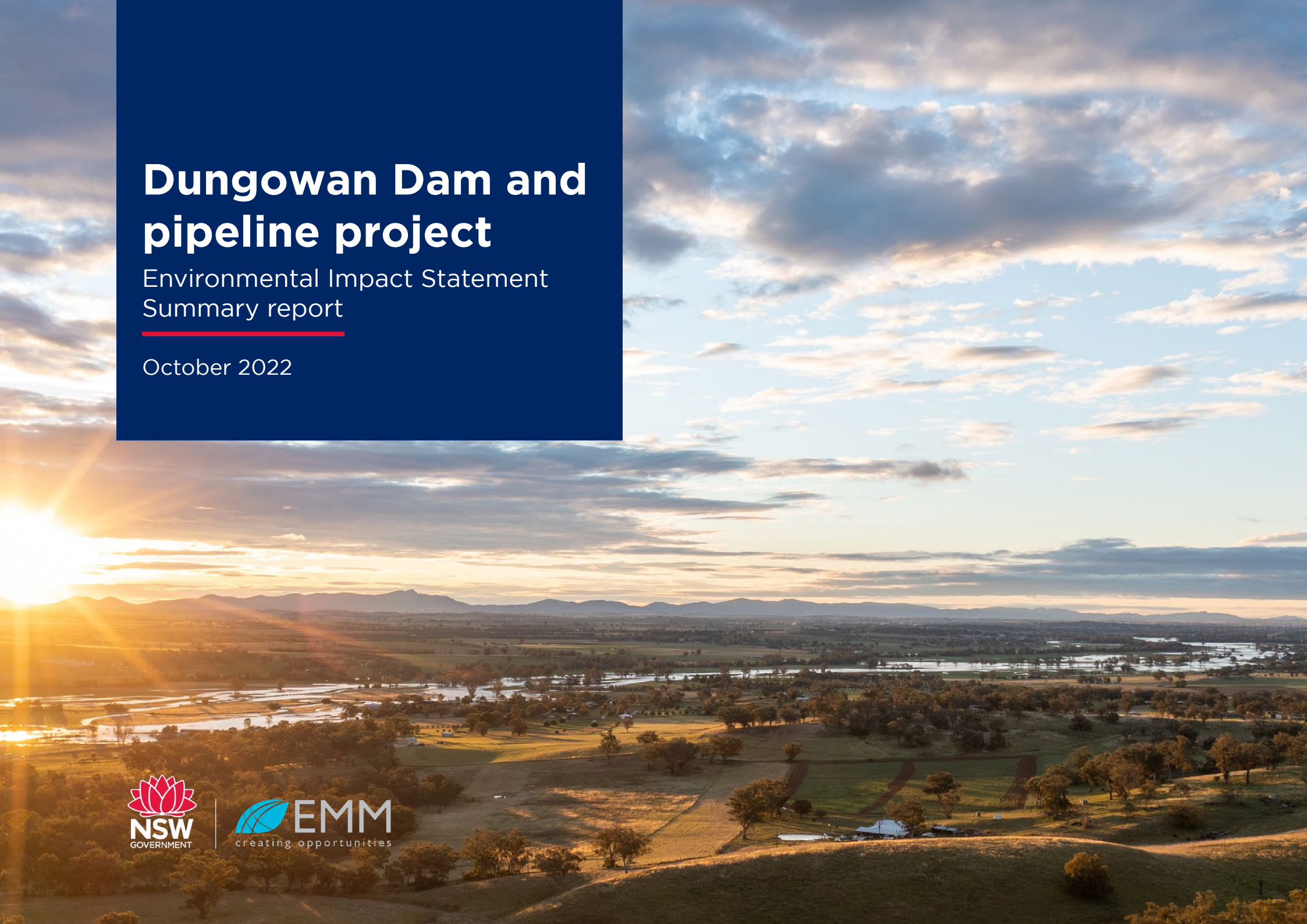
Dungowan Dam and pipeline project

Environmental Impact Statement Summary report

October 2022



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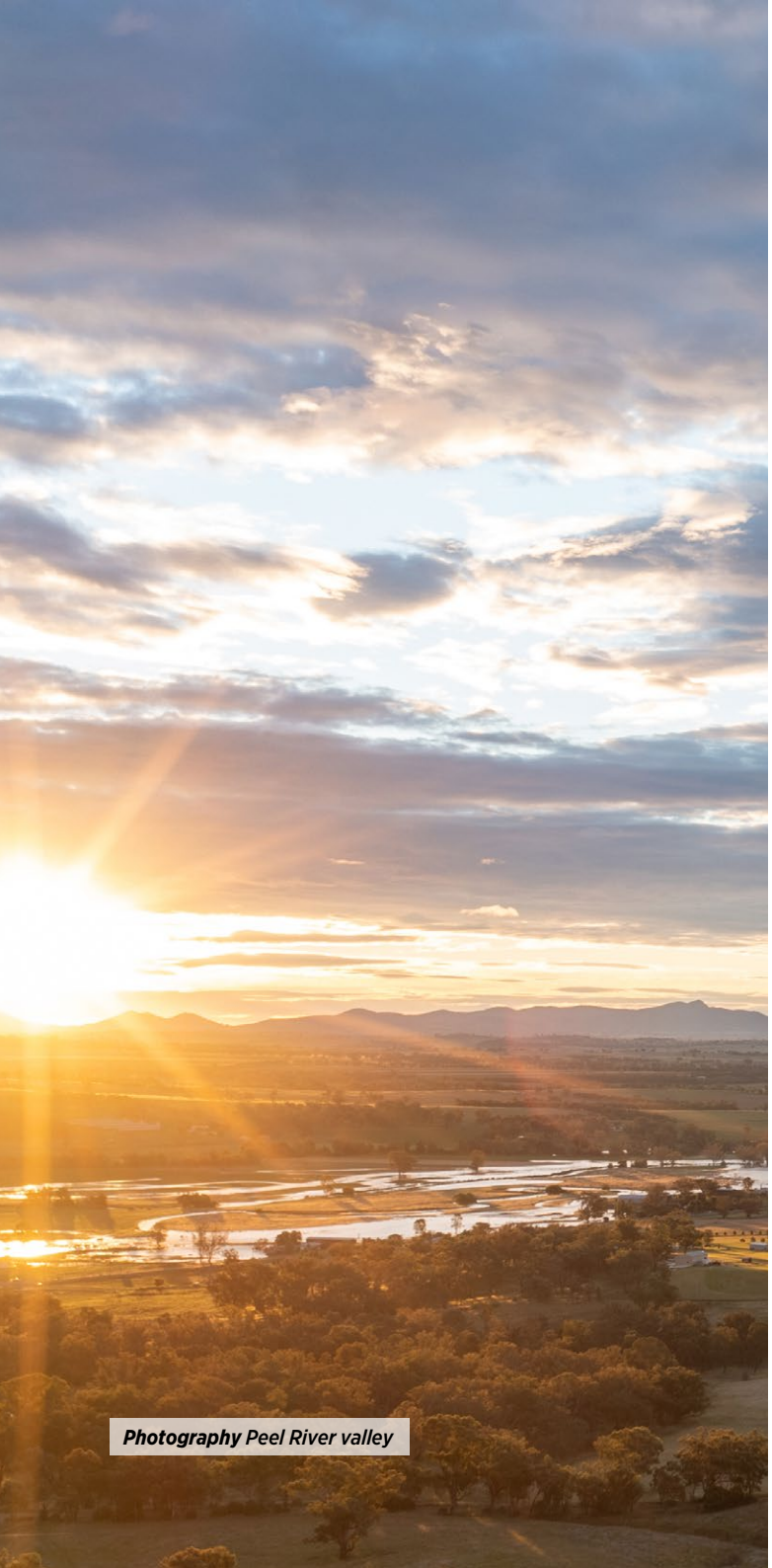

Photography Peel River valley

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Department reference no: ISBN 978-1-76058-631-7

Photography acknowledgement: Andrew Pearson

Preface

***Photography** Existing Dungowan Dam*

Preface

Water Infrastructure NSW is seeking approval to build and operate the Dungowan Dam and pipeline project. The project would improve water security for the Tamworth region, which faced critical water shortage during the most recent drought.

The project is critical State significant infrastructure (CSSI) and requires assessment and approval under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval authority is the NSW Minister for Planning and Homes (Minister). The project is also a "controlled action" under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and will be assessed under the assessment bilateral agreement between the NSW and Commonwealth Governments.

An Environmental Impact Statement (EIS) has been prepared in accordance with the NSW Planning Secretary's environmental assessment requirements (SEARs), the requirements of the EP&A Act, the *Environmental Planning and Assessment Regulation 2021*, and the SSI Guidelines. The EIS details the project, the environmental, social and economic impacts and benefits of the project, and how these impacts would be managed throughout construction and operation.

This document is a summary of the EIS and has been prepared to provide:

- a succinct but complete description of the project for which approval is sought
- a description of any uncertainties that still exist around design, construction methodologies and/or operational methodologies and how these will be resolved
- a compilation of the impacts of the project that have not been avoided
- the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts
- a compilation of the outcome(s) the proponent will achieve
- a consolidated summary of all the proposed environmental management and monitoring measures, and commitments in the EIS.

The EIS is available in full on Water Infrastructure NSW's website:

https://water.dpie.nsw.gov.au/water-infrastructure-nsw/dam-projects/dungowan-dam

The EIS contains a complete and detailed description of the project and provides all detailed technical assessments completed, also available to download.

Photography Existing Dungowan Dam

Description of the project

***Photography** Existing Dungowan Dam*

Description of the project

Overview

Water Infrastructure NSW is seeking approval to decommission the existing Dungowan Dam and to build and operate the new Dungowan Dam and pipeline. The new Dungowan Dam on Dungowan Creek has a catchment size of 175 km^2 and is part of the Peel Valley and Namoi River catchment.

Approval is sought for:

- a new dam about 3.5 km downstream of the existing Dungowan Dam, with an expected capacity of 22.5 GL. The new Dungowan Dam infrastructure would include an earth and rockfill embankment, spillway, outlet works as well as coffer dams and diversions
- a new buried 32 km, 71 megalitre per day (ML/d) delivery (gravity) pipeline delivering water from the new Dungowan Dam to the connection point with the Chaffey Dam pipeline near Dungowan Showground. This would replace a 33 km section of the existing 22 ML/d delivery pipeline
- ancillary infrastructure involving temporary works to facilitate construction (such as construction and accommodation areas, quarry) as well as permanent works and services (such as powerlines and roads) to facilitate operation of the new Dungowan Dam
- decommissioning of the existing ~6.3 GL Dungowan Dam.

Construction of the project is expected to take about six years and would have a workforce of about 125 workers at its peak.

Once commissioned, the new Dungowan Dam and pipeline is proposed to be operated by WaterNSW and Tamworth Regional Council respectively. The workforce during operation would comprise the existing WaterNSW and Tamworth Regional Council operations team, with one to two new full time workers. No public access or water based recreation would be permitted at the dam to ensure public safety and minimise operational risk.

The new Dungowan Dam would be prioritised over Chaffey Dam for Tamworth's future water supply, which would increase the water reserved for town water in Chaffey Dam. This is of greatest benefit in years when rainfall is low, ensuring enough water is set aside to improve resilience to drought conditions.

Figure 1. Peel Valley catchment overview

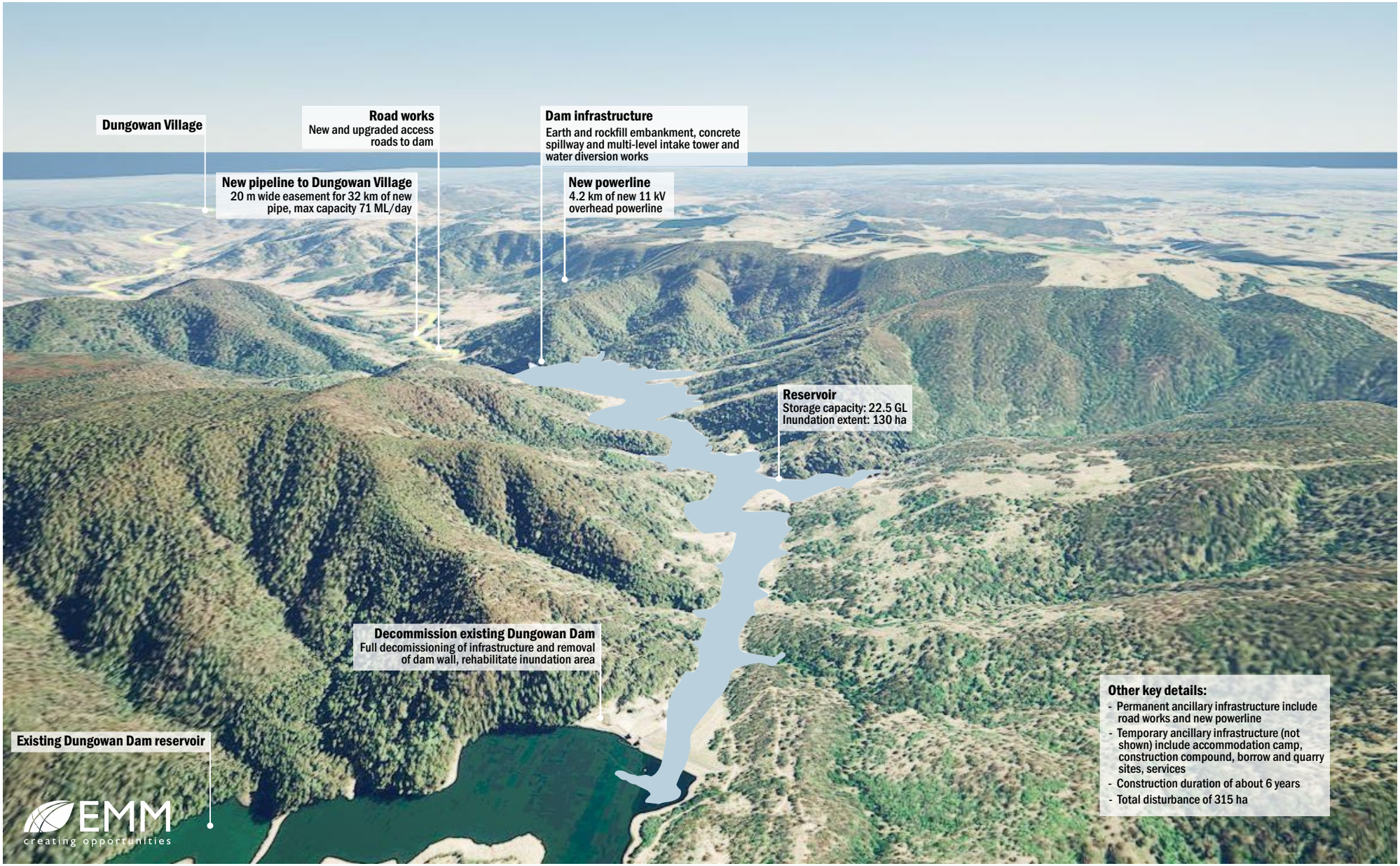


Figure 2. Conceptualisation of the new Dungowan Dam infrastructure

Project need

The Tamworth population was impacted with prolonged water restrictions and imminent water shortage during the most recent drought (2017–2020), which was one of the worst on record. The drought had flow on effects on local agriculture and businesses and highlighted the immediate need for improved water reliability and security for existing and future populations.

The need for the new Dungowan Dam and pipeline responds to:

- a growing Tamworth population, with growth predictions ranging from 10% to 50% over the next 20 years
- the importance of a reliable water supply to the regional economy, as Tamworth is particularly vulnerable to adverse economic impacts from drought given the high demand for potable water (ie. 48% of demand in 2019–20 was for regionally significant businesses)
- cost of drought and water restrictions, which is estimated to be between $0.5M and $2.5M per year over the next 30 years
- an existing unreliable water supply. Tamworth has a high degree of reliance on surface water, and due to the high connectivity between surface and groundwater and the over allocation of groundwater in the Peel River, groundwater is not a viable alternative supply
- current and future climate trends. The most recent drought resulted in a range of emergency drought relief projects being delivered to extend water supplies, including the Chaffey Dam pipeline. These projects in isolation do not reduce the risk of running out of water into the future. The existing Dungowan Dam is predicted to experience increasing shortfalls in water supply due to climate change
- ageing infrastructure and safety risks. The existing dam is sixty years old and was not built to meet current dam safety design standards. The cost of upgrades would be significant and may not effectively achieve current standards. Similarly, the existing Dungowan pipeline is ageing and experiences regular serviceability issues.

The need for improved water security and climate resilience in the Namoi and Peel Valley catchment is highlighted in the NSW Water Strategy, draft Namoi Regional Water Strategy, draft New England North West Regional Plan 2041, and Tamworth Regional Blueprint 100.

***Photography** Existing Dungowan Dam spillway in operation*

The project aims to support the strategic objectives of these plans and strategies as well as meet the following three objectives developed for the project:

- improve water availability and security for the town of Tamworth and to enable growth
- provide efficient and affordable bulk water supplies to Tamworth
- promote environmental and social outcomes in Tamworth and the Peel Valley.

It is important to note that while the new Dungowan Dam and pipeline project is the preferred option and is necessary now, additional infrastructure and non-infrastructure measures will need to be taken in the future to ensure Tamworth remains resilient to climate and population changes. These additional measures are being investigated through the Namoi Regional Water Strategy to form part of a longer investment pathway for water security and efficiency in the Peel and Namoi Valleys.

Project design

A preferred concept design has been prepared for the project and the design drawings are supplied with the EIS. A summary of the design is provided in this section.

New Dungowan Dam

The new Dungowan Dam would have a storage capacity of 22.5 GL and the reservoir (at its full supply level) would cover an area of about 130 ha. The reservoir would be contained by the dam and associated infrastructure.

Key dam infrastructure is shown conceptually on **Figure 3**, and includes:

- earth and rockfill embankment dam (ie the dam wall). The height of the embankment would be about 58 m and it would be about 270 m in length (dam crest length)
- concrete spillway. The spillway comprises an approach channel, ogee crest (referring to the shape of the top of the spillway), chute and stilling basin. The spillway ensures water is able to be released when the dam is full and/or a major flood event occurs
- multiple-level intake tower and access bridge. The intake draws water in to the diversion tunnel and outlet conduit. Water can be drawn from different depths depending on water levels and temperatures (ie to minimise poor water quality and the risk of cold water pollution)
- outlet conduit, valve house and associated pipework and valves. These elements convey the raw water drawn in from the intake, downstream to Tamworth.

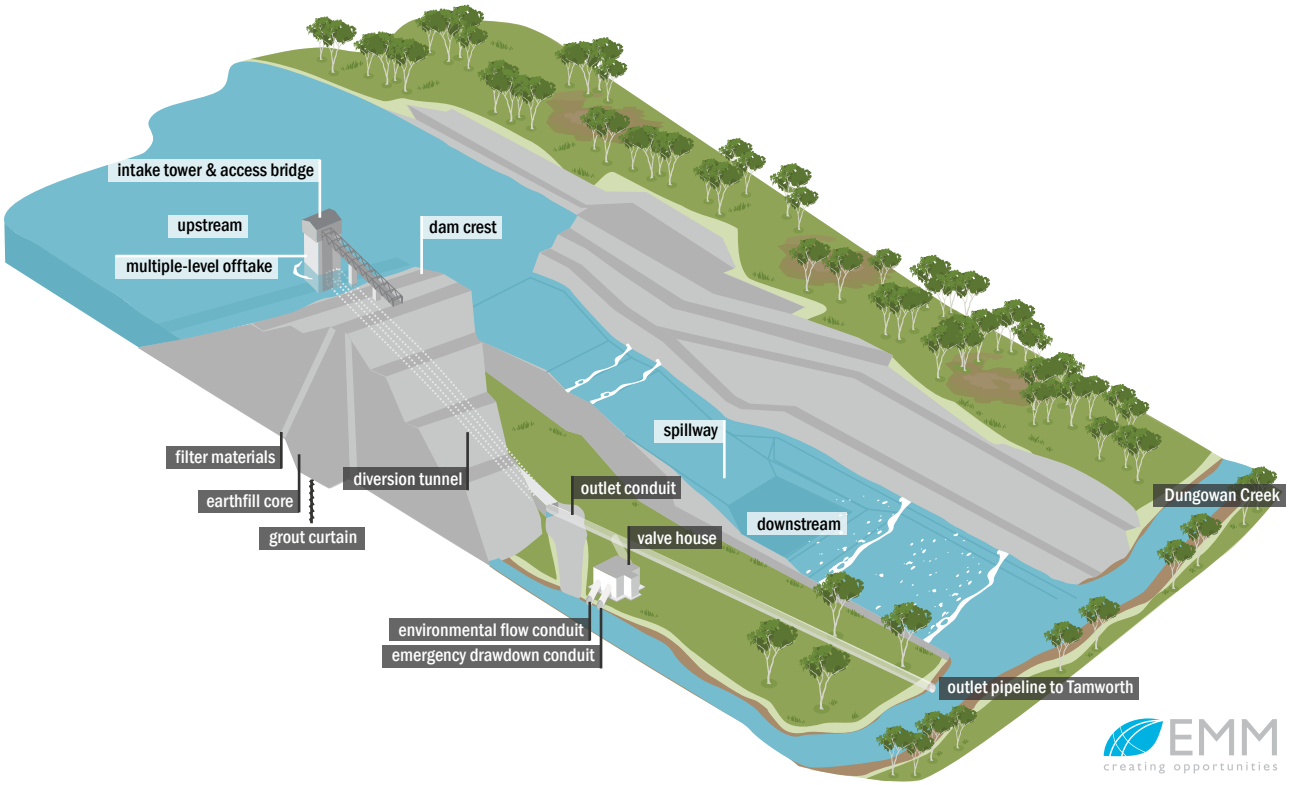


Figure 3. Conceptualisation of the new Dungowan Dam infrastructure

A permanent access road to the dam crest and the valve house is also required for operation and maintenance.

Construction of the dam would require the diversion of Dungowan Creek and the establishment of upstream and downstream coffer dams to ensure a dry working environment (see **Figure 4**). Ground clearing, excavations and bulk earthworks would provide for the installation of dam infrastructure, which would be facilitated by the construction compound and ancillary infrastructure including temporary access roads, quarries and borrow areas, concrete batching plant, and site sheds. An on-site accommodation camp would also be provided for the construction workforce.

Commissioning the new Dungowan Dam would involve filling the dam to above the minimum operating level. This would be achieved through a combination of rainfall events and emptying the existing Dungowan Dam.

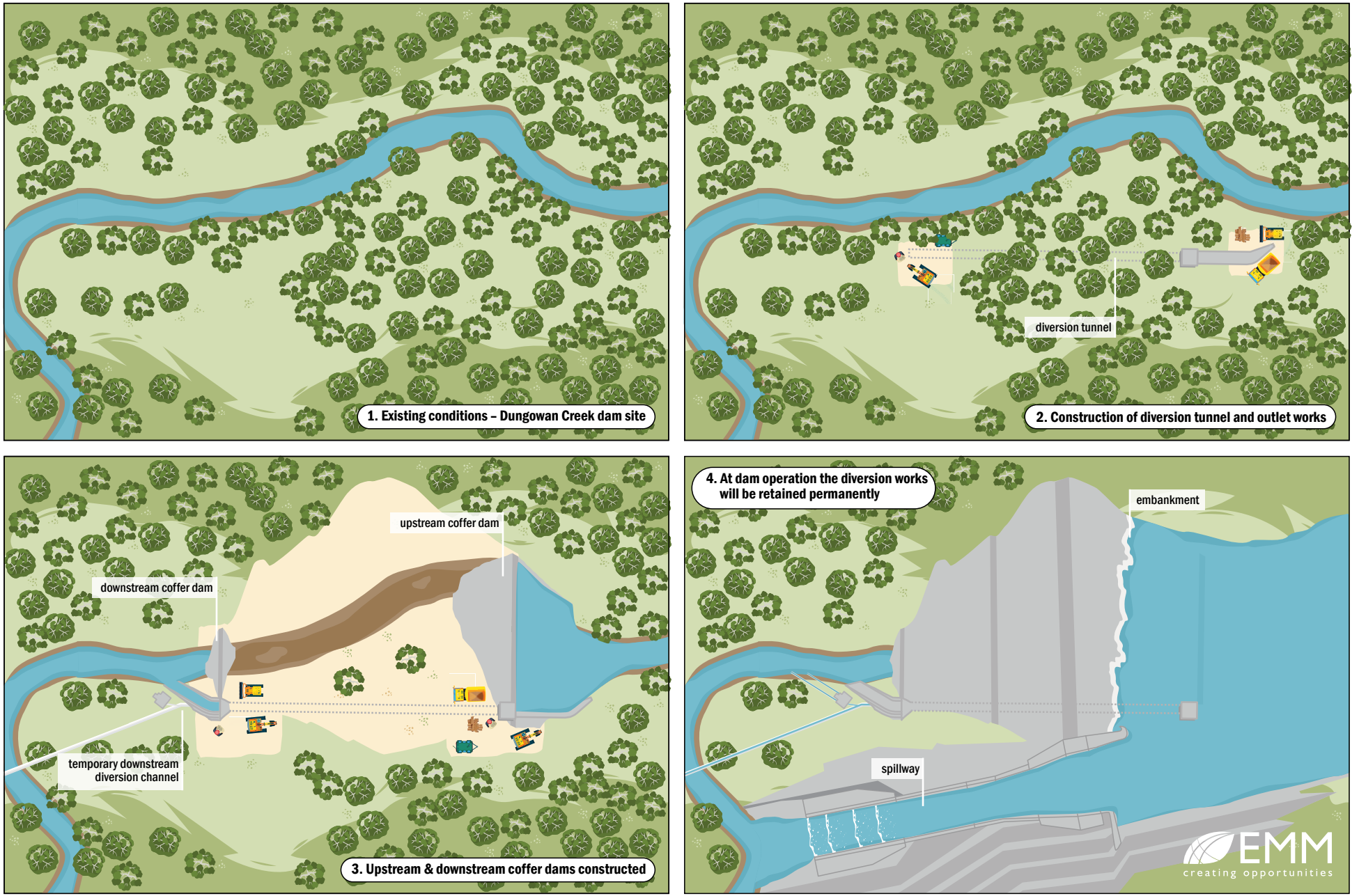


Figure 4. Staging of diversion works

Pipeline

The new pipeline would be trenched and buried along its alignment, except for the single crossing of the Peel River, which would be undertaken using horizontal directional drilling. The pipeline crosses Dungowan Creek eight times and is within a combination of both private and public land. The new pipeline would replace the existing 22 ML/day pipeline.

The pipeline alignment is shown on **Figure 6**. The pipeline design includes:

- high density polyethylene (HDPE) pipe between 710 mm to 900 mm nominal diameter
- a 20 m wide construction corridor and 10 m wide operational easement for the total 31.6 km length of the pipeline
- control, scour, isolation and air valves, located at various intervals along the pipeline length. These need to be exposed and accessed during operation therefore involve above ground or ground level infrastructure (such as pits or safety bollards). Two control valves require above-ground sheds to house the infrastructure.

The pipeline would convey a maximum 71 ML/day from the new Dungowan Dam to the junction with the pipeline from Chaffey Dam to the Calala Water Treatment Plant (WTP).

Customers that have connections to the existing pipeline would be provided raw water connection to the new pipeline. A raw water connection would also be available to additional new customers where the route of the replacement pipeline runs through their property.

The replacement pipeline would be installed within a construction footprint that is a maximum of 20 m wide and this would include a trench and an area to accommodate construction access, set down points, pipeline stringing and storage areas.

Construction across Dungowan Creek would be managed through the use of coffer dams and temporary waterway diversions (as shown conceptually in **Figure 5**).

Pipeline commissioning would involve flushing of the pipeline with raw water, testing and commissioning of valves and other pipeline control elements and undertaking leak tests.

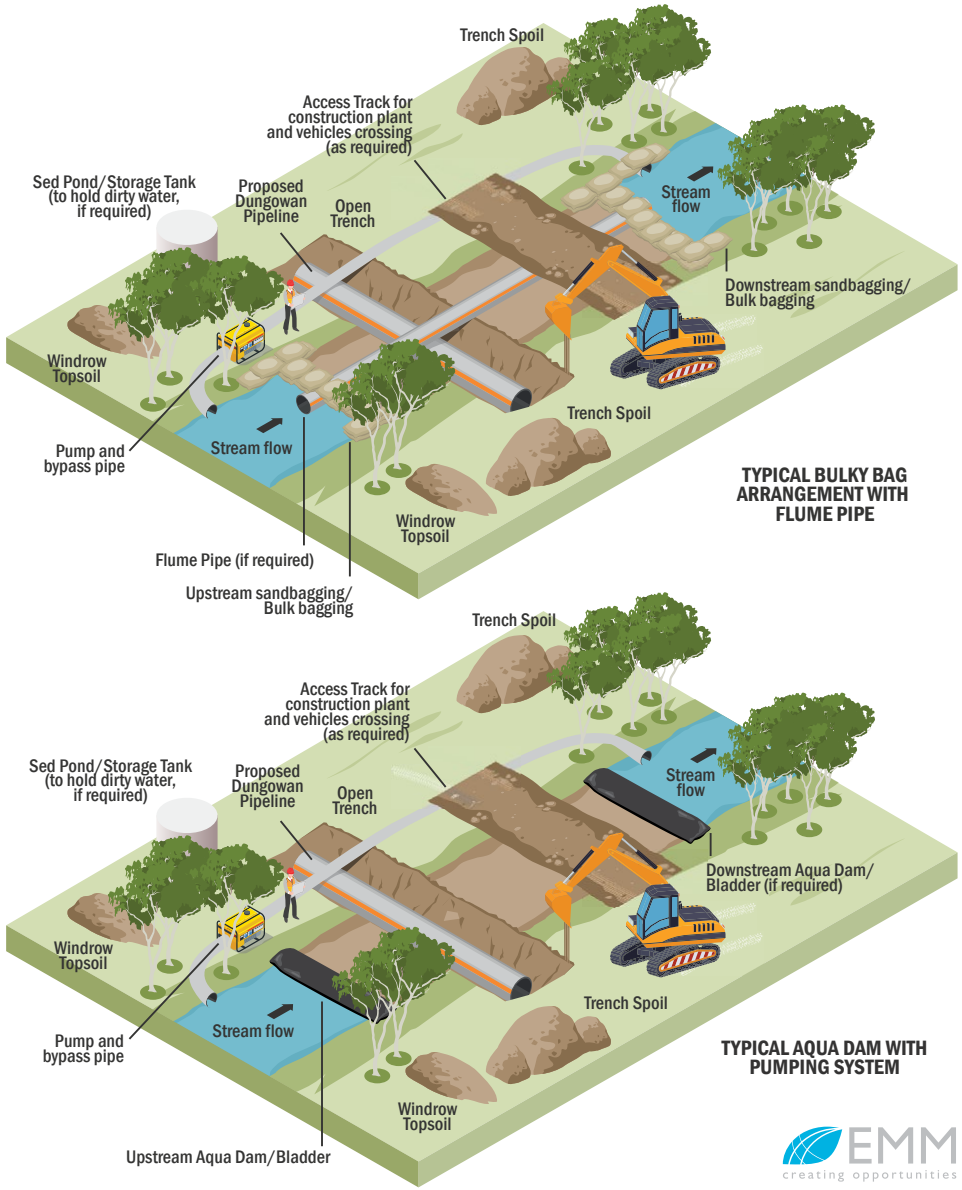


Figure 5. Typical creek crossing construction method

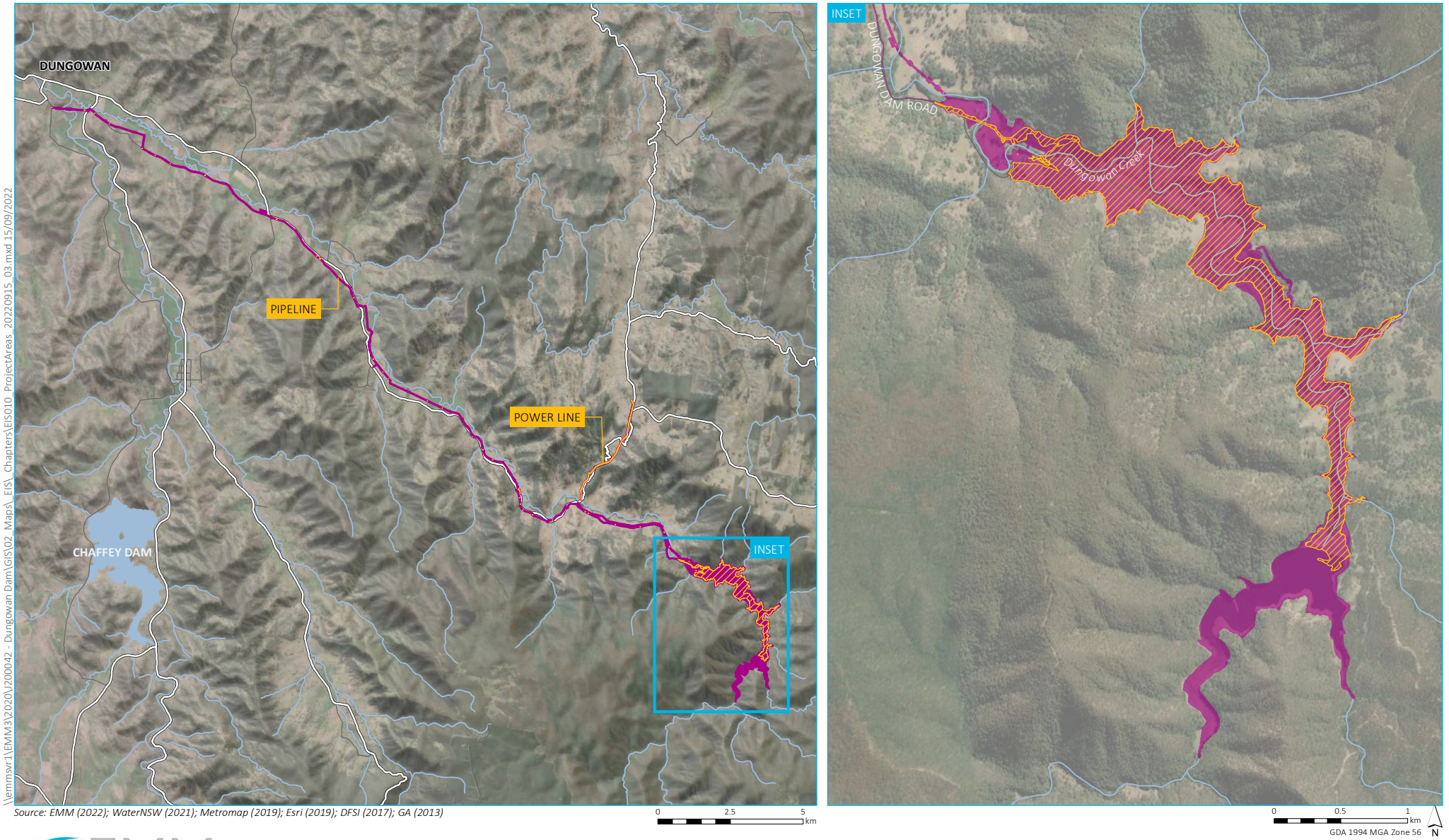


Figure 6. Project footprint

Ancillary infrastructure

Permanent ancillary infrastructure required to operate the new Dungowan Dam and pipeline includes a new overhead powerline and new or upgraded roads. The road upgrade of Dungowan Dam Road, involving widening and re-surfacing where practical along a 3.5 km section, is primarily required to facilitate construction however would be retained for operation. The new road to access the dam crest and valve house is required to allow ongoing operation and maintenance of the dam. Relocation of existing powerlines within the new dam's inundation area is required to ensure connection to the town of Niangala is maintained. This involves:

- a new 4.2 km long 11 kV overhead powerline (including a new easement and access track). The new powerline would connect to an existing overhead line approximately 6 km north west of the dam
- minor upgrades, including re-stringing of new overhead wiring and replacement of some poles, of the existing overhead line that extends approximately 13.2 km to the Niangala area from the new powerline.

Decommissioning the existing dam

Decommissioning the existing Dungowan Dam would occur once the new dam is completed. Decommissioning works involve dewatering of the existing dam through the outlet works (or augmented with pumping), removing the existing spillway crest and all concrete structures, and excavating through the existing dam embankment to the natural creek bed level, with any excess material used to fill in redundant structures and natural low points.

A channel with appropriate erosion protection would be created at the base of the existing dam to route flows downstream. The residual surfaces would be shaped and profiled to blend into the surrounding environment and direct stream flows. The former inundation area of the existing dam would be revegetated in line with a detailed rehabilitation plan.

An excess volume of spoil material would likely be created by decommissioning works. The excess material would be used to construct an additional profiled placement area within the existing reservoir, on the peninsula immediately upstream of the embankment. It is sited below the existing full supply level to limit any incremental environmental impact beyond the existing reservoir footprint and would also be revegetated in line with a detailed rehabilitation plan.

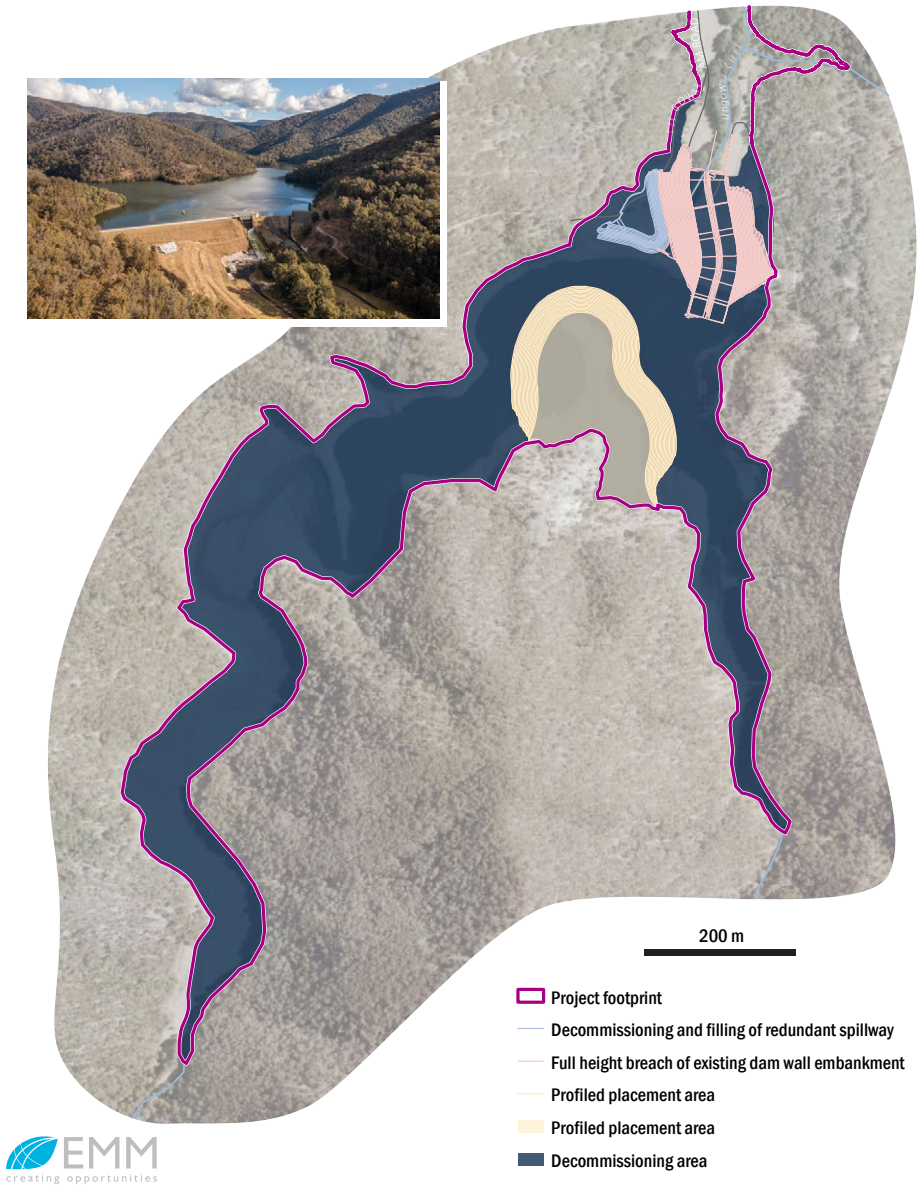


Figure 7. Existing dam decommissioning

Project areas and disturbance

Areas of disturbance have been identified based on the direct impacts of the project. There is some overlap in the areas disturbed during construction and operation, with a resulting total disturbance area proposed for the project of 315 ha (project footprint).

Disturbance would occur in a staged manner, with construction requiring disturbance of approximately 315 ha (construction footprint). Following construction and once rehabilitation is completed, there would be a permanent disturbance of approximately 158 ha comprising the inundation area and permanent infrastructure (operational footprint) (see **Figure 6**).

Construction management

The project would involve different phases and activities with the indicative construction sequencing shown below. The peak construction periods are anticipated to be at the start of spillway construction (Q3 of Year 1) and when the majority of major earthworks are occurring concurrently (Year 4).

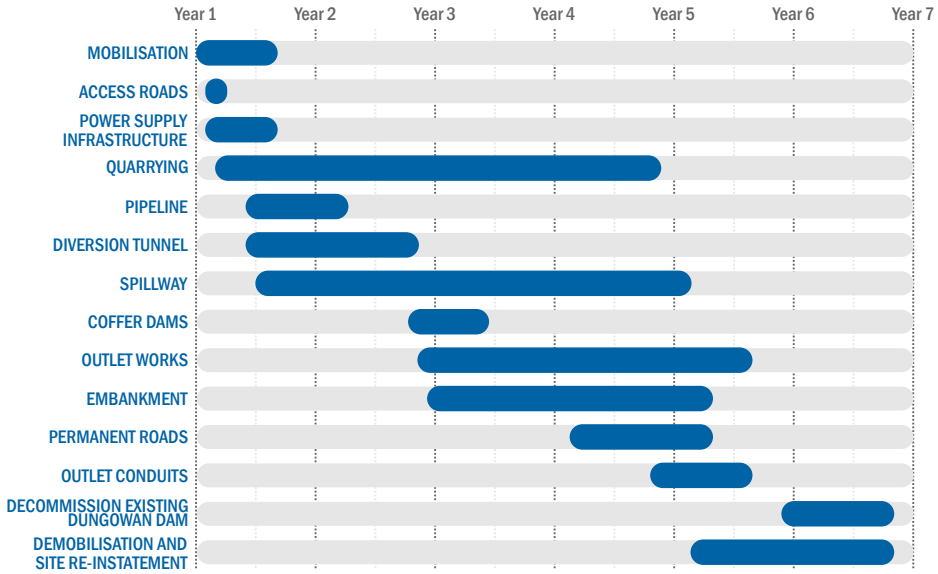


Figure 8. Indicative construction sequencing

The primary transport route to the site follows the New England Highway to Nemingha (about 7 km south-east of Tamworth) and turns onto Nundle Road to Dungowan. Vehicles would then turn off Nundle Road at Dungowan onto Ogunbil Road followed by Dungowan Dam Road.

The anticipated normal working hours would be Monday to Saturday 7 am to 6 pm.

Work type	Recommended standard hours of work
Normal construction	Monday to Saturday 7 am to 6 pm
	Sundays or public holidays – low noise and low traffic generating work may be carried out 9 am to 5 pm

Low noise and low traffic generating work may be carried out on Sundays and public holidays between 9 am and 5 pm. Blasting activities may be required to assist spillway excavation however these would occur within 9 am and 5 pm between Monday and Saturday only.

To ensure environmental performance outcomes are achieved, construction of the project would be guided by a Construction Environment Management Plan and supporting sub plans. This would involve site monitoring and auditing as required.

***Photography** Supervision during site investigations*

***Photography** Erosion protection at bottom of existing Dungowan Dam spillway. A rip rap and stilling basin is proposed for the new Dungowan Dam to reduce flow velocity and minimise erosion and sedimentation downstream*

Operating principles and management

The management and operation of the new Dungowan Dam and pipeline would be consistent with the management and operation of other water storage facilities across NSW. This includes all necessary activities such as monitoring, surveillance and maintenance.

The operation of the new Dungowan Dam would provide:

- raw water to the Calala WTP via the new pipeline (primary purpose)
- run of the river discharges to stock and domestic water licence holders along Dungowan Creek
- environmental flow releases: translucent flows up to 13 ML/day (an increase of 3 ML/day from the current dam due to the larger catchment); and an environmental contingency allowance of up to 200 ML/year.

The new Dungowan Dam and pipeline would operate in parallel with the existing Chaffey Dam to supply raw water to the Calala WTP. The only change in the operations at Chaffey Dam would be that the water reserved for town water would increase from 14.3 GL to 30 GL. It is likely that this would be implemented through a change to the Water Sharing Plan. This change means the system would be able to meet increased water demand at higher levels of security.

Water quality monitoring in the reservoir would be consistent with WaterNSW's water quality monitoring program. Regular and emergency maintenance of the pipeline and associated infrastructure would also be required. Operational management would be guided by dam safety procedures and operational plans.

Uncertainties in design

The EIS has been prepared on the basis of a concept design and using available information at the time. Since the development of the concept design, further geotechnical investigations have been completed, which may further inform design decisions. A detailed design process is underway and following the appointment of a construction contractor, details of the project may change or be refined.

Key elements of the dam design are generally fixed such as the spillway, dam type and orientation. However, final construction methods (for example, whether blasting would be utilised as part of spillway excavation) would be determined by the construction contractor.

Other uncertainties in design would be resolved through ongoing and future consultation. This includes with Essential Energy for specifications and upgrade requirements of the existing powerline requiring re-stringing. Minor changes to pipeline design may also occur until landowner negotiations are finalised. Optimisation of the dam operating principles may also occur following further modelling and consultation, such as optimisation of town water reserves in Chaffey Dam and environmental release arrangements.

Where possible, the EIS has allowed for some flexibility by following a conservative assessment. Any deviations from the project as described in the EIS would be subject to a consistency assessment and if required, subject to further environmental assessment and approval process.

Project impacts

***Photography** Peel River*

Project impacts

The project has been developed following a robust and iterative process including detailed options analysis, design, environmental assessment and stakeholder engagement. Where reasonable and feasible, the project has aimed to avoid and minimise biophysical, social and economic impacts. Where impacts are unavoidable, mitigation measures have been identified to reduce the likelihood, magnitude and consequences of any residual impacts. The following sections provide a summary of the key project impacts.

Water

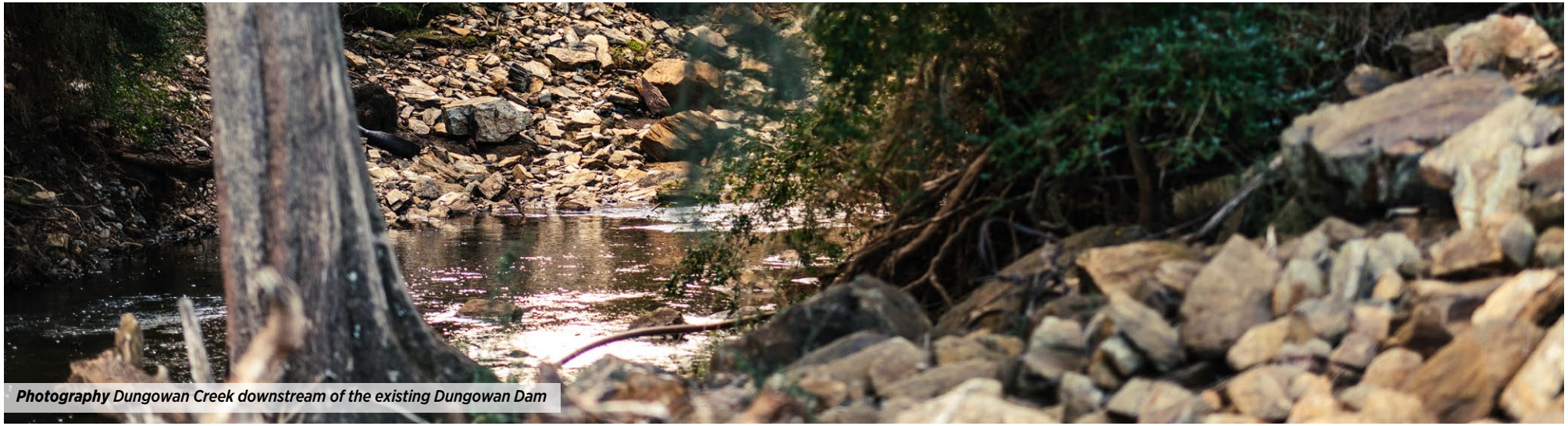
Change in streamflow

Operation of the new Dungowan Dam, and the influence of the project on the operation of Chaffey Dam, would result in changes to flow regimes both in Dungowan Creek, downstream of the new Dungowan Dam, and in the Peel River, downstream of the existing Chaffey Dam. No changes to the flow regime are predicted downstream of Tamworth. The predicted changes are based on hydrological modelling completed by DPE Water using the Peel Valley Source Model.

Flows in Dungowan Creek would not change for the majority of the time due to the increase in environmental flow (translucency) releases compared to the existing Dungowan Dam. The decreases in flow is predicted to occur for 10% of days, however these reductions in flow would occur during higher flow days and are influenced by dam filling and the capture of water by the larger new Dungowan Dam. In the Peel River, reduced run-of-river transfers from Chaffey Dam to Calala WTP would result in decreased flows for 30% of days.

At Piallamore, located downstream of the confluence of the Peel River and Dungowan Creek, moderately significant reductions in flow would occur on 40% of days (ie reductions of between 0 to 40 ML/day compared to a median flow of 60 ML/day). Downstream from Tamworth, changes to flow due to the new Dungowan Dam operation have no effect, while flow effects due to the new Dungowan Dam filling would have no meaningful effect due to the higher flows generated by the upstream catchments.

The minor changes to stream flow would result in negligible changes to stream depth in Dungowan Creek and the Peel River. By inference, the project is not expected to affect the recharge of groundwater to the Dungowan Creek Alluvium (below the new Dungowan Dam) and the Peel River Alluvium (below Chaffey Dam), or effect groundwater access to groundwater dependant ecosystems (GDEs) or other users.



***Photography** Dungowan Creek downstream of the existing Dungowan Dam*

Water availability

Changes to the flow regime would not affect access to water for stock and domestic purposes with the volume of storage in the Peel Valley increasing, leading to greater security of supply. The frequency and severity of water restrictions in Tamworth would decrease following construction of the new Dungowan Dam, while water for irrigation (ie average annual general security allocations) would remain unchanged. With current demands, the frequency of water restrictions would decrease from 18% of the time to around 7% of the time. With future demands (ie +20%), the frequency of water restrictions would decrease from 22% of the time to around 10% of the time, ie restrictions would occur half as often (**Figure 9**).

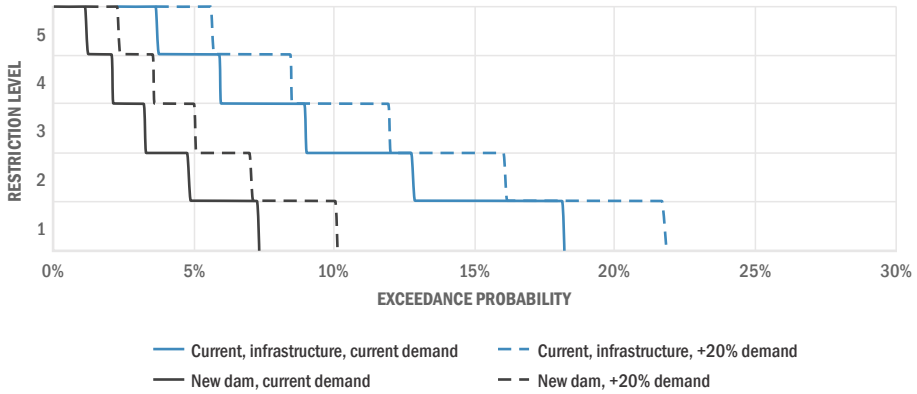
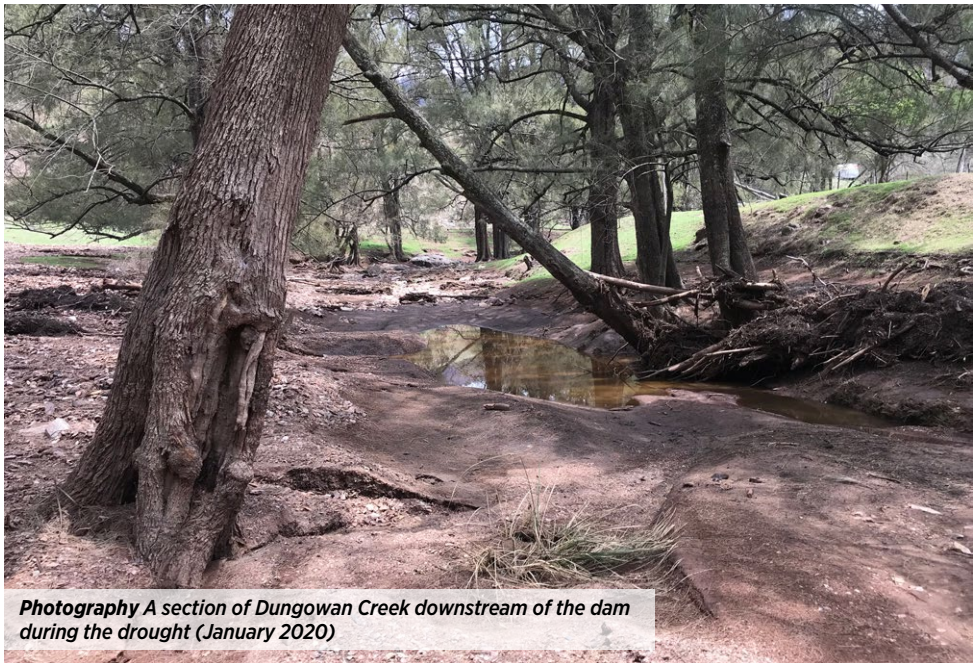


Figure 9. Modelled probability of water restrictions in Tamworth

Groundwater interception

Groundwater is likely to be intercepted during construction of the new Dungowan Dam, however drawdown is expected to be localised around the dam excavations and temporary due to the sequential nature of the works.

There are no groundwater users adjacent the dam excavation areas and ecosystems present do not have a dependent relationship with groundwater. During the construction of the pipeline, groundwater seepage to trenched excavation works is not expected to intercept groundwater and can be readily managed with standard engineering measures.



***Photography** A section of Dungowan Creek downstream of the dam during the drought (January 2020)*

***Photography** Dungowan Creek during high flow event (November 2021)*

Water quality

Impacts to water quality during construction are not considered a significant risk to surface water and groundwater quality and would be managed through the implementation of standard environmental management plans. Water quality during operation could be affected by high nutrient concentrations, which can lead to algal growth and cold water releases. Algal growth and cold water release risk are both increased by thermal stratification.

Utilisation of the proposed multilevel offtake is expected to result in a cold water pollution effect that is either negligible or very minor. In the event of required cold water releases, the effect would be limited to a distance of less than five kilometres downstream before the water warms to that of Dungowan Creek's ambient temperature.

Following filling of the new reservoir, any remaining vegetation would become inundated and begin to die and decompose releasing nutrients to the waterbody. The nutrient load contained within submerged vegetation would be minimised by clearing the inundation area prior to filling the reservoir. Clearing would remove many tonnes of woody mass and the nutrients contained within, but a substantial nutrient load may remain in leaf litter, topsoil, stumps and roots. It is expected that this matter would cause higher nutrient levels in the reservoir in the first few years of reservoir operation than would occur in later years.

Flooding

The new Dungowan Dam would have a larger spillway than the existing Dungowan Dam and may release marginally more water during flood events, however this would not have any meaningful effect on flood water levels. The new Dungowan Dam would have the capacity to capture small flood events, and flood frequency within Dungowan Valley is expected to reduce marginally.

Sustainable diversion limit

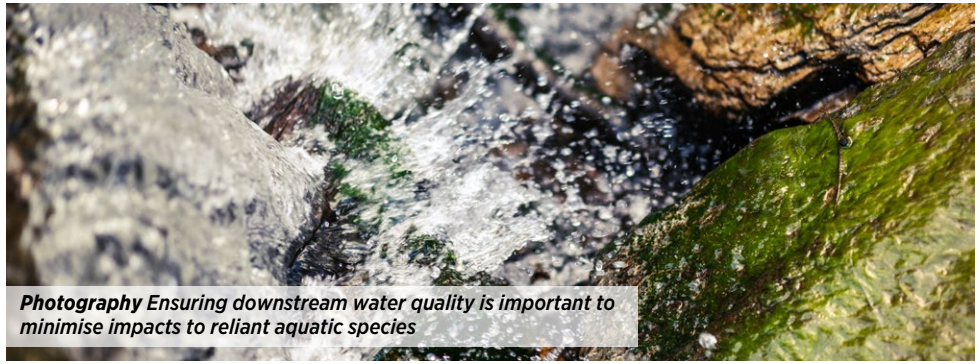
The *Water Sharing Plan (WSP) for the Peel Regulated River Water Source 2022* defines the Long Term Average Annual Extraction Limit (LTAAEL) for the Peel Regulated River water source. Where the extraction of water is likely to exceed the LTAAEL over the long-term, the WSPs prescribes management actions that must be taken.

The WSP recognises that Tamworth Regional Council is the largest single water user in the Peel Valley, and relatively small increases in water use could result in management actions that have a significant impact on other licensed water users. Conversely, there are significantly higher levels of water entitlements and use in the Lower Namoi Valley, and any changes to water access that might arise from growth in water use by Tamworth Regional Council would be distributed across this larger group of water licences and would not result in significant impacts.

Due to a reduction in the frequency and severity of water restrictions and corresponding increase in water used, the project would result in an increase in Town Water Supply usage attributable to the Lower Namoi Regulated River Water Source. However, allocations would only be reduced by around 200 ML to remain within Water Sharing Plan diversion limits, resulting in reductions to Namoi General Security allocations of around 0.2%. As such, there would be no meaningful impact to water resources in the Upper and Lower Namoi and total diversions would be managed to remain within the LTAAEL as required by the WSP.

Changes to Water Sharing Plan

The management of the Peel River catchment surface water resources (including Dungowan Creek) is described in the *Water Sharing Plan for the Namoi and Peel Unregulated Rivers Water Source 2012* and *Water Sharing Plan for the Peel Regulated River Water Source 2022*. As a result of the project and changes to the operational regime within Dungowan Creek with the new dam (including an increase in the Chaffey Dam reserve), changes to these two WSPs will be required. Changes to the WSPs would be prior to operation and in consultation with the community.



***Photography** Ensuring downstream water quality is important to minimise impacts to reliant aquatic species*

Biodiversity

Terrestrial ecology

The main direct impacts of the project are associated with the loss of native vegetation resulting from clearing of land for the construction of the project and from the inundation of the reservoir area during operation, resulting in the loss of 185 ha of native vegetation, of varying condition. These direct impacts include approximately 57 ha of the threatened ecological community, Box-Gum Woodland.

In addition to direct impacts, the project also has the potential for indirect impacts, including edge effects (ie zones of changed environmental conditions occurring along the edges of habitat fragments), temporary habitat inundation during flooding events, and disturbance of animals in adjacent habitat during construction. Indirect impacts have been assessed and are unlikely to significantly impact any threatened species or communities.

Where impacts to threatened species habitat are not associated with clearing of native vegetation (eg caves, cliffs, human structures or vehicle strikes), they are assessed as a 'prescribed' biodiversity impact. Overall, prescribed impacts were found to be unlikely to have a significant impact on populations of any of the threatened species or fauna that are part of a threatened ecological community. For the Border Thick-tailed Gecko, there is a high risk of mortality of a small proportion of the local population during construction, requiring mitigation to minimise this risk.

The project is expected to result in significant impacts on species and ecological communities listed under the EPBC Act including Box Gum Woodland, the Koala, Spotted-tail Quoll, Border Thick-tailed Gecko and Tall Velvet Seaberry.

While no changes are predicted to flows downstream of Tamworth, the project would influence flow regimes in Dungowan Creek and the Peel River. These changes are likely to result in both positive, neutral and negative impacts on different flow events and the reliant ecological objectives identified in the Namoi Long Term Water Plan. There is predicted to be a decrease in the frequency of years with events meeting the target flow thresholds for baseflow flow events, however there are no meaningful changes predicted to mean event volumes or durations.

In Dungowan Creek there is predicted to be negligible change in the frequency of baseflow events. As such, it is likely that the soil moisture levels that riparian communities are reliant on would be retained to a degree that vegetation health and structure would not be significantly impacted. Impacts to species known or likely to occur in the riparian areas of Dungowan Creek and the Peel River upstream of Tamworth would be negligible. Water Infrastructure NSW would compensate for residual terrestrial ecology impacts through the implementation of a biodiversity offset strategy, developed to meet the requirements of the NSW Biodiversity Offset Scheme and the EPBC Act Environmental Offsets Policy.

***Photography** Example of moderate condition Box Gum Woodland near the project*

***Photography** Border Thick-tailed Gecko (*Uvidicolus sphyrurus*) listed as vulnerable under the BC Act and EPBC Act. The species was identified during site survey.*

Native plant community types in the project footprint

PCT ID	Common name	Total (Ha)	Association with listed TECs
84	River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South and Nandewar Bioregions	67.34	Not listed and no association with listed TECs under the BC Act or EPBC Act
381	Rough-barked Apple - Yellow Box grass/shrub footslope open forest, Brigalow Belt South Bioregion	57.20	PCT 381 is classified as 'partially subset' of the TEC, White Box Yellow Box Blakely's Red Gum Woodland. Some PCT 381 vegetation zones within the project footprint are consistent with the TEC listings under the BC Act and EPBC Act.
541	Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion	24.84	Not listed and no association with listed TECs under the BC or EPBC Acts.
563	White Box - Silvertop Stringybark +/- White Cypress Pine grass shrub open forest of the southern Nandewar Bioregion and New England Tablelands Bioregion	1.15	PCT 563 is classified as 'partially subset' of the TEC, White Box Yellow Box Blakely's Red Gum Woodland, however no areas of PCT 563 in the project footprint are representative of the TEC listings under either the BC Act or EPBC Act.
567	Broad-leaved Stringybark - Yellow Box shrub/grass open forest of the New England Tableland Bioregion	5.85	PCT 567 is classified as 'partially subset' of the TEC, White Box Yellow Box Blakely's Red Gum Woodland, however no areas of PCT 567 in the project footprint are representative of the TEC listings under either the BC Act or EPBC Act.
599	Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	28.50	PCT 599 is classified as 'wholly subset' of the TEC, White Box Yellow Box Blakely's Red Gum Woodland. All PCT 599 vegetation zones within the project footprint are consistent with the TEC listing under the BC Act. Some PCT 599 vegetation zones within the project footprint are consistent with the TEC listing under the EPBC Act.
	Total	**184.88**	

Aquatic ecology

Key construction impacts include a loss of key fish habitat and a new barrier to fish movement from the new Dungowan Dam construction, as well as construction risks in the form of habitat removal, construction within waterways and water quality deterioration. Operational impacts are more complex and are associated with the change in flow regime in both Dungowan Creek and the Peel River, as well as other operational issues including cold water pollution and fish migration over the spillway.

Whilst the existing Dungowan Dam is a barrier to fish movement, no fish passage infrastructure is included in the design of the new Dungowan Dam and, as such, would also pose a barrier to fish passage. The construction of the new Dungowan Dam would result in a loss of connectivity to fish habitat via two pathways: the loss of fish passage connectivity to key fish habitat above the new Dungowan Dam, comprising 34.2 km of key fish habitat; and the direct impact to key fish habitat as a result of the construction works and inundation of the dam up to full supply level, which would result in the direct impact to around 210,000 m^2 of key fish habitat. Mitigation of these impacts is difficult given the project involves the construction of a new dam, therefore an offset approach is proposed both for fish passage and key fish habitat loss.

Changes to hydrology is considered a key threat for many species and changes to flow has the potential to negatively impact aquatic habitats. The key period when flow stability is critical is the spring-summer period, which is the breeding/spawning period for a number of listed species including the Silver Perch, Murray Cod, Southern Purple-spotted Gudgeon, Eel-tailed Catfish and Platypus. Successful breeding/spawning for these species is reliant on factors such as access to macrophytes (aquatic vegetation) prior to and during breeding, inundated solid substrates near complex vegetation and increased water levels or shallow waters, all of which may be impacted by hydrological changes.

Although detailed modelling has been undertaken, the results show that there would be both increases and decreases to both the daily flows and depths along much of Dungowan Creek, but with much of the time showing negligible changes in flows or depth. Within the Peel River, the reduction to flow volume and depths has the potential to impact on

***Photography** Juvenile Murray Cod listed as Vulnerable under the EPBC Act*

aquatic habitat and fish passage over natural barriers such as riffles, and is considered to pose a high risk due to potential for disruption of a range of species behaviours.

While impacts to Platypus due to the project are not considered significant, a reduction in feeding habitat may occur due to minor changes to water levels and available riffle habitat. Due to uncertainties in quantifying the degree of impact to riffle habitat, a precautionary approach and high residual risk rating has been adopted.

The effects of cold water pollution are considered either negligible or very minor and would be limited to a distance of less than five kilometres downstream of Dungowan Dam. However, release of colder water during the spring-summer spawning season could result in the potential for spawning of key species to be aborted should breeding cues not occur.

Offsets would be required for the impacts to fish passage as well as for the direct impacts to key fish habitat. Fish passage offsets have been agreed with DPI Fisheries and would include the modification to four existing fish barriers on the Peel River downstream of the new Dungowan Dam, facilitating fish passage to an additional 94.7 km of waterway within the Peel River and Dungowan Creek. Offsets would also be required for direct impacts to 210,563 m^2 of key fish habitat and would require either payment of a monetary offset amount into the Fish Conservation Trust Fund or agreement of other supplementary offset approaches with DPI Fisheries.

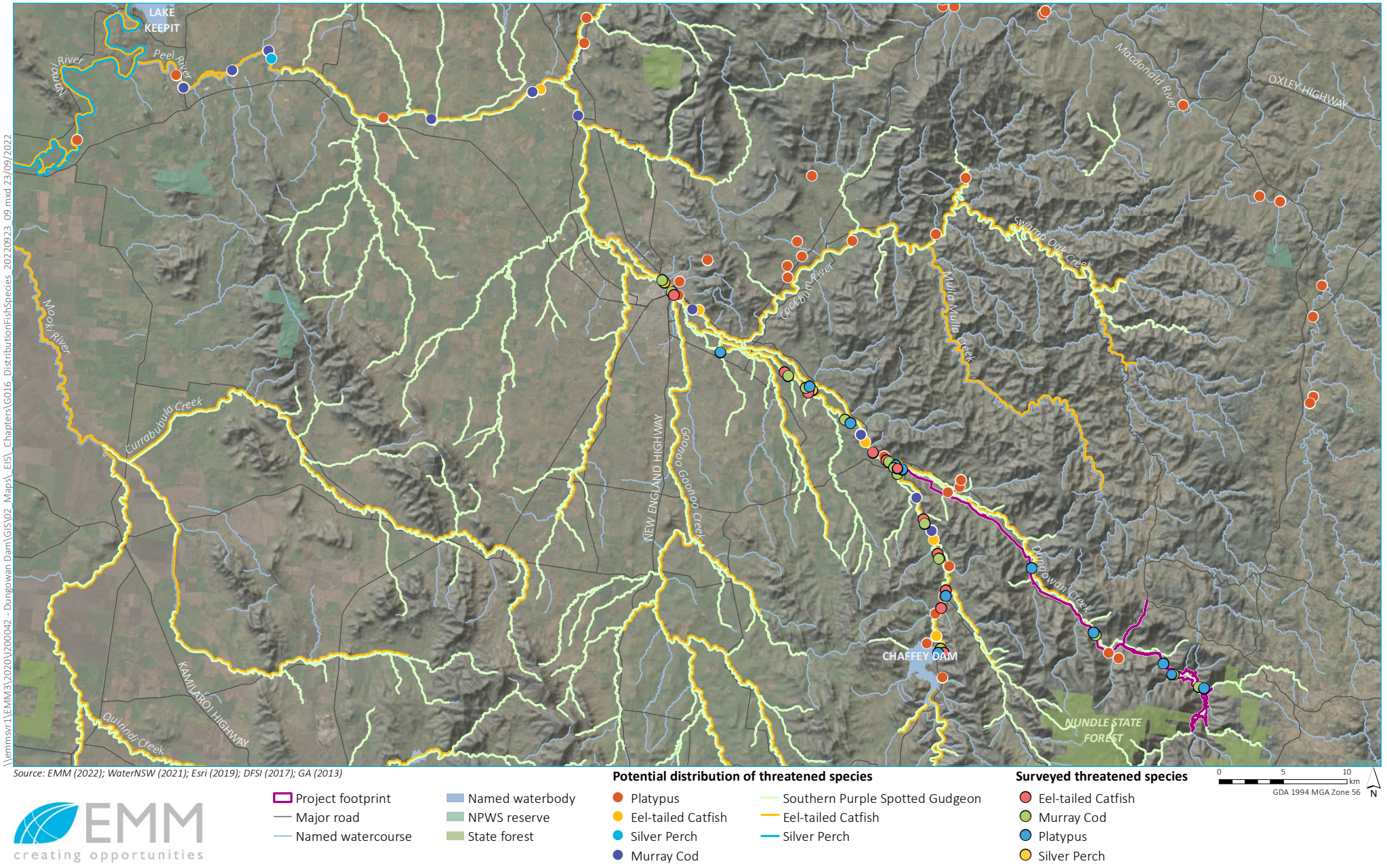


Figure 10. Distribution of threatened species

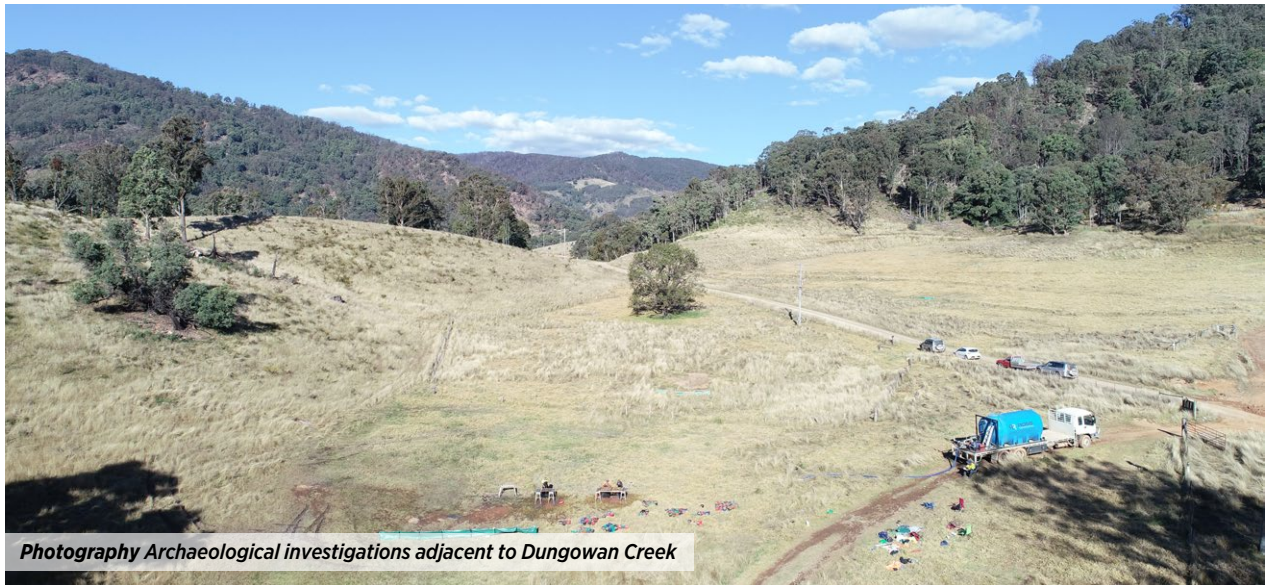
Heritage

Aboriginal cultural heritage

The project area falls largely within the traditional country of the Gamilaroi language group that extends as far west as Lightning Ridge, with the Tamworth region forming the easternmost border. However, the project area is at the edge of this boundary and may also have associations with the Nganyaywana language group to the north, Birpai language to the east and Geawegal language to the south. The territory of the Gamilaroi extended across an estimated area of approximately 75,400 km^2 and represents one of the largest tribes in eastern Australia.

Within the Gamilaroi tribal group, there are two subdivisions; the Corbon Gamilaroi (meaning "the people of the greater country of Gamilaroi") whose territory included the Liverpool Plains and beyond, and the Gammon Gamilaroi (meaning "the people of the lesser country of the Gamilaroi") whose territory included the more southern area from Murrurundi to a very narrow corridor south into the Hunter Valley. The Aboriginal people living around the Peel River and its tributaries, the area of which comprises the project area, were part of the Corbon Gamilaroi.

Consultation has been guided by the relevant guidelines and a project specific Aboriginal Community Engagement Strategy developed with the participating Aboriginal stakeholders. Overall, the project has been liaising with between 10 and 18 registered Aboriginal party (RAP) organisations and/or individuals including a large number of local Aboriginal organisations and/or individuals based in Tamworth and/or immediate surrounds, and a smaller proportion that are based in Sydney and Brisbane but have ancestral connections to the region.



Photography Archaeological investigations adjacent to Dungowan Creek

Opportunity for Aboriginal involvement in the project was provided throughout the Aboriginal Cultural Heritage Assessment and included the following key activities:

- attendance at nine Aboriginal focus group meetings
- participation in a two week field survey of the project footprint
- participation in a six week archaeological test excavation
- participation for key knowledge-holders identified by the RAPs to visit the site with a highly experienced anthropologist to discuss cultural values.

It is anticipated that between four and six out of the 17 identified discrete Aboriginal sites and places would be subject to direct impacts resulting in their complete or partial loss; five would be unaffected, including several of high cultural value; and six would be inundated by the eventual reservoir created. In addition, the project would:

- directly impact 2.2 ha of identified areas of high artefact densities
- directly impact ~42 ha where such cultural material are more likely to be present based on predictive models
- inundate a further ~96 ha of these deposits.

A low-density stone artefact background scatter is considered present across the entire project footprint and would also be adversely affected. A series of investigative actions are proposed to validate the identification of several of the sites that cannot be robustly identified as cultural heritage without specialist input and/or further archaeological research. The locations of potential impacts from direct and indirect activities are shown on **Figure 11** and **Figure 12**.

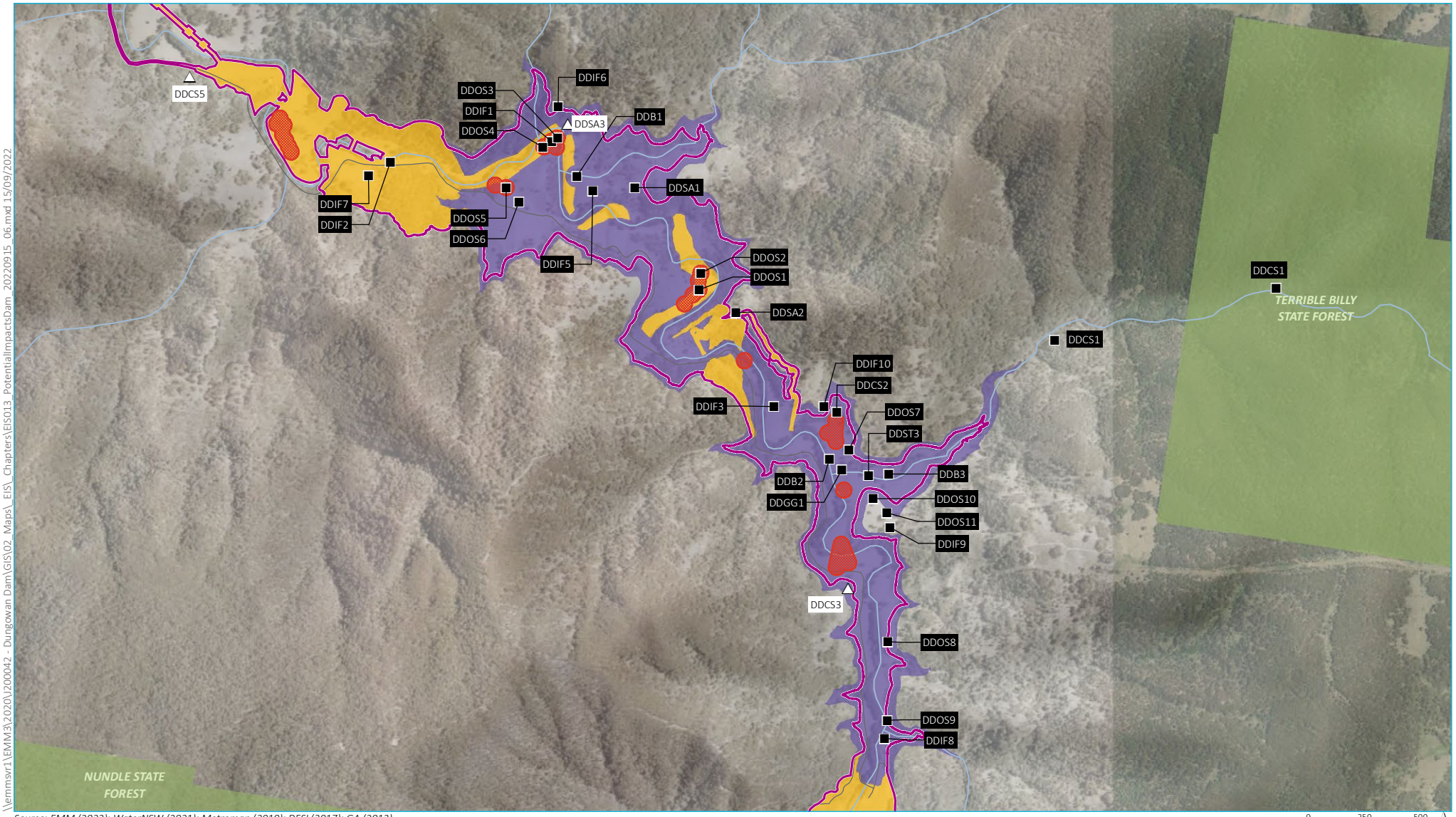


Figure 11. Potential Aboriginal cultural heritage impacts – dam

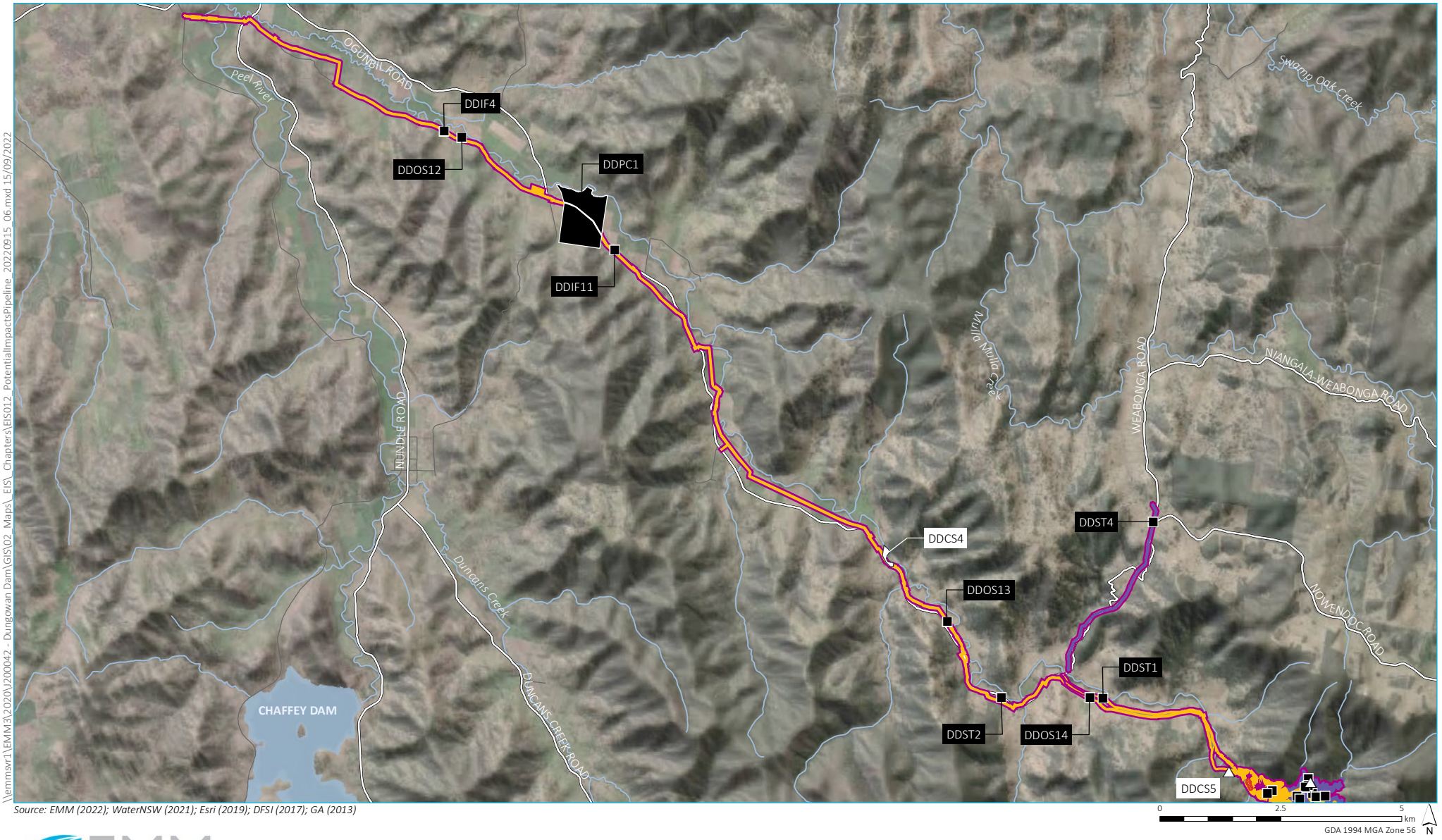


Figure 12. Potential Aboriginal cultural heritage impacts – pipeline and powerline

The majority of the cultural material documented and/or predicted to be present within the project footprint would only be minimally affected by the project. This includes several of the sites identified as of high cultural value by Aboriginal participants that are entirely outside the project footprint. Many of the sites and deposits would be submerged following the completion of the dam and establishment of the reservoir. Evidence from other dam sites suggests that impact to these sites and deposits would be minimal, and constrained to minor burial by silts and sands, but no other substantial modification to the surface or soil profile would be expected.

Meaningful engagement and comprehensive investigations of Aboriginal heritage values of the project area has been undertaken. While the project would result in some intergenerational/ cumulative loss to material culture, there would be numerous cultural heritage benefits. These include the long-term preservation of substantive inundated cultural material that would be inaccessible from future harm, a greater understanding of the past and contemporary values in the region, new 'created' Aboriginal spaces and opportunities for heritage interpretation and public outreach.

Impacts to Aboriginal cultural heritage have been considered and minimised through the project design and would be a key consideration throughout the detailed design process and project construction management.

***Photography** Archaeologists and Aboriginal participants conducting pedestrian field survey*

Historical heritage

Historical value is ascribed to buildings, places, archaeological sites and landscapes modified in the Australian historical period for purposes other than traditional Aboriginal use. In addition to impacts to listed heritage items, research and field survey identified several heritage places or items as shown on **Figure 14**.

Early twentieth century farms in the project footprint have largely been demolished, leaving behind only stockyards, fences and other ephemeral structures. Sites with potential for higher heritage significance are related to Haig's Dungowan Station (1842) for its contribution to the development of the wool industry and its history of squatting and Cadell's Dungowan Station (1867) for its ability to demonstrate the historical development of the area (**Figure 13**).

The existence of a grave was identified early in the investigation through interviews with a former local resident. It was purported that a man by the name of John Wilson was buried in one of the paddocks adjacent to Dungowan Creek, with subsequent project investigations confirming skeletal remains. Investigations are ongoing to confirm ancestry. Should the skeleton be found to be Caucasian, the probability of it being the remains of John Wilson are high and as such the skeleton is of local heritage significance, with the possibility that scientific analysis may provide answers to historical practices that are of State significance. It is believed he was an itinerant worker or swagman. In addition to possessing significance in its own right, the burial contributes to the cultural landscape of the Dungowan Valley. Should the skeleton be found to be of Aboriginal ancestry, consultation would be held with the Aboriginal stakeholders to agree on a final resting place.

The project is anticipated to have minimal impact on listed heritage items and a greater impact on the cultural landscape values. The cultural landscape that would be affected is locally significant for its ability to demonstrate changes to the landscape that have resulted from natural forces and human agency, both pre- and post-British settlement. While some physical impacts would occur, the majority of the impact would be through inundation, which would obscure the landscape rather than destroy it.

The pipeline would be installed through a landscape that was once a part of Dungowan Station, a squatting run that was established in 1847. The original

Figure 13. Dungowan Station (HLRV Parish of Wollomin 1917) showing the location of the project footprint.

headstation belonging to the run is in proximity to the northern extent of the pipeline but well clear of the project footprint. The survival of any features of the headstation, built or archaeological, is unknown and as the project footprint is outside the property, the project is unlikely to impact upon relics or ruins associated with Haig's Dungowan Station. However, two extant properties being the second Dungowan Station that is operating as a farm, and the 'Ogunbil brick shearing shed and silo' may be related to the original Dungowan Station headstation and may possess relics that relate to the historical period.

The installation of a new overhead powerline would occur in the vicinity and across the locally listed Port Stephens Cutting on Nowendoc Road. However, construction of the powerlines would not have a detrimental impact on the significance of the Port Stephens Cutting and footings and poles could be placed in areas that would not physically impinge on the item even inside the listed curtilage.

The existing Dungowan Dam is also considered to hold local significance and therefore, its decommissioning would be recorded.

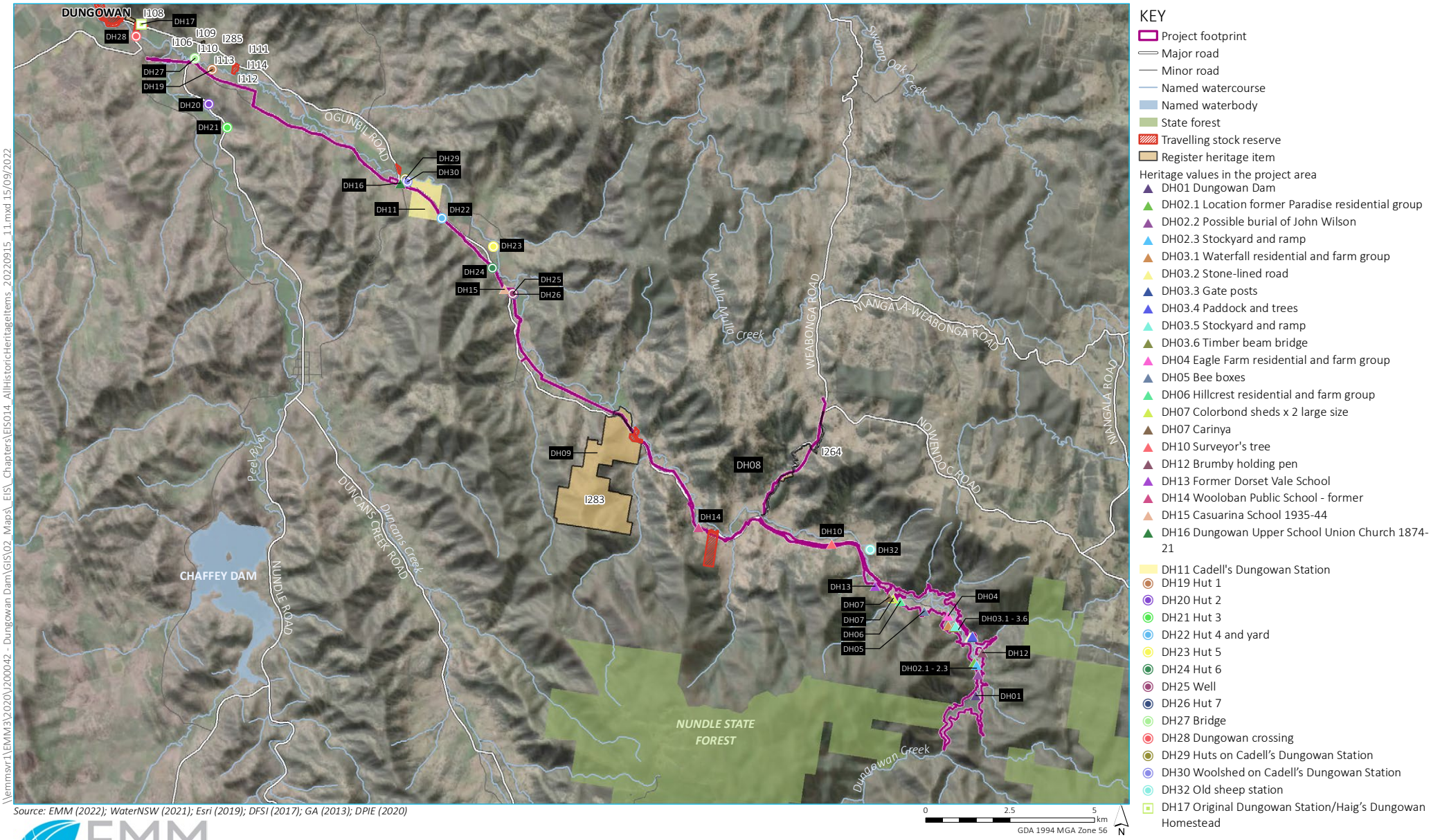


Figure 14. All historic heritage items

Land

The project's impacts to land include the potential for erosion, soil and landform stability, contamination risks and changes to land capability and use. The project impacts are well understood and would primarily occur during the construction phase.

Soil types have been classified using the Australian Soil Classification. Physically the soils are consistently shallow, particularly on the hillslopes, and coarse fragments are consistent throughout all soil profiles. Chemically the existing soil profile has no salinity or dispersion limitations, and subsequently are expected to pose minimal erosion hazard. Other than the area mapped as a high probability of occurrence within the existing Dungowan Dam area, no acid sulphate soils (ASS) were identified within the project footprint through desktop or field investigations.

Soil ranges from high to moderately high in inherent soil fertility on the relatively flat area around Dungowan Creek, to low or moderately low fertility on the surrounding slopes. Current and past agricultural practices, and rural and infrastructure developments associated with these practices, are the key contributing factor to the presence of contaminants of potential concern across the project footprint.

The project would require large scale earthworks across the project footprint, with up to 315 ha of soil disturbance over a construction period of about six years. While potential erosion, sedimentation, soil and landform stability impacts may pose a risk to the environment if not appropriately managed, they can be mitigated and managed through appropriate engineering design and the development and implementation of relevant management plans.

Crop and pastureland would be temporarily taken out of production during and after pipeline construction activities, however impacts would be low due to the small areas involved and the relatively short period of time over which production would be lost. Permanent loss of value due to the loss of crop and pasture land from the operational footprint (158 ha) is estimated to represent only 0.01 per cent of the gross value of agricultural production for the Tamworth Region.

A conceptual model of the potential contamination pathways for the project are shown in **Figure 15**. The project is only likely to interact with known sources of contamination during the construction phase. A risk assessment was completed for each of the key contaminants of potential concern and rated the overall contamination risk as low for all pathways with a low to medium risk for potential acid forming rock and ASS.

***Photography** Grazing and cropping are the primary agricultural land uses in the region*

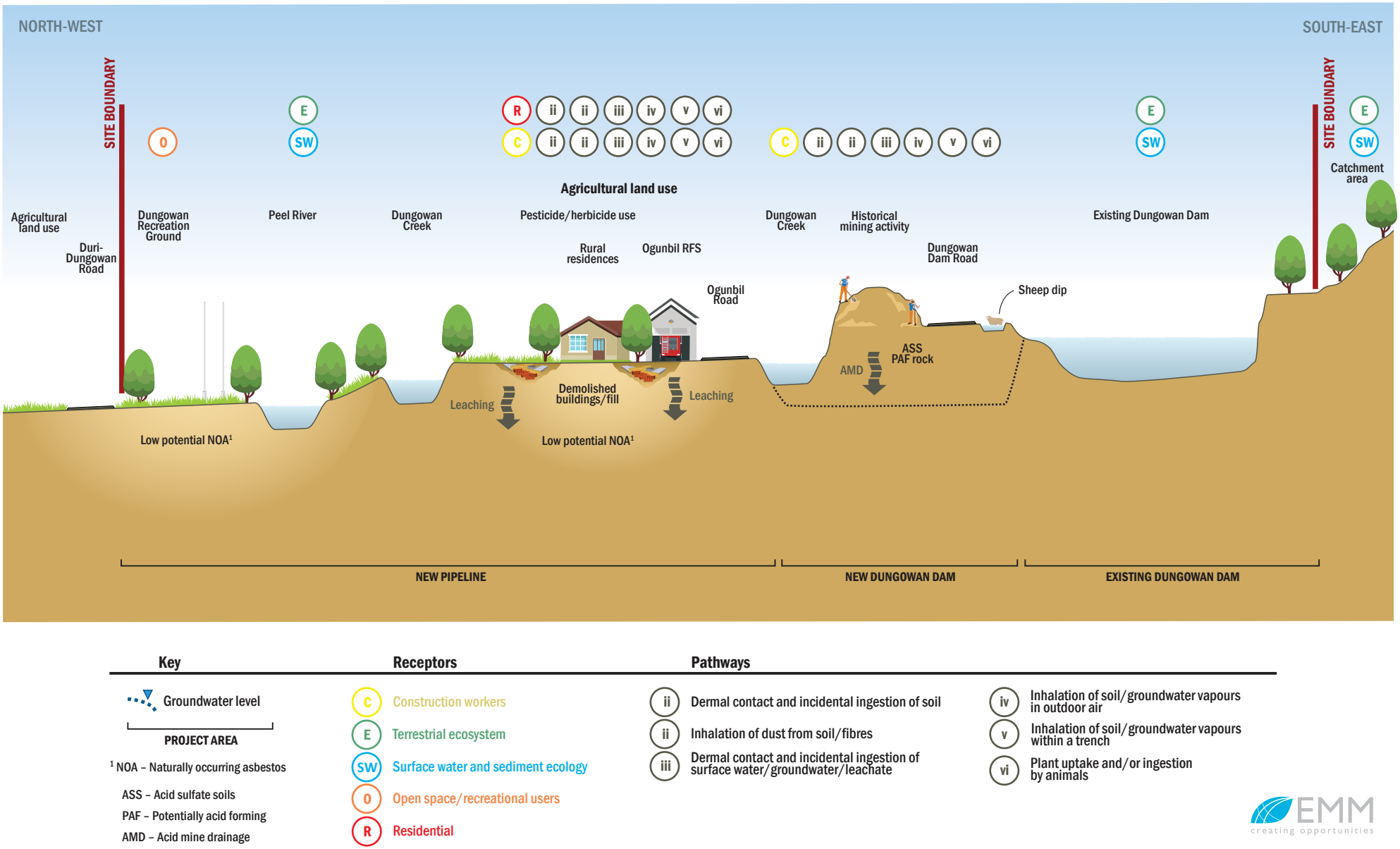


Figure 15. Conceptual site model

Waste

The project approach to waste management would be consistent with principles of the NSW Waste and Sustainable Materials Strategy 2041 Stage 1: 2021–2027 (EPA 2021), with the primary aim of waste management for the project to avoid and minimise the generation of waste, followed by the reuse of any waste material produced.

During construction of the project, waste generated would include general liquid waste, general solid waste (non-putrescible), general solid waste (putrescible), hazardous waste, spoil and potential for special waste such as spoil containing contaminated material. The key sources of waste streams generated by the project include waste from the existing Dungowan Dam decommissioning (including concrete and spoil), vegetation clearing from within the new Dungowan Dam construction footprint and inundation area and general construction waste.

Vegetation clearing during construction would be significant and up to 8,000 tonnes of vegetation waste may be generated. It is expected that the majority, and likely all, of the vegetation waste generated by the project would be re-used or recycled through construction and rehabilitation of the project.

It is expected that minimal waste would be generated during the project's operation. This is primarily because once operational, the project would not require a significant operational workforce to function.

Reuse opportunities identified include reuse of excess excavated material generated by the spillway excavation and spoil from dam decommissioning. Provided the material is suitable for reuse (following a material testing process), the material would be used in natural re-profiling of the downstream areas disturbed during construction, backfilling borrow areas within the reservoir area, or emplaced in a profiled placement area within the former inundation area of the existing dam. Excess excavated material and spoil that cannot be re-used would require management.

The volume and type of waste streams to be generated by the project and the correct classification method, storage and treatment facilities at each construction area would be addressed as part of construction environmental management.

Amenity (Air, Noise, Traffic, Visual)

Temporary amenity impacts can be expected during construction, including dust, noise and traffic generation. Visual impacts due to the presence of construction plant and activities along and in view of public roads are also likely, though temporary and minor in nature. These impacts would be localised and primarily associated with construction of the replacement pipeline and new section of powerline.

Along the pipeline route, the potential traffic impacts would primarily be limited to locations where the project construction activities interact with existing roads. At these locations there may be temporary disruptions to traffic flows through lane or road closures or other access impacts. Forecast traffic may be noticeable but would have minimal impact on traffic flow.

Relevant technical assessments completed for air, noise and traffic determined that impacts are within relevant criteria and guidelines and would not be significant.

Once the project is built and operational, minimal amenity impacts are expected. The new Dungowan Dam is located in a remote location and there are no permanent residences that would have views of the dam or experience noise or air emissions from dam operation and maintenance activities. These activities would result in very low and infrequent vehicle traffic, similar to that experienced for the existing Dungowan Dam.

Valves located along the pipeline route would require access as part of ongoing maintenance, however, are unlikely to result in material air, noise or traffic impacts. These valves are at or above ground and therefore would have some permanent visual impact though this is consistent with other structures in the rural landscape. Two control valves housed within sheds would be the most visible structures.

***Photography** Example of rural landscape near Dungowan*

Public safety

The key risk to public safety during operation is a breach of the embankment of the new Dungowan Dam. Given the high consequences of dam safety risks, this has been a key consideration throughout design of the project and would require ongoing monitoring and management.

Dam breach modelling was completed for the project to provide an understanding of the risks and quantifiable consequence of a failure. The modelling found that during a worst-case event and with no warning system in place, up to 320 persons would be at risk. The modelling highlights the need for appropriate monitoring and warning systems, which would reduce the population at risk, and this is the case for the new Dungowan Dam.

The new Dungowan Dam would be fitted with instrumentation to ascertain the health and performance of the dam and would comply with the NSW *Dams Safety Act 2015* and *Dams Safety Regulation 2019* (and future amendments) during the full life cycle.

WaterNSW has a documented dam safety management system in place, which would include a specific Dungowan Dam operation and maintenance plan and Dam Safety Emergency Plan.

This plan would be prepared in consultation with Tamworth Regional Council, the State Emergency Service and other emergency services, and include specific operation and inspection requirements and include downstream evacuation plans for different emergency events.

***Photography** Existing Dungowan Dam*

Other risks to public safety were assessed including health and bushfire risks, as well as road safety. The findings concluded there are no overall health risk issues of concern for the community and although works are within bushfire prone land, bushfire risk from the project is assessed as low.

A road safety audit was completed for the transport route and identified several actions needed to improve overall road safety along Dungowan Dam Road, and these were adopted into the design or project mitigation measures. This includes reducing the speed limit on Nundle/Ogunbil Road from 100 km/hr to 80 km/hr for the duration of the construction period.

Social and economic

Social impacts were assessed on a worst-case scenario initially and then the residual effect assessed on the basis that mitigation of negative impacts or enhancement of positive impacts are successfully implemented. The social impact assessment was informed by a review of social baseline information, community and stakeholder interviews, and other technical assessments completed for the EIS. The findings are summarised in the table below.

Impacts assessed as having a high negative social impact	Impacts assessed as having a high or very high social benefit
• intergenerational loss of material culture and cumulative loss of material culture • loss of access to land and cultural sites • connections to declining fish populations and impacts on cultural and recreational fishing • bushfire impacts • changes to the landscape	• water security, quality, price and allocations • benefits related to improved access to local services • growth and economic development • increased local employment opportunities

Key social impacts are primarily associated with the construction phase of the project, with many of the social benefits realised once the project is in operation.

Some benefits would be realised during construction, including the economic benefits to the local and regional communities and businesses. The local effects analysis completed for the EIS determined that the project is estimated to make up to the following annual contributions to the regional economy over the 6-year construction period:

- $263M in annual direct and indirect regional output or business turnover
- $94M in annual direct and indirect regional value-added
- 922 direct and indirect local jobs.

***Photography** Employment opportunities during construction and water security during operation are key social aspects considered by the project*

During operation, social and economic benefits of the project include reduced water restrictions, new user access to raw water infrastructure, opportunities for agricultural sector and food production in the local and regional area and supporting regional population growth.

Community concerns raised during the EIS that are uncertain are the impact of price increases on vulnerable residents. The impact of the project on customer water bills as a result of the project was assessed and identified that a minimum bill increase of approximately $50–$53 per annum could be expected for residential users. Any increases would not be applied to general security allocations. However, ultimately water prices are set by IPART and subject to a range of factors, and as such the estimated increase is only a preliminary indication. Overall, the social and economic benefits of the project would outweigh the project impacts.

An adaptive approach is proposed for the project, allowing Water Infrastructure NSW, WaterNSW and/or Tamworth Regional Council to manage and respond to changing circumstances and new information over time through ongoing monitoring and periodic review of social mitigation strategies, allowing for modification if required and appropriate. This adaptive approach would ensure that the management of social impacts identified minimises negative social consequences and maximises social benefits for the community.

Climate change

Climate change can pose significant long-term risks to infrastructure through changes in temperature, rainfall and the increased occurrence or intensity of extreme weather events. A climate risk assessment was completed to investigate the project's exposure and vulnerability to projected climate change variables.

Most of the climate risks identified would not occur during the construction of the project as they relate to long-term changes that would have a greater impact during the operational phase. The findings concluded:

- the direct risks to the project are damage to infrastructure from floods, storms and bushfires, and indirect risks to the project are associated with damage to the electricity network
- the main source of risk to the project is temperature, followed by the impacts of storms
- the project elements with greatest susceptibility to risk are water quality, power supply, the reservoir, dam operations and the embankment.

As a result of the risk assessment, the following priority climate risk areas were identified to be managed by the project:

- maintenance of water quality for downstream users and the environment
- operational impacts from climate-related blackouts
- the impacts of more frequent severe drought and reduced inflows and increased water demand on long-term water supply.

To manage these risks and to enhance the project's resilience to the effects of a changing climate, a range of mitigation and monitoring measures have been presented for further consideration in project design and operation. This includes monitoring of vegetation and debris, regular maintenance and investigation of further water quality improvement options if raw water quality unacceptably deteriorates due to hotter future conditions.

Sustainability

A materiality assessment was conducted to identify the most important sustainability issues for the project, and an infrastructure sustainability (IS) target was determined in accordance with the IS rating scheme (using the IS Rating Tool V1.2).

Two scenarios were considered in terms of an IS rating: a business as usual (BAU) and a stretch target.

The assessment identified a BAU score of 42 was achievable and a stretch target score of 67 could be achieved, resulting in an 'excellent' score relative to IS rating levels.

The project could effectively achieve a Commended rating using a business as usual approach for achieving sustainability outcomes, in particular for the key weighted criteria of water use and water discharge, ecology and habitats, heritage values and stakeholder engagement. However, the project would target an Excellent rating with a minimum target score of 61. The target is considered achievable with increased investment and optimal management of contractor performance.

The target ensures ecologically sustainable development principles are incorporated into a focused design, which considers environmental impacts and sustainability initiatives and carries them into the construction and operation of the project.

***Photography** Climate change can pose significant long-term risks to infrastructure through changes in temperature, rainfall and the increased occurrence or intensity of extreme weather events. Priority climate risk areas for the project relate to downstream water quality, operational impacts and impacts of more frequent, severe drought*

Cumulative impacts

Cumulative impacts describe the impacts of the project together with the impacts of other relevant future projects within an identified area. For the project:

- the relevant area for cumulative impacts to occur is within the Tamworth Regional Local Government Area
- the relevant future projects for the cumulative impact assessment are Chaffey Dam pipeline project, and renewable energy projects associated with the New England Renewable Energy Zone (Middlebrook Solar Farm, Bendemeer Solar Farm, Thunderbolt Wind Farm and Hills of Gold Wind Farm). Other future projects in the region are unlikely to result in cumulative impacts.

The cumulative impact assessment completed as part of the EIS determined the key matters that may be materially affected by cumulative impacts are changes to water, biodiversity and social impacts and benefits, as outlined in the table below.

Cumulative impact	Summary of findings
Water	Primarily neutral or beneficial impacts. The new Dungowan Dam would reduce the frequency and period of time that Chaffey Dam Pipeline would be operational. Any environmental and ecological effects attributed to Chaffey Dam Pipeline operation (e.g. reduction in pool flushing flows) would reduce in frequency when the Dungowan Dam and pipeline project is operational. Indirect cumulative impacts with other projects in the region are likely to be beneficial as a result of improved water security provided by the Dungowan Dam and pipeline project.
Biodiversity	Cumulative impacts to aquatic values are considered negligible. Outcomes for fish passage are likely to improve across the Namoi due to the implementation of project offset agreements that would enhance multiple other waterways downstream of the project. While relatively minor and small-scale clearing of the critically endangered Box Gum Woodland community is proposed for future projects independently, because impacts associated with the Dungowan Dam and pipeline project are considered significant, cumulatively the impacts are also considered significant. Offset strategies respond to the regional threats of threatened species and communities and any unavoidable project impacts would be appropriately offset as required under the *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act.
Social	The potential cumulative peak employment demands for relevant future projects exceeds 1,500 full-time employees as construction periods would likely overlap. As a result, there is likely to be an increased demand for local housing and accommodation due to the influx of workers, as well as demand for other goods and services. This demand could increase supply pressures however would also provide local business benefits.

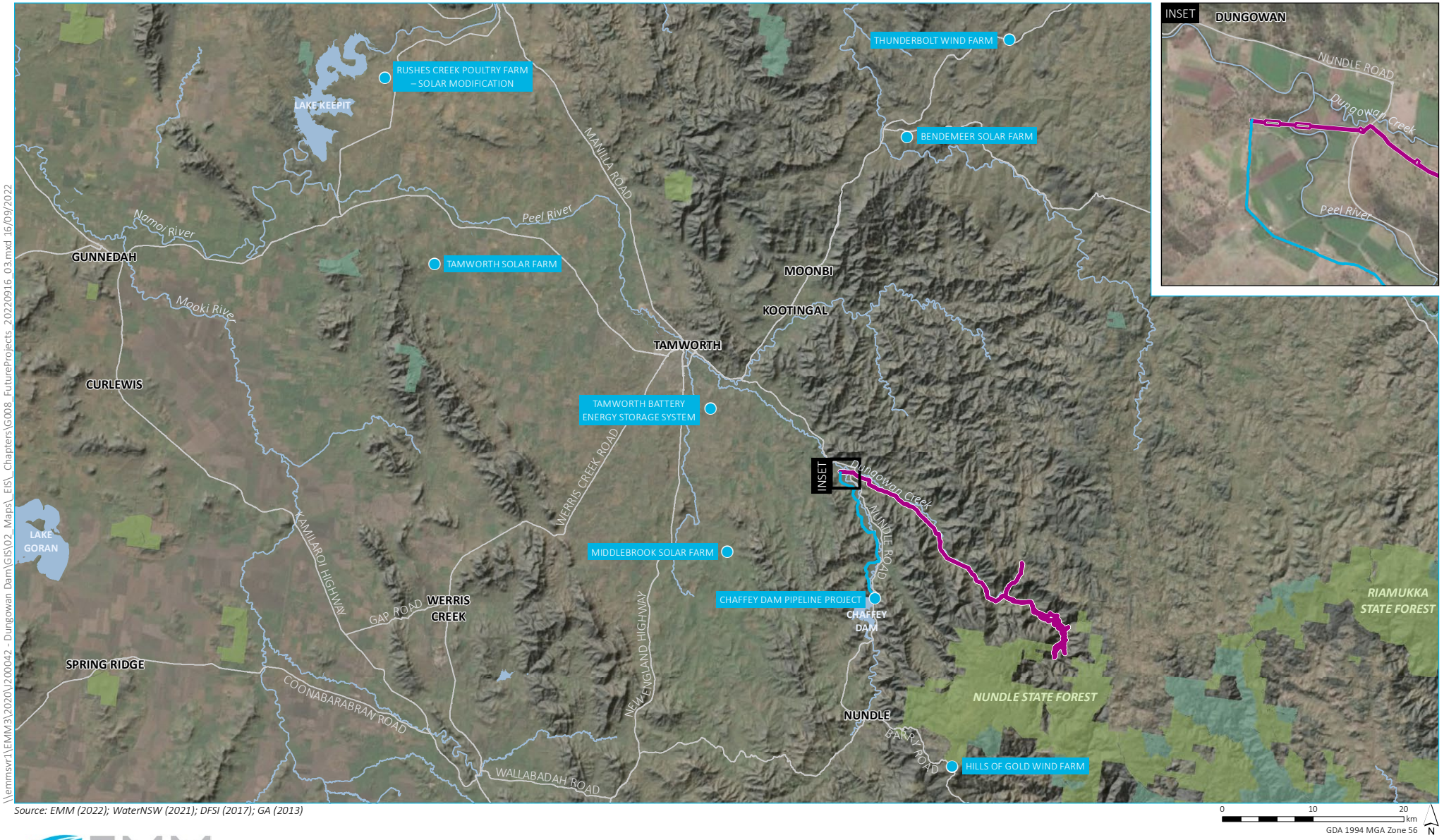


Figure 16. Future projects within Tamworth Regional LGA

Management framework

Photography *Boulders and water at base of Dungowan Dam*

Management framework

Project delivery will be managed by Water Infrastructure NSW, which includes governance and environmental policy shared with DPE Water. However, ongoing operation is proposed to be managed by WaterNSW and Tamworth Regional Council.

There will be key management strategies and plans that would guide the construction and operation of the project, and these are:

- Construction Environment Management Plan (CEMP) and associated sub plans to manage impacts of the project throughout the construction phase
- Operation Environment Management Plans (OEMPs) and associated sub plans to manage impacts during operation and maintenance
- Biodiversity Offset Strategy, prepared to meet the requirements of the NSW Biodiversity Offsets Scheme and the EPBC Act Environmental Offsets Policy
- Surface Water Monitoring Program, to be implemented over the duration of construction and carried forward for longer term monitoring through the operational phase of the project.

Other supporting strategies would be developed to complement the above core plans, including a Heritage interpretation strategy and Cultural Flow Management Plan. The contents and direction of these plans would be developed in consultation with Heritage NSW and the Aboriginal community. A social monitoring framework would also be developed.

Operating principles

The operating principles are key to the operation of the dam and release of flows downstream. The proposed operating principles result in the downstream changes in flows assessed in the EIS. Ongoing investigation of operating principles would seek to further minimise downstream impacts in consultation with relevant State and Commonwealth agencies.

Construction environmental management

The CEMP would be an overarching management plan to provide guidance for the implementation of mitigation measures across a suite of project impacts, including responsibilities for their implementation as well as auditing requirements and incident reporting procedures. The CEMP would ensure the project would meet relevant legislative and compliance requirements. The proposed sub plans to accompany the CEMP are shown in **Figure 14.**

Operation environmental management

An overarching operating plan would be developed by WaterNSW and Tamworth Regional Council (as asset owners) to ensure integration between the dam and pipeline operation, management and maintenance. Associated plans prepared by WaterNSW would include an operations and maintenance manual and a Dam Safety Emergency Plan (DSEP), prepared to meet the requirements of the *Dam Safety Regulation 2019*. Mitigation measures identified in the EIS such as fish salvage and providing for bushfire protection would be included within the OEMPs.

Biodiversity offset strategy

It is likely that a combination of payment into the Biodiversity Conservation Fund, purchase of credits from existing offset sites and creation of new offset (stewardship) sites will be the most efficient way of meeting offset requirements.

Water Infrastructure NSW would target direct offsets based on the priority of exploring the protection of land owned by Tamworth Regional Council in areas of native vegetation adjacent to the project as well as seeking stewardship agreements with private landowners. Staging of offsets is proposed to meet the project's offset liability as shown in the table.

Component	Impact	Offset timing
Stage 1a – dam infrastructure construction	Direct loss of vegetation	Retirement of biodiversity credits prior to construction and/or clearing works commencing on Stage 1a.
Stage 1b – pipeline construction	Direct loss of vegetation	Retirement of biodiversity credits prior to construction and/or clearing works commencing on Stage 1b.
Stage 2a – clearing of the inundation area	Direct loss of vegetation	Retirement of biodiversity credits prior to construction and/or clearing works commencing on Stage 2a.

In discussions with DPI Fisheries, an offsets pathway has been established to offset loss of connectivity to upstream aquatic habitat whereby Water Infrastructure NSW will facilitate the removal, upgrade or bypassing of four existing barriers to fish passage on the Peel River downstream of the new Dungowan Dam. This will facilitate increased connectivity and free movement of fish and platypus between Gunidgera weir and the new Dungowan Dam wall. Whilst details have not been finalised, a draft Fishways Workplan has been prepared and is included in the EIS.

Surface water monitoring

The primary objectives of the monitoring program are to provide additional monitoring of baseline conditions; enable the effectiveness of water quality controls to be assessed; identify and quantify any water quality impacts; identify and quantify any potential impacts on stream flows; and enable compliance with relevant consent and licence conditions to be assessed.

The monitoring program will include requirements to monitor weather, stream flows, process water quantity and quality, stormwater quality and receiving water quality. To monitor the effects of the changes in downstream flows, the program recommends regular surveillance of the Dungowan Creek channel downstream of the new Dungowan Dam, and the Peel River downstream of Chaffey Dam to the Dungowan Creek junction.

Monitoring of geomorphic aspects of the Dungowan pipeline watercourse crossings would also be incorporated and would focus on significant storm runoff events, as impacts are only likely under conditions of heavy rainfall and fast flowing deep water in the channels.

Management of Aboriginal cultural heritage

The management of impacts to Aboriginal cultural heritage will be implemented across the project lifecycle. A key commitment in the EIS is to ensure that cultural material relocated from project impact areas are retained on Country and accessible to the future Aboriginal community.

An Aboriginal Cultural Heritage Management Plan would be developed in consultation with the project's Aboriginal participants to provide the post-approval framework for managing Aboriginal heritage within the project area. An Interpretation Strategy and Plan would be developed to provide acknowledgement and other visual/educational opportunities for the Aboriginal and broader local community. A Cultural Flow Management Plan would also be prepared to further explore and manage hydrological regimes downstream, if affected by the project and its impact on places of cultural value.

Social monitoring framework

Social impacts would be experienced across the construction and operation of the project and have been predicted based on a conservative assessment and consideration of future projects in the region. Management needs to be adaptable based on the actuation of impacts. It is proposed that a social monitoring and management framework would be developed to ensure that the identified positive and negative impacts are monitored over time to measure the effectiveness or otherwise of the proposed management measures. The social monitoring framework provides for regular project updates and ongoing community engagement over the project duration, the capture of information on reported impacts, key performance indicators, targets and outcomes, a complaints handling process, and mechanisms for ongoing adaption of management measures when and if required.

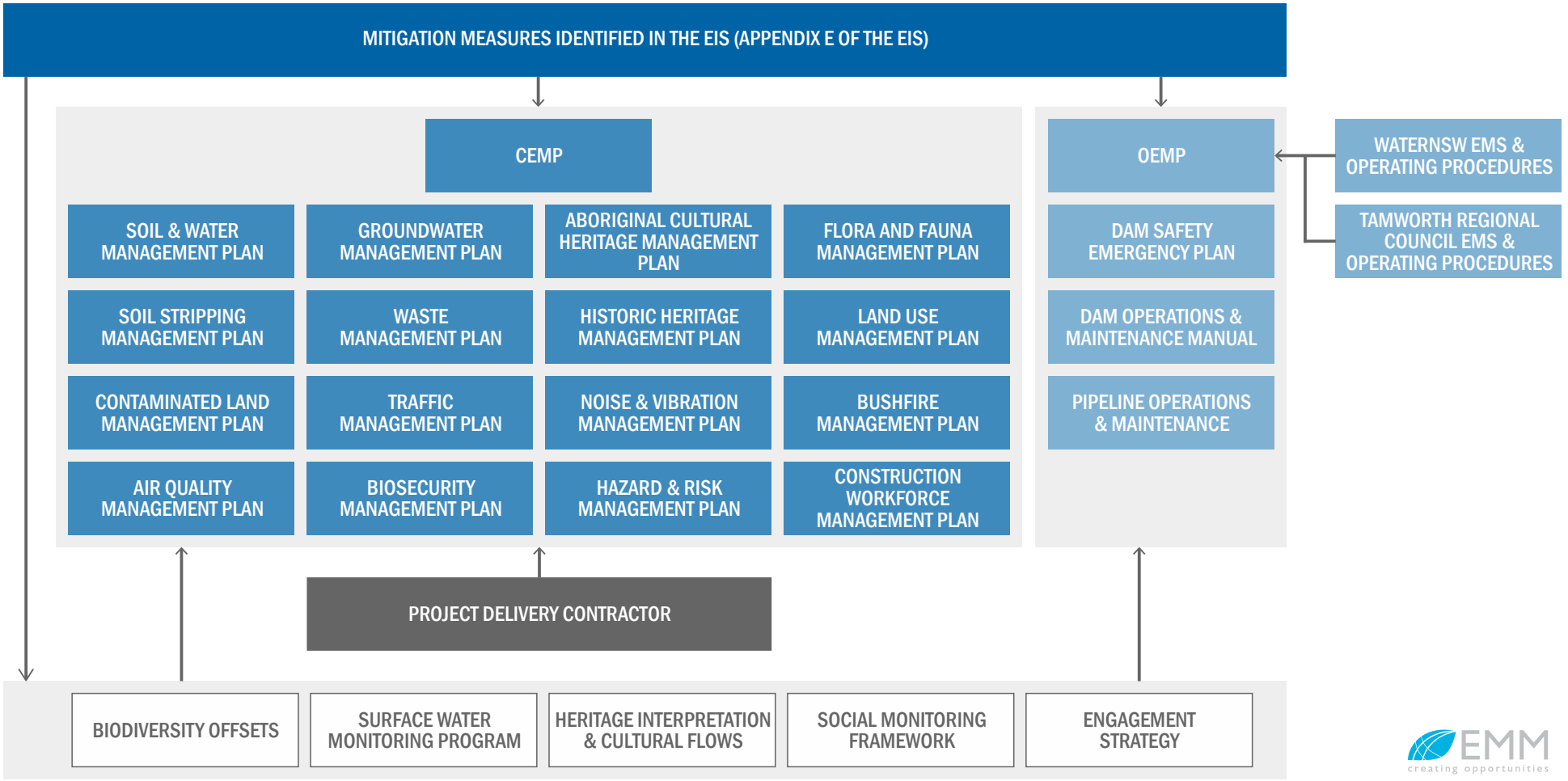


Figure 17. Project Environmental management framework

Engagement

Photography *Dungowan Dam cross over, Andrew Pearson*

Engagement

The project began engagement activities in 2020, with an initial focus on informing the community of the EIS process and how they can engage. As the project progressed, engagement on specific technical areas was undertaken to identify key issues and to ensure they were considered through the development of the project. Engagement has been undertaken in accordance with Undertaking Engagement Guidelines for State Significant Projects, the SEARs and a project specific engagement strategy.

The project team has held 55 community events with close to 1,200 attendees, including meetings with community groups and local organisations. Engagement with landowners whose properties would be impacted by the project has included over 390 meetings, plus targeted community information sessions. The feedback received from these engagement activities have been considered in detail in the EIS and in some instances resulted in refinement to project design (such as the pipeline route and provision for customer connections).

The timeline of the key community engagement activities completed to July 2022 is shown in **Figure 18**.

Consultation with Commonwealth and State Government agencies for the project has also been extensive during the development of the EIS and has included numerous general and issue specific workshops, meetings, emails, discussions and interactions. The hydrological modelling, data, calibration and climate change assessment have been developed in close consultation with DPE Water. The project team has also consulted with agencies such as DPI Fisheries and DPE Environment and Heritage throughout the preparation of key technical studies on assessment methodologies, data requirements, interpretation of impacts and development of offset strategies.

Community and stakeholder engagement would continue throughout the assessment process, including community 'roadshows' during the EIS exhibition period, allowing the community multiple opportunities to view summary presentations from the project team on the EIS and to ask any additional questions they may have to inform any formal submission during the exhibition period.

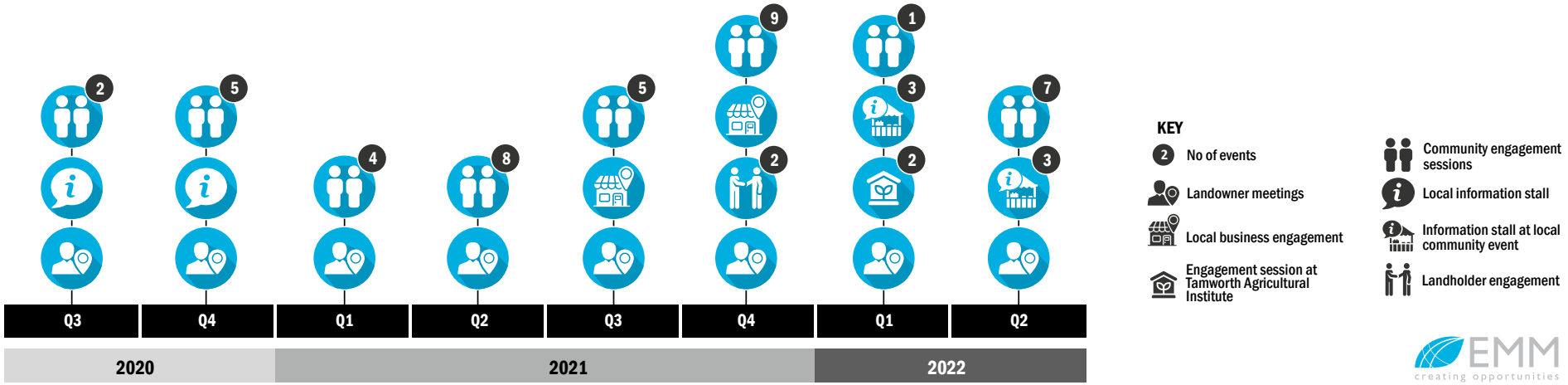


Figure 18. Community engagement activities timeline

Justification for the project

***Photography** View of Dungowan Valley towards new dam, Andrew Pearson*

Justification for the project

The Dungowan Dam and pipeline project has been developed to ensure Tamworth is better prepared for variable climatic events. As evidenced by the most recent drought, the existing town water supply system does not provide sufficient water security.

The project was developed to satisfy the following three objectives:

- **Objective 1:** To improve water availability and security for the town of Tamworth and to enable growth
- **Objective 2:** To provide efficient and affordable bulk water supplies to Tamworth
- **Objective 3:** To promote environmental and social outcomes in Tamworth and the Peel Valley.

Consideration of community views

Community engagement for the EIS began in 2020 and set out to understand community views and incorporate feedback into the project's design and assessment where possible. Examples where changes to the project have occurred due to community feedback include revisions to the pipeline design and alignment, allowing customer connections to the replacement pipeline, ensuring real time data availability in dam safety measures, and ensuring a range of scenarios are considered in water modelling and assessments.

Efforts to avoid and minimise impacts

The project has been developed to avoid and minimise impacts where reasonable and feasible to do so and has been informed by numerous design and technical specialist studies. Examples of avoidance measures include adopting alternate road access via existing fire trails to avoid clearing a substantial perimeter trail along the reservoir, fully decommissioning the existing dam instead of partial decommissioning thereby maximising rehabilitation, and siting quarries and borrow areas within the project inundation area to reduce additional disturbance impacts.

***Photography** The project will support growth in the Tamworth region and build resilience to a changing climate*

Biophysical, social and economic considerations

The project has been assessed with regard to biophysical, social and economic considerations, and taken into account the principles of ecologically sustainable development. Detailed research, field investigation and modelling (where required) has been completed to inform technical studies to ensure a level of certainty has been achieved and to establish a good understanding of the existing environment.

The key residual impacts that are unable to be avoided are:

- Changes to the flow regime in Dungowan Creek downstream of the new dam, and changes to the flow regime in the Peel River downstream of Chaffey Dam. The changes present a high risk to aquatic habitat availability however is unlikely to have a significant impact on threatened fish or aquatic fauna (Platypus). There are expected to be minimal other impacts that occur due to the predicted changes in flow. Offsets for the direct impact to key fish habitat have been calculated in accordance with the NSW Biodiversity Offsets Policy for Major Projects Fact sheet: Aquatic biodiversity.
- Construction of the new Dungowan Dam will result in a loss of key fish habitat and fish passage connectivity. Fish passage offsets would include the modification to four known fish barriers on the Peel River.
- Clearing and ground disturbance of 315 ha of land, resulting in loss of 185 ha of native and riparian vegetation, including 57 ha of Box Gum Woodland threatened ecological community and threatened species habitat. These impacts would be offset in accordance with the Biodiversity Offset Scheme.
- Direct impacts to up to six Aboriginal sites and a further six that would be indirectly impacted by inundation of the reservoir. Direct and indirect impacts to cultural materials generally across the project footprint.
- Impacts on historical landscape values.
- An influx in the external workforce to the local area during construction, increasing demand for local housing, goods and services.

Other impacts identified in the EIS such as soil erosion, potential exposure of contaminated materials, waste generation, and amenity impacts due to dust, noise and traffic generation, are considered acceptable and manageable through standard mitigation measures.

Cumulative impacts of the project with other relevant future projects are limited to water (interaction with Chaffey Dam pipeline), biodiversity (regional cumulative impacts on native vegetation and Box Gum Woodland), and social impacts (overlap of workforce during construction). Water and social impacts would provide neutral or beneficial impacts and impacts to biodiversity are significant as a result of the Dungowan Dam and pipeline project alone.

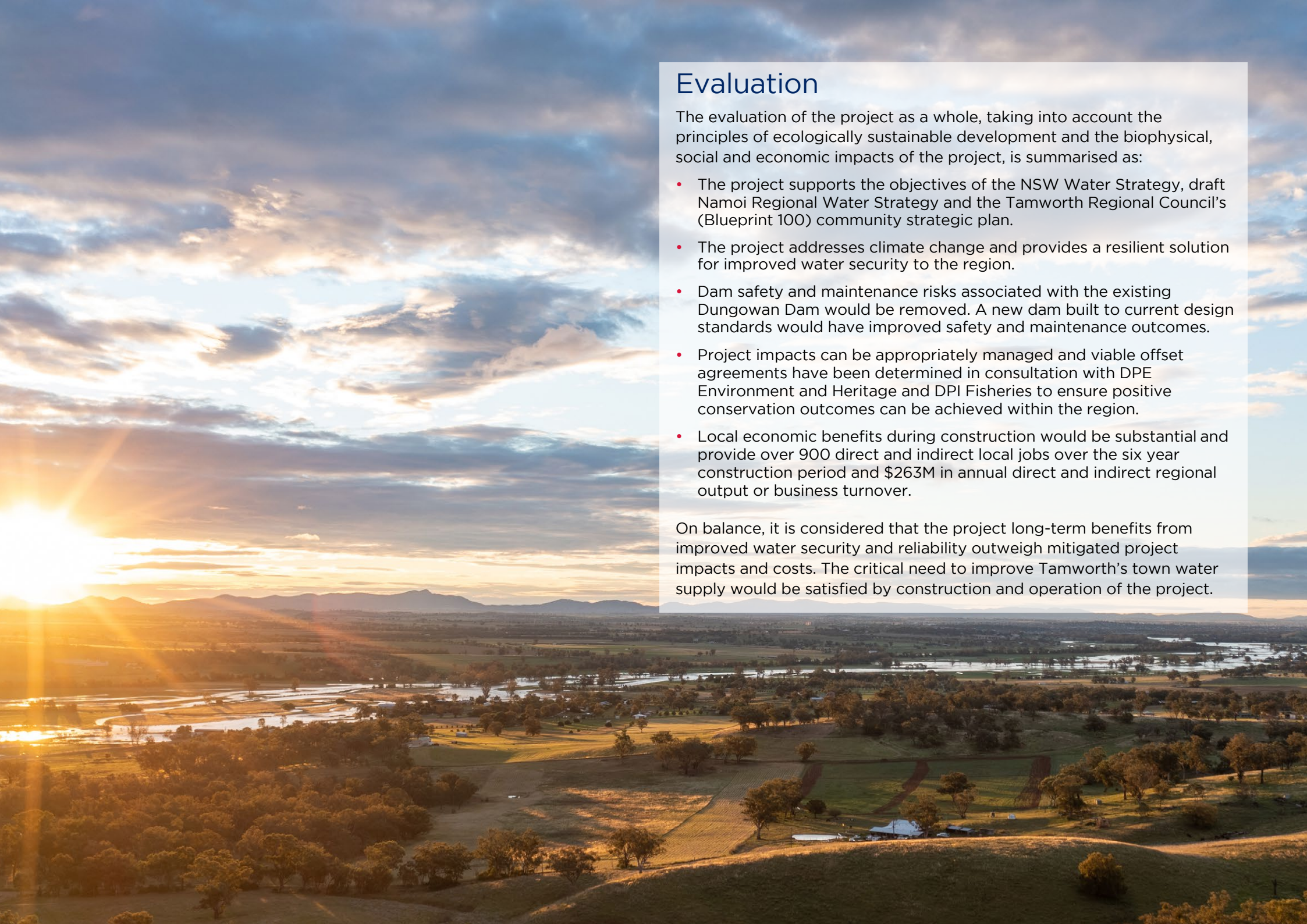
The social and economic assessments highlighted significant benefits of the project including increased local employment and business opportunities. The input to the local economy during construction would be substantial.

Project outcomes

The key project outcomes are:

- improved water security for town water supply as Tamworth's water demand grows
- replacement of aging infrastructure, significantly reducing serviceability and dam safety risks
- substantial local opportunities during construction of the project including opportunities for Aboriginal participation in construction.

As a result of the project and the investigations completed during its development, there is a better understanding of the existing environment and its susceptibility to impacts. Scientific and archaeological knowledge has been improved and the data collected is able to be shared with the community. Biodiversity offsets would be provided that would benefit and enhance regional ecosystems.



Evaluation

The evaluation of the project as a whole, taking into account the principles of ecologically sustainable development and the biophysical, social and economic impacts of the project, is summarised as:

- The project supports the objectives of the NSW Water Strategy, draft Namoi Regional Water Strategy and the Tamworth Regional Council's (Blueprint 100) community strategic plan.
- The project addresses climate change and provides a resilient solution for improved water security to the region.
- Dam safety and maintenance risks associated with the existing Dungowan Dam would be removed. A new dam built to current design standards would have improved safety and maintenance outcomes.
- Project impacts can be appropriately managed and viable offset agreements have been determined in consultation with DPE Environment and Heritage and DPI Fisheries to ensure positive conservation outcomes can be achieved within the region.
- Local economic benefits during construction would be substantial and provide over 900 direct and indirect local jobs over the six year construction period and $263M in annual direct and indirect regional output or business turnover.

On balance, it is considered that the project long-term benefits from improved water security and reliability outweigh mitigated project impacts and costs. The critical need to improve Tamworth's town water supply would be satisfied by construction and operation of the project.

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