weeds reduced to between 0 and 30% of pre-treatment cover by year 5.
3. Water quality (1).	Continue on-site sewage management program.	3.6 Inspect and evaluate condition of all OSM systems in this reach by end of year 3.
	Water quality monitoring.	3.7 Obtain background and ongoing water quality data and evaluate results against standards.
4. Channelisation and low channel complexity.	Investigate opportunities of returning channel morphology to a more 'natural' state with variation flow, deep and shallow pools, snags and woody debris.	3.8 By end of year 3 liaise with landholders to determine feasibility of returning channel to shallower structure, ie promote less drainage and wet pasture management of surrounding low lying areas.
5. Aquatic habitat degradation (1-4).	Survey and classify diversity of biota activity.	3.9 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.
		3.10 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.

4.4 FIND FEASIBLE SOLUTIONS

4.4.1 Are the objectives feasible?

This Step required a decision to be made on the feasibility of the stream rehabilitation plan based on the financial cost, other constraints, and possible undesirable side effects.

Table 5 below provides a feasibility assessment if each of the strategies and objectives identified in section 4.3.3. The feasibility has been assessed in terms of estimated cost legality, confidence in meeting the objective and other costs, benefits and/or detriments likely to occur.

Table 5 – Feasibility of Objectives

Reach 1 – Highest Priority (Actions to be Completed in Years 1 & 2)			
Specific & Measurable Objectives (Actions)	**Feasibility**		
	Estimated Cost	**Legality**	**Other costs, benefits and /or problems**
1.1 Ensure ongoing compliance of DA's with relevant local planning instruments.	**Minimal Costs (part of usual DA process).**	**Council required to assess development applications.**	• **Minor cost to developer.**
1.2 Undertake a Local Environmental Study (LES) for proposed rezoning of approximately 82ha of land for industrial use in this reach. Ensure environmental protection (buffer) zones for the Creek and tributaries are included.	**Nil (part of existing Strategic Planning budget).**	**LES required to make and amendment to LEP**	• **Will allow for future development of catchment while ensuring future protection of creek.** • **Cost to developer.**
1.3 Inspect and evaluate condition of all OSM systems in this reach by end of year 1.	**Nil (use in-house resources).**	**Inspection of on-site sewage management system is a requirement of the Local Government Act 1993.**	• **Cost to landholders for licence to operate on-site sewage management system and on going maintenance costs.** • **Provide for a tighter control on effluent entering the natural environment and creek itself.**
1.4 Obtain background and ongoing water quality data.	**Annual water quality monitoring program for this reach will cost approx. $1,200 (or $3,600 for 3 years).**	**Council permitted to undertake water quality monitoring in public waterways.**	• **Water quality monitoring will provide background and ongoing data used to assess improvements in water quality.**
1.5 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation by end of year 1.	**$10,000.**	**Access to land depends on land tenure.**	• **May be constrained by limited access to privately owned land.** • **Supplement existing mapping.**
1.6 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.	**Nil (use in-house resources)**	**NA**	• **Assist in communications with landholders.**

Reach 1 – Highest Priority (Actions to be Completed in Years 1 & 2)			
Specific & Measurable Objectives (Actions)	**Feasibility**		
	Estimated Cost	**Legality**	**Other costs, benefits and /or problems**
1.7 Engage contractor to implement riparian revegetation program in year 2. Vegetation coverage of these areas should have increased by 15-30% by year 5.	**$10,000 (dependent on volunteers).**	**Requires landholder permission.**	• **Dependent on landholder support.** • **Dependent on volunteers.** • **Available funding.**
1.8 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation by end of year 1.	**$5,000.**	**Access to land depends on land tenure.**	• **Maybe constrained by limited access to privately owned land.**
1.9 Engage contractor to undertake weed removal program in year 2. Cover of weeds reduced to between at least 20 and 30% of pre-treatment cover.	**$15,000 (dependent on volunteers).**	**Requires landholder permission.**	• **Dependent on landholder support.** • **Dependent on volunteers .** • **Need to ensure appropriate management of potential runoff of sediments and chemicals resulting from weed control.**
1.10 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.	**$1,000**	**Council permitted to undertake biota sampling in public waterways**	• **Dependent on finding suitable study team**
1.11 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.	**$5,000 (for stream watch project coordinator).**	**Partnership between Council, Stream Watch and community.**	• **Dependent on community support.** • **Dependent on volunteers.** • **Dependent on funding.**

Table 5 – Cont'd

Reach 2 – Medium Priority (Actions to be Completed in Years 1-3)			
Specific & Measurable Objectives (Actions)	**Feasibility**		
	Estimated Cost	**Legality**	**Other costs, benefits and /or problems**
2.1 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation, by end of year 1.	**$10,000.**	**Access to land depends on land tenure.**	• **Maybe constrained by limited access to privately owned land.**
2.2 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.	**Nil (use in-house resources).**	**NA.**	• **Assist in communications with landholders.**
2.3 Engage contractor to implement revegetation program in year 2. Vegetation coverage of these areas should have increased by 15-30% by year 5.	**$10,000 (dependent on volunteers).**	**Requires landholder permission.**	• **Dependent on landholder support.** • **Dependent on volunteers.**
2.4 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation, by end of year 1.	**$5,000.**	**Access to land depends on land tenure.**	• **Maybe constrained by limited access to privately owned land.**
2.5 Engage contractor to implement weed removal program in year 2. Cover of weeds reduced to between 30 and 50% of pre-treatment cover by year 5.	**$15,000 (dependent on volunteers).**	**Requires landholder permission.**	• **Dependent on landholder support.** • **Dependent on volunteers .** • **Need to ensure appropriate management of potential runoff of sediments and chemicals resulting from weed control.**
2.6 By end of year 1 engage consultant to undertake stormwater modeling of Gills Bridge Creek Catchment to identify potential areas for natural retention and treatment of stormwater pollutants.	**$30,000.**	**NA.**	• **Maybe possible for future developers to cover part of the costs.**

Reach 2 – Medium Priority (Actions to be Completed in Years 1-3)			
Specific & Measurable Objectives (Actions)	**Feasibility**		
	Estimated Cost	**Legality**	**Other costs, benefits and /or problems**
2.7 By end of year 1 undertake cooperative environmental reviews of industrial & commercial premises and provide advice on environmental management by end of first year.	**Nil (use in-house resources).**	**Council permitted to undertake environmental reviews of industrial / commercial premises.**	• **Reduce pollution events to Creek.** • **Potential costs to industrial / commercial businesses to develop better environmental management practices.**
2.8 Undertake follow up environmental review inspections from years 2 to 5.	**Nil (use in-house resources).**	**As above.**	• **As above.**
2.9 Inspect and evaluate condition of all OSM systems in this reach by end of year 2.	**Nil (use in-house resources).**	**Inspection of on-site sewage management system is a requirement of the Local Government Act 1993.**	• **Cost to landholders for licence to operate on-site sewage management system and on going maintenance costs.** • **Provide for a tighter control on effluent entering the natural environment and creek itself.**
2.10 Obtain background and ongoing water quality data.	**Annual water quality monitoring for this reach will cost approx. $5,000 (or $15,000 over 3 years).**	**Council permitted to undertake water quality monitoring in public waterways.**	• **Provide background and ongoing data used to assess improvements in water quality.**
2.11 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.	**$1,000**	**Council permitted to undertake biota sampling in public waterways**	• **Dependent on finding suitable study team**
2.12 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.	**$5,000 (for stream watch project coordinator).**	**Partnership between Council, Stream Watch and community.**	• **Dependent on community support.** • **Dependent on volunteers.** • **Dependent on funding.**

Table 5 – Cont'd

Reach 3 – Lowest Priority (Actions to be Completed in Years 2, 3 +)			
Specific & Measurable Objectives (Actions)	**Feasibility**		
	Estimated Cost	**Legality**	**Other costs, benefits and /or problems**
3.1 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation, by end of year 2.	**$10,000**	**Access to land depends on land tenure.**	• **Maybe constrained by limited access to privately owned land.**
3.2 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.	**Nil (use in-house resources)**	**NA**	• **Assist in communications with landholders**
3.3 Engage contractors to implement revegetation program in year 3. Vegetation coverage of these areas should have increased by 15-30% by year 7.	**$10,000 (dependent on volunteers)**	**Requires landholder permission.**	• **Dependent on landholder support** • **Dependent on volunteers**
3.4 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation, by end of year 2.	**$5,000**	**Access to land depends on land tenure.**	• **Maybe constrained by limited access to privately owned land.**
3.5 Engage contractor to undertake weed removal program in year 3. Cover of weeds reduced to between 0 and 30% of pre-treatment cover by year 5.	**$15,000 (dependent on volunteers)**	**Requires landholder permission.**	• **Dependent on landholder support** • **Dependent on volunteers** • **Need to ensure appropriate management of potential runoff of sediments and chemicals resulting from weed control**
3.6 Inspect and evaluate condition of all OSM systems in this reach by end of year 3	**Minimal Costs (part of on-site sewage management program).**	**Inspection of on-site sewage management system is a requirement of the Local Government Act 1993.**	• **Cost to landholders for licence to operate on-site sewage management system and on going maintenance costs.** • **Provide for a tighter control on effluent entering the natural environment and creek itself.**

Reach 3 – Lowest Priority (Actions to be Completed in Years 2, 3 +)			
Specific & Measurable Objectives (Actions)	**Feasibility**		
	Estimated Cost	**Legality**	**Other costs, benefits and /or problems**
3.7 Obtain background and ongoing water quality data.	**Annual water quality monitoring program for this reach will cost approx. $3,000 (or $9000 over 3 years)**	**Council permitted to undertake water quality monitoring in public waterways.**	• **Provide background and ongoing data used to assess improvements in water quality.**
3.8 By end of year 3 liaise with landholders to determine feasibility of returning channel to shallower structure, ie promote less drainage and wet pasture management of surrounding low lying areas.	**Absorbed into existing budget.**	**Dependent on agreement by private landholders.**	• **Dependent on landholder support and feasibility.**
3.9 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.	**$1,000**	**Council permitted to undertake biota sampling in public waterways**	• **Dependent on finding suitable study team**
3.10 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.	**$5,000 (for stream watch project coordinator).**	**Partnership between Council, Stream Watch and community.**	• **Dependent on community support.** • **Dependent on volunteers.** • **Dependent on funding.**

4.5 EVALUATION AND IMPLEMENTATION

4.5.1 How to evaluate the project?

The general purpose of evaluation is to determine how effective the program has been in achieving its aims. The Rehabilitation Plan must adequately provide for and assure that ongoing monitoring and evaluation is based on easily observed and measurable parameters. A major consideration of any rehabilitation program is the determination of what is or what could be considered a success. Ecosystems can generally be described and evaluated by the observable conditions of their structure and function and any observed changes to both components overtime. The analysis of information collected / observed overtime will provide a mechanism to plot direction or trends towards the long term objectives.

Table 6 identifies potential evaluation measures and types that will be used to assess and evaluate each of the measurable objectives.

4.6.1 How to plan and implement the project?

This step involves planning when each task will happen and who will be responsible for making it happen. This includes the work itself, and any monitoring and evaluation tasks that are required before, during and after the work. Table 6 includes a breakdown of the responsible organisation and officer as well as an indication of timing for each of the measurable objectives.

Table 6 – Implementation and Evaluation of Objectives

Reach 1 – Highest Priority				
Specific & Measurable Objectives (Actions)	**Responsible Organisation / Department / Officer**	**Estimated Time Frame**	**Evaluation Measure**	**Evaluation Type**
1.1 Ensure ongoing compliance of DA's with relevant local planning instruments.	**Council / SDS / Development Assessors / Compliance Officers.**	**On-going.**	• **No. of development approvals issued within reach.** • **No. non-compliance matters inspected and resolved.**	**Execution Point.**
1.2 Undertake a Local Environmental Study (LES) for proposed rezoning of approximately 82ha of land for industrial use in this reach. Ensure environmental protection (buffer) zones for the Creek and tributaries are included.	**Council/ SDS / Strategic Planner.**	**Finalise LES by Dec 07.**	• **LES Finalised by due date.** • **Environmental protection (buffer zones) included in final LES.**	**Execution Point.**
1.3 Inspect and evaluate condition of all OSM systems in this reach by end of year 1.	**Council / SDS / OSM Officer.**	**Complete by June 08.**	• **All properties with OSMS inspected by due date.**	**Execution Point.**
1.4 Obtain background and ongoing water quality data.	**Council / SDS / ESD Officer.**	**Quarterly (ongoing).**	• **Water sampling conducted quarterly.** • **Results compiled and trends identified.**	**Execution Point.**
1.5 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation by end of year 1.	**Council / SDS / ESD Officer.**	**Complete by June 08.**	• **Vegetation survey undertaken.** • **Map produced detailing priority areas for revegetation works.**	**Execution Point.**
1.6 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.	**Council / SDS / ESD Officer.**	**Complete by June 08.**	• **Strategy Developed.**	**Execution Point.**
1.7 Engage contractor to implement riparian revegetation program in year 2. Vegetation coverage of these areas should have increased by 15-30% by year 5.	**Council / SDS / ESD Officer.**	**Revegetation works complete by June 08.**	• **Revegetation program completed.** • **Riparian vegetation coverage increased by 15-30%.**	**Execution Point** **Biological/Aesthetic Outcome.**

Reach 1 – Highest Priority				
Specific & Measurable Objectives (Actions)	**Responsible Organisation / Department / Officer**	**Estimated Time Frame**	**Evaluation Measure**	**Evaluation Type**
1.8 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation by end of year 1.	**Council / SDS / ESD Officer.**	**Complete by June 08.**	• **Vegetation survey undertaken.** • **Map produced detailing priority areas for rehabilitation.**	**Execution Point.**
1.9 Engage contractor to undertake weed removal program in year 2. Cover of weeds reduced to between at least 20 and 30% of pre-treatment cover.	**Council / SDS / ESD Officer.**	**Complete by June 09.**	• **Weed removal program completed** • **Weeds reduced to between at least 20 and 30% of pre-treatment cover.**	**Execution Point.** **Biological/Aesthetic Outcome.**
1.10 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.	**University Study team & Council (SDS / ESD Officer & Senior Natural Resources Officer).**	**Complete by June 08.**	• **Engage suitable study team** • **Level of invertebrate species abundance and diversity quantified.**	**Execution Point.** **Biological Outcome.**
1.11 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.	**NRCMA, Stream Watch, Community, Schools, Council (SDS / ESD Officer).**	**Complete by June 10.**	• **Develop Program** • **Changes in abundance / diversity overtime.**	**Execution Point.** **Biological Outcome.**

Table 6 – Cont'd

Reach 2 – Medium Priority				
Specific & Measurable Objectives (Actions)	**Responsible Organisation / Department / Officer**	**Estimated Time Frame**	**Evaluation Measure**	**Evaluation Type**
2.1 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation, by end of year 1.	**Council / SDS / ESD Officer.**	**June 08.**	• **Vegetation survey undertaken.** • **Map produced detailing priority areas for revegetation works.**	**Execution Point.**
2.2 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.	**Council / SDS / ESD Officer.**	**Complete by June 08**	• **Strategy Developed.**	**Execution Point.**
2.3 Engage contractor to implement revegetation program in year 2. Vegetation coverage of these areas should have increased by 15-30% by year 5.	**Council / SDS / ESD Officer.**	**June 09.**	• **Revegetation program completed** • **Riparian vegetation coverage increased by at least 30%.**	**Execution Point.** **Biological/Aesthetic Outcome.**
2.4 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation, by end of year 1.	**Council / SDS / ESD Officer.**	**June 08.**	• **Vegetation survey undertaken.** • **Map produced detailing priority areas for rehabilitation.**	**Execution Point.**
2.5 Engage contractor to implement weed removal /eradication program in year 2. Cover of weeds reduced to between 30 and 50% of pre-treatment cover by end of year 2.	**Council / SDS / ESD Officer.**	**June 09.**	• **Weed removal program completed** • **Weeds reduced to between at least 20 and 30% of pre-treatment cover.**	**Execution Point.** **Biological/Aesthetic Outcome.**
2.6 By end of year 1 engage consultant to undertake stormwater modeling of Gills Bridge Creek Catchment to identify potential areas for natural retention and treatment of stormwater pollutants.	**Council / SDS / ESD Officer.**	**June 08.**	• **Consultant engaged to undertake stormwater modelling of catchment.**	**Execution Point.**

Reach 2 – Medium Priority				
Specific & Measurable Objectives (Actions)	**Responsible Organisation / Department / Officer**	**Estimated Time Frame**	**Evaluation Measure**	**Evaluation Type**
2.7 By end of year 1 undertake cooperative environmental reviews of industrial & commercial premises and provide advice on environmental management by end of first year.	**Council / SDS / Coordinator Environmental Health, OSM Officer, ESD Officer.**	**June 08.**	• **Initial inspection undertaken on all premises.**	**Execution Point.**
2.8 Undertake follow up environmental review inspections from years 2 to 5.	**Council / SDS / Coordinator Environmental Health, OSM Officer, ESD Officer.**	**Ongoing for 5 years.**	• **Follow-up inspections carried out where required.**	**Execution Point.**
2.9 Inspect and evaluate condition of all OSM systems in this reach by end of year 2.	**Council / SDS / OSM Officer.**	**Complete by June 09.**	• **All properties with OSMS inspected by due date.**	**Execution Point.**
2.10 Obtain background and ongoing water quality data.	**Council / SDS / ESD Officer.**	**Quarterly (ongoing).**	• **Water sampling conducted quarterly.** • **Results compiled and trends identified.**	**Execution Point.**
2.11 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.	**University Study team & Council (SDS / ESD Officer & Senior Natural Resources Officer).**	**Complete by June 08.**	• **Engage suitable study team** • **Level of invertebrate species abundance and diversity quantified.**	**Execution Point.** **Biological Outcome.**
2.12 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.	**NRCMA, Stream Watch, Community, Schools, Council (SDS / ESD Officer).**	**Complete by June 10.**	• **Develop Program** • **Changes in abundance / diversity overtime.**	**Execution Point.** **Biological Outcome.**

Table 6 – Cont'd

Reach 3 – Lowest Priority				
Specific & Measurable Objectives (Actions)	**Responsible Organisation / Department / Officer**	**Estimated Time Frame**	**Evaluation Measure**	**Evaluation Type**
3.1 Engage consultant to undertake vegetation survey and produce map to identify area and extent of native riparian vegetation and priority areas for rehabilitation, by end of year 2.	**Council / SDS / ESD Officer.**	**June 2009.**	• **Vegetation survey undertaken.** • **Map produced detailing priority areas for revegetation works.**	**Execution Point.**
3.2 Develop a communications strategy to liaise with landholders in order to identify and agree to areas for revegetation of riparian zones.	**Council / SDS / ESD Officer.**	**Complete by June 08.**	• **Strategy Developed.**	**Execution Point.**
3.3 Engage contractors to implement revegetation program in year 3. Vegetation coverage of these areas should have increased by 15-30% by year 7.	**Council / SDS / ESD Officer.**	**June 2010 Re-assess in June 2012.**	• **Revegetation program completed** • **Riparian vegetation coverage increased by 15-30% by year 7.**	**Execution Point.** **Biological/Aesthetic Outcome.**
3.4 Engage consultant to undertake vegetation survey and produce map to identify area and extent of weed vegetation and priority areas for rehabilitation, by end of year 2.	**Council / SDS / ESD Officer**	**June 2009.**	• **Vegetation survey undertaken.** • **Map produced detailing priority areas for rehabilitation.**	**Execution Point**
3.5 Engage contractor to undertake weed removal /eradication program in year 3. Cover of weeds reduced to between 0 and 30% of pre-treatment cover by year 5.	**Council / SDS / ESD Officer.**	**June 2010.**	• **Weed removal program completed.** • **Weeds reduced to between at least 20 and 30% of pre-treatment cover.**	**Execution Point.** **Biological/Aesthetic Outcome.**
3.6 Inspect and evaluate condition of all OSM systems in this reach by end of year 3.	**Council / SDS / OSM Officer.**	**June 2010.**	• **All properties with OSMS inspected by due date.**	**Execution Point.**
3.7 Obtain background and ongoing water quality data.	**Council / SDS / ESD Officer.**	**Quarterly (ongoing).**	• **Water sampling conducted quarterly.** • **Results compiled and trends identified.**	**Execution point.**

Reach 3 – Lowest Priority				
Specific & Measurable Objectives (Actions)	**Responsible Organisation / Department / Officer**	**Estimated Time Frame**	**Evaluation Measure**	**Evaluation Type**
3.8 By end of year 3 liaise with landholders about to positive benefits of returning channel to shallower structure, ie promote less drainage and wet pasture management of surrounding low lying areas.	**Council / SDS / ASS Officer.**	**June 2010.**	• **Meeting held with landholders to issues.** • **Potential solutions identified.**	**Execution Point.**
3.9 Engage study team to undertake initial classification of present aquatic biota diversity and abundance.	**University Study team & Council (SDS / ESD Officer & Senior Natural Resources Officer).**	**Complete by June 08.**	• **Engage suitable study team** • **Level of invertebrate species abundance and diversity quantified.**	**Execution Point.** **Biological Outcome.**
3.10 Investigate options for engaging a stream watch program with local community and schools to monitor ongoing aquatic biota diversity and abundance throughout the rehabilitation project to assess any trends.	**NRCMA, Stream Watch, Community, Schools, Council (SDS / ESD Officer).**	**Complete by June 10.**	• **Develop Program** • **Changes in abundance / diversity overtime.**	**Execution Point.** **Biological Outcome.**

Notes: **SDS – Sustainable Development Services**
ESD – Ecologically Sustainable Development
OSM – On-Site Sewage Management
ASS – Acid Sulfate Soils

4.7 ASSESS AND MAINTAIN PROJECT

4.7.1 Has the project worked?

This step requires completing the evaluation process by assessing the results. There are a range of techniques available for doing this analysis, from intensive, detailed statistical analysis, to a simple comparison of before and after photos, or a count of the kilometres of vegetation reinstated or weeds removed etc. However, all analysis is based around one simple question - "Did the project achieve the specific and measurable objectives?" - as set out in Table 4 of Section 4.3.3?"

Final assessment of the project will endeavour to answer the following questions:

- **Did the rehabilitation project achieve the intended aims and objectives?**
- **What contributed to that success or failure of the project?**
- **What would be done differently next time?**
- **Have people been told about the outcome of the project.**

4.7.1 On-going Monitoring

Monitoring of observed and measurable parameters as described in section 4.6 should take place on a regular basis throughout the implementation phase of the Rehabilitation Project. Monitoring of these parameters should also be undertaken post-implementation phase, to enable an on-going assessment of the success / failures of the recommended actions, so measures can be put in place to address similar issues or problems in future rehabilitation projects.

5.0 REFERENCES

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