Executive Summary

Stream frontage management (SFM), including rehabilitation measures, such as the removal of exotic vegetation, riparian revegetation, and improved stock management, have become increasingly common methods applied to attempt to improve water quality and reduce the transport of pollutants to waterways (Hughes and Quinn, 2014; McKergow et al., 2016). To understand the effectiveness of SFM actions in improving water quality and biodiversity, the monitoring of river conditions during and following works is needed, but is rarely undertaken. The current program is unique as it is assessing the effects of stream frontage management works (SFMW) on ambient water quality and biodiversity, while also trying to understand whether other factors may be influencing water quality and instream health, over a 13 km stretch of the Upper Campaspe River, Snipes Creek and Post Office Creek around Kyneton over a 5-year period. As of December 2020, woody weed control, planting, fencing and the installation of off stream watering had been completed across the four SFM sites included in the Caring for the Campaspe project. These sites are now largely in a management phase until June 2023.

In Year 4, water quality, aquatic ecology, nutrient bioavailability, and ecotoxicology were surveyed at eight sites along the Campaspe River, and in two associated tributaries, between August and December 2021. While the full benefits of SFM are not likely to be observed in four years of monitoring, results to date show evidence of differences in river condition emerging between sites based on riparian condition e.g., between SFMW sites, native vegetation sites and sites where no interventions have occurred, which remain willow dominated with stock access.

At SFMW sites, there is evidence that the works initially led to increases in nutrient and sediment inputs, but once vegetation has become more established, and banks more stabilised, abiotic conditions appear to have stabilised. Similar abiotic conditions are observed at sites surrounded by established native vegetation. Since monitoring started in 2018 across the SFMW and established native vegetation sites, macrophyte cover has become less temporally variable and has substantially increased. In contrast, filamentous algal cover, particularly medium and long filamentous algae, has simultaneously declined, with nuisance levels not observed since Year 1 monitoring. With this stabilisation of macrophyte communities we have also seen an increase in biofilm communities and improvements in dissolved oxygen levels, particularly at SFMW sites. Highest macroinvertebrate diversity and taxon richness occurs at the SFM influenced sites, followed by the native vegetation sites, which is likely related to better habitat structure, food resources and the presence of relatively stable water levels during dry periods (notably at Campaspe River Sites 3-6) at these sites. Increases in macroinvertebrate diversity were observed in Year 4 at the native vegetation sites (Campaspe Sites 9 and 10), which was likely due to increased rainfall during 2021.

In contrast, sites where no interventions have occurred are in the poorest abiotic and biotic condition. Sites are characterised by elevated concentrations of dissolved nutrients, which were often found to exceed guideline values, had lower dissolved oxygen levels and water temperatures, and had poorer water clarity. These sites are also dominated by opportunistic macrophyte species, including *Azolla* and *Lemna*, that blanket the water surface, reducing light and oxygen to the water column. While declines in macrophyte cover were observed in Year 4 at these sites, likely due to reduced availability of nutrients and high rainfall, the presence of good quality macrophytes and benthic algal supply remains poor. These factors continue to result in reduced instream processing and greater export of nutrients from these sites. Poorest macroinvertebrate diversity and taxon richness was observed at these sites, likely a result of poor habitat, lack of quality food resources and elevated nutrients. Without intervention, these sites are likely to remain in poor abiotic and biotic condition.

Several additional pressures continue to be observed across the study area, including the presence of toxicity and a range of pollutants associated with urban, industrial and agricultural runoff, and wastewater inputs. Numerous pesticides, pharmaceuticals, heavy metals and hydrocarbons have been detected at levels which could pose a risk to river ecological health.

Continued improvements to the ecological health of the river are expected at sites influenced by SFMW in Year 5. However, improvements in the condition of many of these sites is complicated by the surrounding residential, industrial and agricultural land-uses which create additional challenges for stream management.