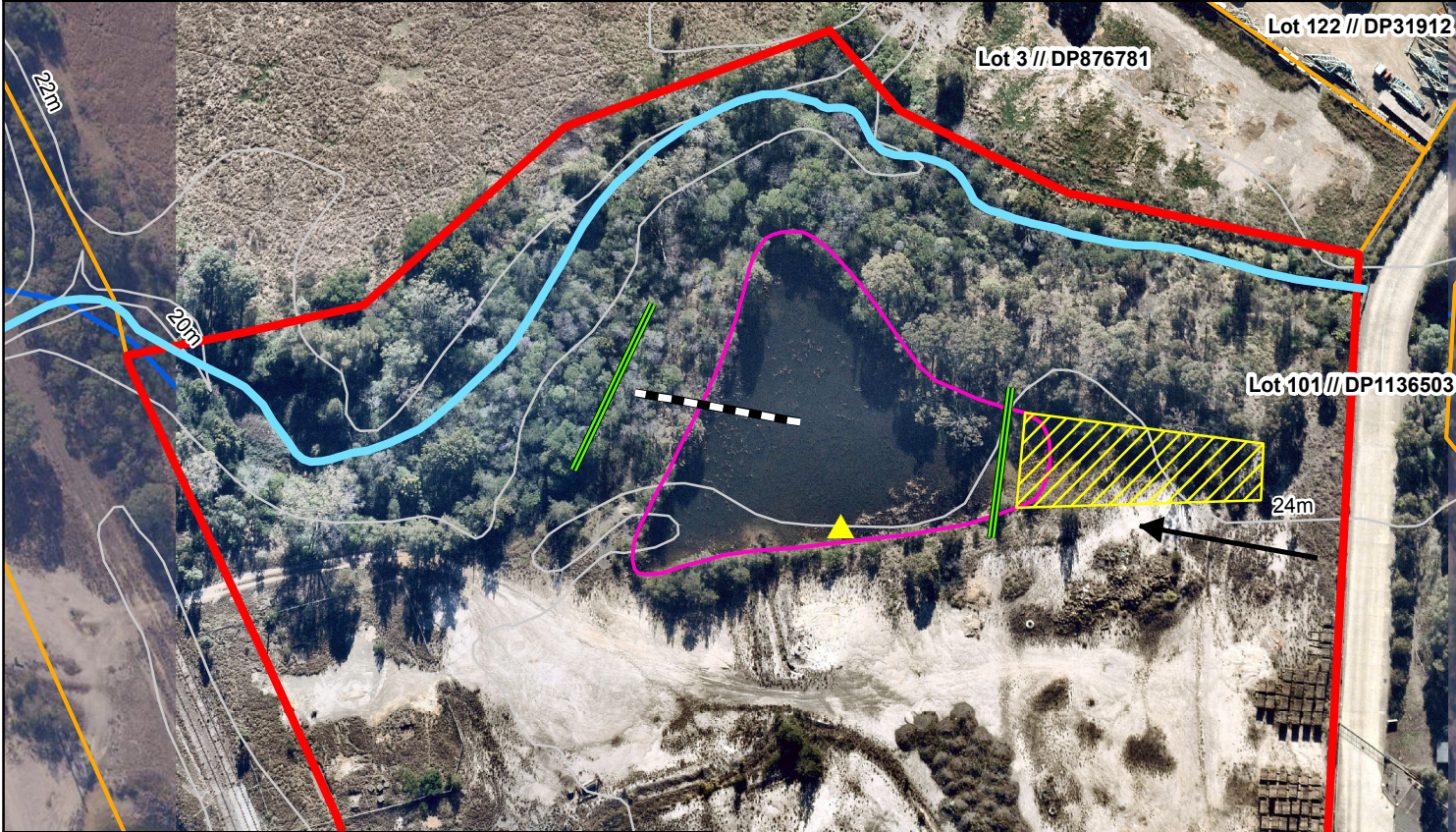


Dam Dewatering Plan: ADDRESS (Lot 2 DP 876781)



Analyte	Dam	South Creek	Guidelines	Units
Total Metals (water)	11/09/2019 12:13	11/09/2019 12:50	ANZECC (1)	
Arsenic (As III / As V)	<0.001	<0.001	0.024 / 0.013	mg/L
Cadmium	<0.0001	<0.0001	0.0002	mg/L
Chromium (Cr VI)	<0.001	<0.001	0.001 (VI)	mg/L
Copper	<0.001	0.002	0.0014	mg/L
Lead	<0.001	0.001	0.0034	mg/L
Mercury (inorganic)	<0.0001	<0.0001	0.0006	mg/L
Nickel	<0.001	<0.001	0.011	mg/L
Zinc	<0.005	0.011	0.008	mg/L
Nutrients			ANZECC (2)	
Ammonia as N	0.03	<0.01	0.02	mg/L
Nitrite + Nitrate as N (NOx)	0.02	0.03	0.04	mg/L
Total Kjeldahl Nitrogen as N (TKN)	0.7	0.5		mg/L
Total Nitrogen as N (NOx + TKN)	0.7	0.5	0.35	mg/L
Total Phosphorus as P	<0.01	0.05	0.025	mg/L
Reactive Phosphorus as P (Filterable RP)	<0.01	<0.01	0.02	mg/L
Biological			ANZECC (3)	
Faecal Coliforms	~43	~28	1000	CFU/100mL
Biological Oxygen Demand	<2	2	15	mg/L
Physicochemical			ANZECC (2)	
Temperature	17.54	10.33		°C
pH	7.7	7.3	6.5 - 8	pH units
Dissolved Oxygen (% saturation)	113.4	59.8	85	% sat
Dissolved Oxygen (mg/L)	10.51	6.47		mg/L
Turbidity	9.7	19.3	50	NTU
Oxidation reduction potential (ORP)	190	166		mV
Conductivity	135	760	300	µS/cm
Salinity	0.1	0.4		ppt
Alkalinity	55	93		ppm
Total suspended solids	<5	<5		mg/L

*values in bold outside ANZECC trigger values
(1) 95% Level of Protection for Freshwater
(2) Default trigger values for low land rivers in south-east Australia (values for NSW & Vic east flowing coastal rivers)
(3) Guidelines for recreational water quality and aesthetics: Secondary contact

Legend

- Site

Dam

Cadastre

1:25,000 waterway mapping (DPI)

Creek Centreline (ELA)

Contours (2m)
- Water quality sample point

Pump clear water

Pump sludge material

Slope

Recommended erosion control



0 10 20 40
Metres
GDA 1994 MGA Zone 56

Version 1
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Dam size, volume and catchment

Surface area = 3,257 m². Max depth estimated as 1 m. Volume = 1.3 ML (0.4 x Surface Area x Depth / 1000). Surrounding land is industrial/commercial. Catchment size of dam is <4 ha. Land slopes from east to west at 1:150 grade. Nearest receiving creek is 35 m downslope to the west which then flows to South Creek (mapped as Key Fish Habitat by NSW Fisheries). Water testing occurred in the dam and receiving waterway at South Creek at Christie St.

Likely contamination issues

Sediment testing will occur post-dewatering to determine its waste classification or suitability for reuse. Water within the dam was generally better than water downstream in South Creek (see table to the left). In the dam, only Ammonia and Total Nitrogen concentrations exceeded ANZECC trigger values, but not by a large amount. Although Ammonia concentration was lower in South Creek, the creek fell outside of guideline trigger values for two heavy metals (Copper and Zinc), Total Nitrogen, Total Phosphorus, Dissolved Oxygen and Conductivity. The dam water had low Faecal Coliform concentration and low Biological Oxygen Demand, and is therefore suitable for irrigation and secondary human contact.

Method of dewatering and fate of water

The dam is offline and collects surface runoff from a small cleared catchment. Most of the adjacent land near the dam is highly compacted crushed rock, which would not soak water into the soil if the dam water was irrigated across it. Given the dam water quality is overall better than the water in South Creek downstream, it is reasonable to slowly discharge the dam into the adjacent ephemeral creek leading to South Creek. Dewatering of his dam should occur prior to any vegetation removal, to help slow flows and prevent erosion and sedimentation downstream. Discharged water should have a turbidity of <50 NTU before it reaches the creek. The intake pipe should be floated to avoid drawing bottom sludge into the pump. Clear water should be pumped over the wall into rows of staked haybales upslope of the ephemeral creek. These haybales will absorb the initial velocity and dissipate flows across a broader area before reaching the channel. Discharge rate should not exceed the holding capacity of the downstream waterway, or cause scouring of bed and bank. Bottom sludge material and remaining turbid water should be excavated and dried on site. As there is minimal suitable land to work with, the dam may need to be compartmentalised with a bund to temporarily store sludge material while the aquatic fauna are rescued from the deepest part of the dam.

Timeline

Day 1	Day 2 - 6 (or longer)	Day 7	Day 8-9	Ongoing
Install bunds to divert surface flow. Install erosion controls (e.g. silt fence, hay bales and/or geotextile fabric) and prepare pump pad. The pump intake head is best positioned on a floating device above the deepest part of dam, held in position with ropes spanning the dam. It is difficult to move the pipe when the water is low, so it's easiest to install when dam is full. Test discharge and diversion to ensure no erosion/sedimentation occurs downstream. Avoid disturbing vegetation where water will travel. Notify Aquatic Ecologist .	Pump water into adjacent ephemeral creek at a slow rate that does not cause erosion or transport of large amounts of woody debris in that channel. Update Aquatic Ecologist .	During final 0.3 - 0.5 m of dewatering allow Aquatic Ecologist to rescue fauna in one day. Water will become turbid as levels drop and when ecologists wade over muddy bottom. This water should be discharged away from the drainage line and onto dry open land where mud can settle. To allow rapid fauna rescue, pump inlet needs to be large enough to suck sediment (e.g. 4 - 6 inch). Earthworks machinery can push sediment across the dam to assist final fish capture (adjusted to suit conditions and ecologist's instructions). Grade escape ramp for fauna hidden in bottom sediment overnight.	Clear surrounding vegetation if part of works plan. Leave escape ramp for fauna trapped overnight (two nights).	Remove sediment and commence reconstruction.

Dam Decommissioning Work Method Procedure; and Sediment and Erosion Control

See Contractor's/Proponent's specifications plus recommendation on this map.

Appropriate permit applications

This dam removal is part of DA. If the dam is licensed with Water NSW, they require notification of dam decommissioning to remove it from the register. Website: www.water.nsw.gov.au/Water-licensing/Applications/default.aspx; Email: Customer.Helpdesk@watermsw.com.au; Phone: 1300 662 077.

Presence of fauna (terrestrial and aquatic) and action plan for any species detected.

Observations during a brief field survey (11/09/2019) found there is no permanent bird population occupying or nesting in the dam. Prints in the soft edge suggest at least one bird species visits the dam, likely *Egretta novaehollandiae* (White-faced Heron). One common species of frog was heard calling in the fringing *Juncus* sp., *Crinia signifera* (Common Eastern Froglet). Large numbers of small-bodied pest fish were observed in the shallows, *Gambusia holbrooki* (Plague Minnow). Other pest species may occur, such as *Carassius auratus* (Wild Goldfish), but given the shallow and clear water Carp are not expected to occur in this dam. No native fish or aquatic reptiles were observed, although based on dewatering activities nearby, it is predicted the following native aquatic fauna could inhabit the dam: *Anguilla australis* (Shortfin Eel), *Anguilla reinhardtii* (Longfin Eel), *Chelodina longicollis* (Eastern Long-necked Turtle) and *Philypnodon grandiceps* (Flathead Gudgeon). No aquatic or noxious weeds were detected in or immediately surrounding the dam.

During dewatering, an aquatic ecologist should be on site to handle aquatic fauna. This will only be performed by a person with the following licenses/approvals: Section 37 *Fisheries Management Act 1994* (for fish); Biodiversity Conservation Licence – *Biodiversity Conservation Act 2016* (for turtles, frogs, wetland birds) (may not be required if the DA Conditions specify an Aquatic Ecologist is to be involved); and an Animal Research Authority (issued by the Secretary's Animal Care & Ethic Committee). The likely **aquatic fauna handling procedures** are:

- NOTICE:** The **Aquatic Ecologist** is to notify NSW Fisheries of the activity 48 hours prior to fish relocation (unless an agreement is in place), including locations of dewatered and relocation sites (see regional office contacts <https://www.dpi.nsw.gov.au/contact-us/local-office>). Fisheries require permits to be carried by the licensed ecologist; who should also display a sign clearly showing licence number (if working in public areas, especially when releasing fauna to local creek).
- PLANNING:** The dewatering schedule should allow time for fish rescue, especially during the final 0.3 - 1 m water depth (to be advised by Aquatic Ecologist). Fauna should be captured in one day, so pumps need to be of an adequate size and placed in an area free from mud and debris (e.g. inside excavator bucket or screened sump pit). If wetland birds are observed nesting, or young birds (chicks) are using the dam, advise the Aquatic Ecologist immediately for advice. Depending on species and age, birds may be able to relocate themselves. Chicks will need temporary refuge during dewatering; or works may need to be postponed.
- CAPTURE:** Fish are to be collected by hand nets during the final day of dewatering. This is most effective when the water is <0.3 m deep. Dissolved oxygen concentration will drop rapidly as water volume decreases, especially in warm water or if lots of fish are present. Larger bodied fish should be targeted first. Wetland birds will scavenge for small fish in the shallows (e.g. Gambusia). Most small fauna will likely remain uncaptured in the dam until the water becomes very shallow (especially eels and turtles). Eels are best captured by large hand nets in water <30 cm deep, although they burrow into mud. When the water is extremely low, turtles and fish may head towards the intake pump (placed in deepest part). This area should be monitored to intercept fauna (e.g. stand in water next to intake). Turtles will burrow into mud and may require observation and rescue the following morning but can also move themselves to suitable nearby habitat if an escape ramp is graded. For safety, at least two people are required when wading and handling heavy tubs of water/fish up banks (excavator can dig access steps/ramp).
- RELOCATE:** Native fish healthy enough for relocation are to be contained and transported in an aerated tub/bucket/tank to an appropriate dam/lake/waterhole/creek. NSW Fisheries advise that the host location should be large enough to accommodate additional fish, especially predatory eels. Additional release sites may be needed. Do not overstock tubs or leave in direct sun for extended periods. Aeration can be provided by battery aquarium pumps or manual turbulence if only stored for a short period. Turtles can be transported in a shaded tub with a wet hessian bag placed inside for moisture and support during transport. Tadpoles can be transported in small buckets.
- RELEASE:** Water from the receiving waterbody should be mixed slowly over 5 - 10 minutes with the tank water to allow fish to acclimatise to the new water quality. Care should be taken when releasing fauna not to also transfer weeds or invasive species (e.g. Carp eggs and Gambusia). Transfer animals via hand nets, rather than tipping the tub with water. Eels can be released on land a few metres from edge and pointed towards the water.
- PESTS:** Exotic fish (e.g. Carp, Gambusia, Goldfish, Redfin Perch, Spotted Livebearer) are to be intercepted, euthanised and disposed of in accordance with the ecologist's Animal Research Authority (issued by the Secretary's Animal Care & Ethic Committee). Exotic *Trachemys scripta* (Red-eared Slider Turtle) are to be contained humanly and DPI immediately notified (Biosecurity Line - 1800 680 244). They will collect the live turtle from the ecologist.
- POST-DEWATERING:** An escape ramp should be graded to allow trapped fauna to escape overnight. Sediment should be left up to two nights to allow hidden fauna to emerge, unless the ecologist confirms there are no fauna remaining (site specific assessment). Earthworks staff should notify the appointed aquatic ecologist if stranded fish or turtles are observed post-dewatering.