Farm Dams Technical Guide

Design & construction of high-performing dams

Introduction

Farm dams are a key asset in the agricultural landscapes of eastern Australia, providing essential water for stock, crops, households and for native wildlife.

In the context of a changing climate, water loss from farm dams by evaporation is likely to increase due more extended dry periods, meaning traditional dams may become a less secure farm water source. This heightens the need for careful farm water planning and dam management.

Good design, construction and management of farm dams can pay significant dividends for farm productivity and for the environment. Enhancement of existing dams has significant benefits for agricultural productivity, biodiversity and climate management, through improved water quality, improved water persistence, improved provision of ecosystem services and reduced greenhouse gas emissions.

This guide provides detailed technical information to support the process of dam enhancement and dam construction, in order to optimise dam performance.

What is an enhanced dam?

An enhanced dam is one where livestock access is managed to limit the impact of stock on the water body and on the surrounding vegetation.

When stock have unrestricted access to dams, they often congregate around the water's edge, preventing the growth of vegetation through trampling and grazing, and pugging dam edges. This increases inflow of sediment and pollution of the water with faeces and urine.

An ideal enhanced dam has healthy native vegetation in and around the water body, which creates a buffer to filter nutrients and sediment from run-off. As a result of stock exclusion and better vegetation cover, the water is cleaner. Native vegetation also provides habitat for wildlife.

Most enhanced dams are fenced to exclude livestock, utilising a reticulated water system with tank and trough to provide clean water for stock.

Benefits of farm dam enhancement

Improve water quality & productivity

Water quality is influenced by the inflow of pollutants such as sediment and nutrients. Water contaminated by sediment, nutrients and faeces can be less palatable to stock, resulting in reduced water intake and an associated reduction in feed intake.[1]

Fenced, well-vegetated dams have a greater capacity to filter contaminants from run-off, improving water quality. This leads to improved palatability and the potential for increase stock weight gain and productivity. Clean reticulated water also contains fewer pathogens that may affect stock health.

Improved water quality is also beneficial for aquatic biodiversity. Turbidity and reduced light penetration reduce aquatic flora and fauna, while inflows of nutrients can cause excess algal growth.

[1] Williams WD, Kenzie OR, McAllister TA, Colwell D, Veira D, Wilmshurst JF, Entz T, Olson ME (2002) Effects of water quality on cattle performance. *Journal of Range Management* 55: 452-460.

Figure 1: An enhanced farm dam at Ettamogah NSW

Aquatic life forms in a dam provide many ecosystem services including nutrient cycling, so a dam without a diversity of aquatic organisms will not deliver many of the benefits provided by a biodiverse dam.

Increase water security

Evaporation is the principal source of water loss from farm dams. As climate change reduces water inflows and increases evaporation, on-farm water security will increasingly be a key management issue.[2]

Strategically-placed revegetation around a dam increases shading and reduces windspeeds, both of which reduce evaporation from farm dams. This improves water security, as well as reducing the impacts that farm dams have on overall flows within the wider catchment. Reduced evaporation also reduces evapo-concentration of water pollutants.

Floating and emergent aquatic plants also shade the water and keep it cooler, reducing evaporation and making water more palatable to livestock. These plants generally flourish in fenced, enhanced dams, but will often struggle in typical dams that may have high sediment loads.

Reduced sedimentation due to increased ground cover around a dam also helps to retain the capacity of the dam further improving water security.

Improve pasture management

Establishing a reticulated water system for stock water also has potential benefits for improved pasture management. Multiple water points can be added to enable subdivision of paddocks for more flexible pasture management, such as rotational grazing. During drought periods, a trough

[2] Malerba, ME, Wright, N, and Macreadie, PI (2022) Australian farm dams are becoming less reliable water sources under climate change, *Science of The Total Environment* 829: 154360. DOI: https://doi.org/10.1016/j.scitotenv.2022.154360

system means water can be provided where the feed is, while other water points are turned off – providing the landholder with more options for matching feed and water requirements.

Enhance biodiversity

While natural wetlands have been largely lost from agricultural landscapes, farm dams that are well managed can play a similar role to natural wetlands – helping restore biodiversity by providing much needed wetland habitats for native wildlife.

While some native species, such as Australian wood ducks, will use almost any dam in the landscape regardless of its condition, there are many other species that will only be found at healthy, enhanced dams.

Birds like the spotless crake, little grassbird, golden-headed cisticola, diamond firetail and white-faced heron all use enhanced, well-vegetated farm dams – but not traditional dams. Platypus, which generally inhabit streams and are rarely found in dams, have even been observed using enhanced dams. Enhanced dams also support a rich diversity of aquatic life.

Increase provision of ecosystem services

The community of organisms that flourish in and around an enhanced dam play a significant role in ecological function. This leads to an increase in ecosystem services including nutrient cycling, waste decomposition, natural pest control and pollination, all of which can benefit agricultural production.

Reduce greenhouse gas emissions

Freshwater systems, particularly farm dams, emit potent greenhouse gases, such as methane. These emissions are triggered by fertiliser and manure run-off increasing nutrients and creating the ideal conditions for the production of methane, a gas with 30-100 times greater warming potential than carbon dioxide.

However, a large-scale study by Deakin University's Blue Carbon Lab and Sustainable Farms has demonstrated that enhanced dams can reverse this trend. In the study, fenced farm dams recorded lower levels of nitrogen and phosphorus and higher levels of dissolved oxygen.[3] Subsequently, enhanced dams had on average a 56% reduction in methane emissions compared to typical dams.

The increase in dissolved oxygen levels is significant because farm dams with high levels of dissolved oxygen stop emitting methane, and can instead start absorbing greenhouse gases from the atmosphere. This means that enhancing farm dams can turn these systems from being a problem for climate change, to be a solution to lower the carbon footprint of Australian agriculture.

In the future, carbon credits for farm dam management could also deliver a financial dividend to farmers.

[3] Malerba, ME, Lindenmayer, DB, Scheele, BC, Waryszak, P, Yilmaz, IN, Schuster, L & Macreadie, PI (2022) Fencing farm dams to exclude livestock halves methane emissions and improves water quality, *Global Change Biology* 28(15): 4701-4712. DOI: https://doi.org/10.1111/gcb.16237

Cost-benefit analysis

A cost-benefit analysis undertaken by Sustainable Farms compared the cost of enhancing all the dams on a farm with the potential financial benefits from modest weight gains in cattle and reduced dam siltation. The analysis found a 3:1 ratio of benefits to costs over the 50-year life of a dam in Victoria, and a 3:2 ratio of benefits to costs in NSW. There was a 70% probability that benefits would exceed costs.[4]

[4] Dobes, L, Crane, M, Higgins, T, Van Dijk, AIJM & Lindenmayer DB (2021) Increased livestock weight gain from improved water quality in farm dams: A cost-benefit analysis. Plos one, 2021. 16(8):e0256089. DOI: https://doi.org/10.1371/journal.pone.0256089