A ‘chain-of-ponds’ configuration as a potential goal for rehabilitation activities in Tuppal Creek

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Introduction

This document is intended to inform the development of a management plan for Tuppal Creek. Its purpose is to describe one particular target for restoration of Tuppal Creek – namely a chain of ponds configuration and includes a discussion on the ecological benefits and disbenefits of this approach.

Tuppal Creek is a distributary of the Murray River, historically redirecting flood water around the ‘Barmah Choke’ (capacity ca. 10,600 Ml/day) via the Edwards River. The upper reaches of the creek would have been fed directly from the upper creek, while the lower reaches would have been fed both from upstream flows as well as inflows from Native Dog Creek (another distributary downstream of Tuppal Creek, which joins the Tuppal Creek about halfway down its length.

Changes to both the physical condition of the main channel of the Murray River and, river regulation has resulted in significant changes to the flow regime of Tuppal Creek, which in turn has significantly effected the ecology of the creek and its associated floodplain (Figure 1). Prior to European settlement Tuppal Creek would have been an ephemeral, ‘chain-of-ponds’ type creek located within a river redgum and black box forests or woodlands. Flow data would suggest that there would have been flowing water in the creek for at least some of each year. Once the flow ceased to flow the water would have remained in remnant pools. Because flows occurred in most years, these pools would have persisted under all but the most extensive dry period and therefore would have acted as refugia for a variety of aquatic organisms.

The creek would have hosted a number of fish species, particularly the smaller natives like gudgeon and rainbow fish. Although larger species like yellowbelly and Murray cod may have used the floodplain system during large flood events, it is unlikely they would have occurred in any great numbers during low flow periods (the exception being larval fish that became trapped in remnant pools). The creek would have supported a diverse macroinvertebrate community including yabbies. The creek would also been home to a number of vertebrates including the freshwater tortoise, platypus, possibly water rats as well as birds like native ducks and cormorants. The remnant pools would have been a foraging site for wading birds including ibis. The pools within the creek would also have provided drinking water for forest birds and animals.

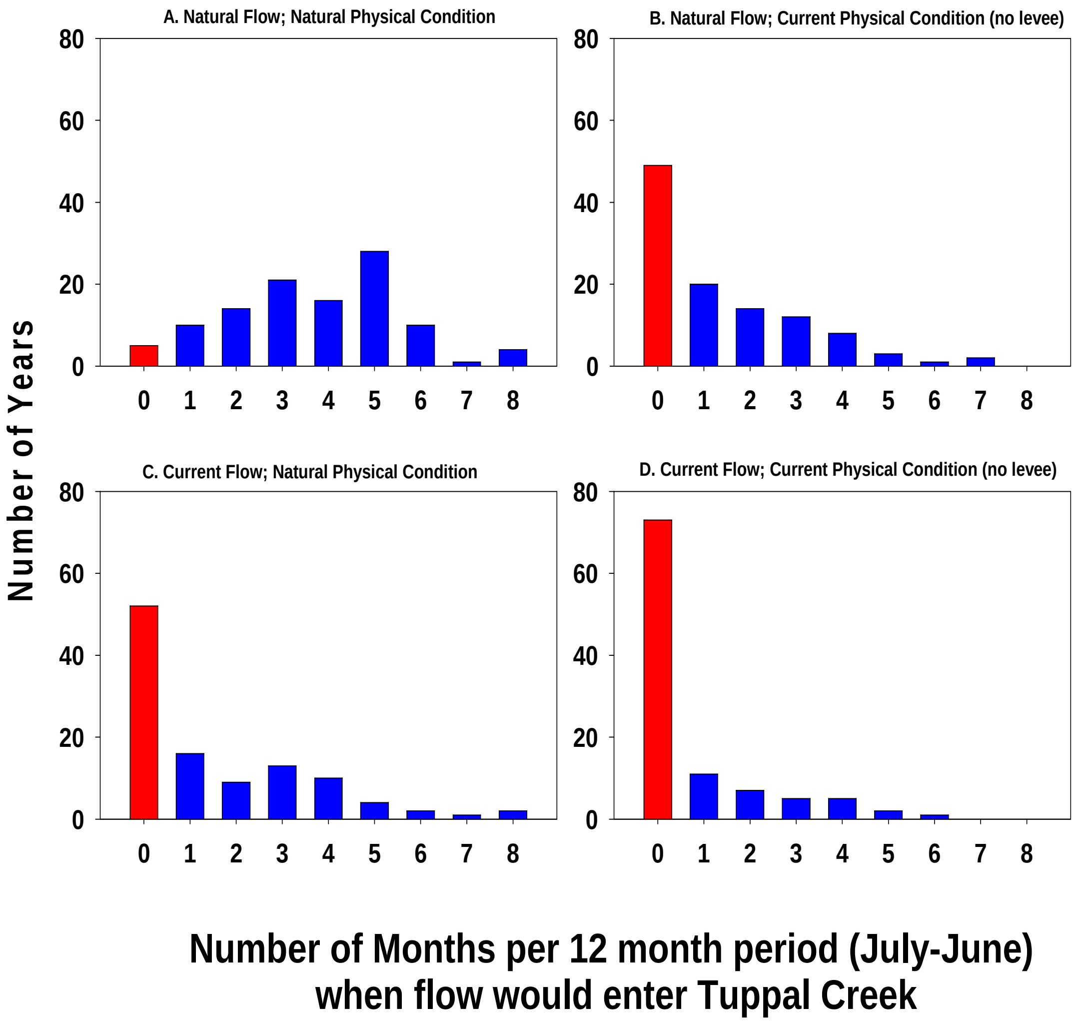

Figure 1 – Estimated flows into Tuppal Creek from the Murray River based on modelled flows and commence-to flow data- see text for details (from Baldwin 2007).

There have been a number of recent assessments of the ecological condition of Tuppal Creek (SKM 2006b and references therein). Generally speaking the Creek is in very poor condition

Flows in Tuppal Creek now consist mostly of small releases from the Berriguin Irrigation District via the Lalalty and Pinelea drainage systems, releases that rarely reach the Edward River. Prior to the privatisation of the irrigation system in 1996, surplus irrigation water was regularly flushed through Tuppal Creek from the Tocumwal Channel Escape, but this no longer occurs. Currently, where water exists it is restricted to a number of remnant pools of poor water quality particularly with respect to nutrients, salinity and pesticide residues (Conallin 2002, SKM 2006b). High salinity has also resulted in the build up of potential acid sulfate soils in the sediments of the creek (SKM 2006b).

A number of vegetation studies have focused on riparian vegetation in the upper reaches around the drainage outfalls (Lanscope Environmental Consultants 1999; Biosis Research Pty. Ltd. 2001). They have found ‘highly disturbed’ riparian zones comprising mostly of red gum *Eucalyptus camaldulensis* woodland — grey box *Eucalyptus microcarpa* and yellow box *Eucalyptus melliodora* are also present (Landscope Environmental Consultants 1999; Biosis Research Pty. Ltd. 2001). Further down, through Tuppal Reserve and beyond, the channel widens and deepens and the riparian zone becomes much wider. There are extensive woodlands on the floodplain either side of the confluence with Native Dog Creek, including significant black box *Eucalyptus largiflorens* woodland (pers. obs.). Where the riparian zone does support a native canopy cover, the understorey and ground cover are typically highly modified and degraded as a result of prolonged grazing pressure and weed invasion (SKM 2006b). In-stream vegetation is also highly disturbed from natural condition. Below the drainage outfalls, the Tuppal Creek channel is choked with cumbungi (*Typha* sp) (SKM 2006b). The bed of the creek in dry areas has also been colonised by extensive stands of red gum saplings.

Various studies have investigated fish and macroinvertebrate communities in Tuppal Creek; however, a general lack of water in the system has compromised the results of these studies (Conallin 2001, 2002; AWT 2001). The surveys with artificial substrates revealed a relatively poor macroinvertebrate community, and electro-fishing found a relatively poor fish community dominated by exotics including carp and oriental weather loach (Australian Museum 2007 a,b).

As part of the management planning for the creek it is necessary to describe appropriate end points for any restoration activities. Given the significant changes in flow regimes, the ability to return the creek back to a condition described as ‘natural’ seems quite remote.

An alternate approach would be to secure sufficient water to pump into the creek (preferably in winter or early spring) on an annual basis (subject to prevailing climatic conditions – see later) to produce a flow lasting for only a limited period of time (days-weeks) sufficient to refill all of the creek and producing a semi-permanent ‘chain-of-ponds’ configuration (eg see Figure 2). Preferably the filling can be done in conjunction with transfers of water from upstream to downstream water storages. The economic cost of the project would them be limited to the amount of water ‘lost’ during the transfer process.

Ecological Benefits:

Such an approach could be used to return the creek back to a chain of ponds configuration. Water would be retained within the creek and would benefit riparian vegetation condition by providing water to sustain plant life. It would also minimise the growth of ‘nuisance’ plants, particularly the proliferation of red gum seedlings, in the bed of the creek, while at the same time promoting recruitment of redgums on the banks of the creek. (Improvement of riparian condition would also be contingent on restricting stock access to the riparian zone).

Semi-permanent standing water in the creek would also potentially benefit both aquatic and terrestrial animals. The standing water could provide habitat for large invertebrates (including yabbies), small native fishes, frogs and possibly platypus. The standing water could also be used by terrestrial mammals for watering and aquatic birds for feeding habitat.

Ecological disbenefits:

Such an approach has some real risks associated with it. In particular there is a real risk of creating and/or exporting water of very poor water quality downstream from the creek.

Standing water can become anoxic (no dissolved oxygen) particularly during warm weather (late spring – early autumn). The lack of oxygen is caused by the oxygen demand from the creeks sediments (from microbial respiration) outstripping the supply of oxygen from the atmosphere. This problem can be enhanced if the creek received significant input of leaf material from surrounding trees (blackwater – see below). Such conditions would have naturally occurred in Tuppal Creek during the summer months in at least some years. There is evidence that at least some small native fish have adapted to living in water bodies which experience periods of low oxygen tension (N. Bond, Monash University, pers. comm.). The real problems would arise if the timing of managed flows in the creek, or unplanned flows due to rain events, mobilise this water. The slug of poor water quality would then be exported downstream where it could cause environmental harm, including the potential to create a fish kill. This could be minimised by

- Ensuring that the managed flows only occur in the cooler months, when anoxia is less likely to be an issue.
- Managed flows only occur after the water quality in the remnant pools along the length of the river has been asses and,
- Managed flow events coincide with larger flows in the Edwards River to dilute any water quality issues

There is also a real risk that the first flood events in the creek will produce poor water quality. Tuppal Creek is known to contain actual and potential acid sulfate soils (SKM 2006). Careful management of flow events, particularly at the inception of the project, need to be undertaken to limit the export of acidic water from the creek into the Edwards River. Before any flows are re-instated into the Creek it is essential that an assessment of the potential for acid-export be investigated. It is also important that any water used in the rehabilitation of the creek is low in dissolved salts to minimise the rate of formation of acidic sediments. Furthermore, partial or complete drying of the creek should occur on a fairly regular basis, coinciding with climatic conditions. For example, flows into the creek should not occur if moderate to severe drought conditions exist in the Murray catchment.

There has also been a significant build-up of plant material (living and dead) in the bed of the creek. Initial flooding of the creek has the potential of producing a front of blackwater, high in organic carbon and low in dissolved oxygen, if the flood occurs in the warmer months.

Algal blooms, particularly blooms of toxic cyanobacterial (blue-green algae) may also occur in the pools during the warmer months.

Water quality is not the only potential risk. As noted above, the lower sections of the river have been invaded by pest fish species, particularly carp and weather loach. Introduction of standing water in the upper reaches of the creek could contribute to their spread.

Finally, this approach does nothing to improve the condition ot the Tuppal Creek shedding floodplain. This area would naturally have been inundated on a regular basis (at least decadal, but probably significantly more often). These floods would have contributed silt to the floodplain, increasing soil condition, added moisture to the soil profile and, exported carbon back to the creek, increasing in-stream productivity.

Recommendations:

Before the establishment of a 'chain-of-ponds' as an end point for rehabilitation efforts in Tuppal Creek I would strongly recommend that a detailed assessment of the proposal be undertaken. This assessment would include:

- An accurate assessment of the volume of the water required and the feasibility of securing that water on a permanent basis. (This approach will only improve the condition of the creek if there is a long-term commitment to supply good-quality water when it is required).
- An assessment of the potential for the dry reaches of the creek to be recolonised by target and pest species;
- A detailed assessment of the water quality in the 'first flush" of the creek;
- A detailed assessment of the likelihood of poor water-quality conditions forming in the creek (particularly during the warmer months) and,
- A set of ecologically sensible 'rules' for managing flows within the creek, including timing of both flow events and periods of complete drying.

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