Water NSW

WaterNSW Peel River Drought Protection Works Biodiversity Offset Plan

Revised September 2022

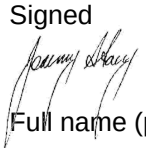
Cover page and declaration of accuracy

- EPBC number: EPBC 2019/8590
- Project name: Operation of the Chaffey Dam to Dungowan Village pipeline
- Proponent /approval holder and ACN or ABN: WaterNSW, ABN: 21 147 934 787
- The proposed/approved action: Operation of the Chaffey Dam to Dungowan Village pipeline
- Location of the action: Tamworth, NSW
- Date of preparation of the environmental management plan: 10 July 2020

Declaration of accuracy

In making this declaration, I am aware that section 491 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed



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Glossary of terms and acronyms

Term	Definition
Biodiversity offset	Actions that are put in place to counterbalance (offset) an impact on biodiversity values.
DAWE	Department of Agriculture, Water and Environment (Commonwealth)
DPIE	Department of Planning Industry and Environment (NSW)
EEC	Endangered ecological community
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
PCT	Plant community type
PEWTAG	Peel environmental water technical advisory group
Threatened biota	Threatened species, populations or ecological communities listed under the BC Act, FM Act and/or the EPBC Act.

1. Introduction

1.1 Context

WaterNSW has implemented a drought response project in two stages to respond to Tamworth's deteriorating reliability of water supply in drought conditions and improve the long-term security of water supply. This is designed to prolong the water supplies in bulk storage and mitigate the water losses during transmission from Chaffey Dam to the Calala Water Treatment Plant (WTP). It includes both permanent and temporary works and would be implemented in two stages.

Stage 1 included installing a temporary weir, intake structure, pump station and pipeline at Dungowan, which is located on the Peel River between Chaffey Dam and Tamworth. This allowed for water extraction from the weir pool and transfer to an existing pipeline that links Dungowan Dam and the Calala WTP. Stage 1 began operation in late November 2019 and ceased operating 17 June 2020. The temporary weir was removed on 9 July 2020.

The Stage 2 works involved the construction of a pipeline approximately 18 kilometres long to connect Chaffey Dam to the existing 54 kilometre long pipeline that extends from Dungowan Dam to the Calala WTP. The two pipelines connect at Dungowan. The pipeline enables water to be pumped from Chaffey Dam and delivered directly to the Calala WTP and this will eliminate the current losses that occur when delivering water to the Calala WTP via the Peel River. The water savings achieved are critical to slowing the depletion of Chaffey Dam and thereby prolonging Tamworth's water supply. The pipeline commenced operation on 17 June 2020.

This Biodiversity Offset Plan has been prepared to meet the commitments outlined within the Drought Operations – Delivery of Peel Environmental Water Plan, approved by the Commonwealth Minister for the Environment, approval reference EPBC 2019/8590 (12 June 2020). The Biodiversity Offset Plan has been prepared to fulfil conditions Part A 4 of Annexure A of EPBC 2019/ 8590. The Commonwealth consent under the EPBC Act expires in 2030.

1.2 Consultation

WaterNSW consulted with NSW DPI Fisheries and DPIE – EES when developing the offsets detailed in this Plan to ensure that they integrate and expand upon existing conservation initiatives being undertaken by these agencies and are directly applicable to offsetting impacts of the project on local populations in the affected stretch of the Peel River.

Operation of the pipeline is a controlled action under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* and was approved by the Department of Agriculture, Water and Environment (DAWE) on 12 June 2020.

According to the EPBC Act *Environmental Offsets Policy October 2012* (EPBC Act Offsets Policy) (DSEWPaC 2012), biodiversity offsets are required for significant residual impacts on threatened species and communities listed under the EPBC Act (i.e. those significant impacts that cannot otherwise be avoided or mitigated through other measures). In accordance with DAWE's decision on 12 June 2020, biodiversity offsets are required for significant residual impacts on Silver Perch *Bidyanus bidyanus* and Murray Cod *Maccullochella peelii*. WaterNSW consulted with DAWE to ascertain the suitability of offsets for impacts to these two species. DAWE were also consulted in the development of this Plan as members of the Peel Environmental Water Technical Advisory Group (PEWTAG) and provided comments on the proposed approach.

The PEWTAG, established under the NSW Authorisation to Operate the Chaffey to Dungowan Village pipeline, will provide advice to the NSW Department of Planning Industry and Environment (DPIE) regarding environmental releases from Chaffey Dam when the Chaffey to Dungowan Village pipeline is in operation. PEWTAG were consulted in the development of this Plan and provided comments on the proposed approach.

1.3 Responsibilities

WaterNSW is responsible for implementing this Plan, which includes:

- Selecting and installing proposed offset measures
- Monitoring of offset measure efficacy
- Securing ongoing funding to allow for monitoring to be completed

A Biodiversity Management Plan (BMP) and Surface Water Management Plan (SWMP) have been prepared for the project and provide details of monitoring and mitigation measures to be implemented during operation to minimise impacts to EPBC Act-listed fish species. The plans are based on the monitoring outline identified within the *Drought Operations – Delivery of Peel Environmental Water*, approved as part of the EPBC 2019/8590. The monitoring and mitigation measures have not been detailed within this Biodiversity Offset Plan. They do however, provide a framework for monitoring and reducing impacts under an adaptive management framework. The monitoring carried out as part of the BMP and SWMP will assess impacts during operation and will end 12 months following the cessation of pipeline operation.

1.4 Limitations

This report has been prepared by GHD for Water NSW and may only be used and relied on by Water NSW for the purpose agreed between GHD and the Water NSW as set out in this report.

GHD otherwise disclaims responsibility to any person other than Water NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

2. Conditions of approval

Table 1 lists the conditions of approval and where each item is addressed in this plan.

Table 1 Conditions of approval reference table

Ref	Cond.	Condition Requirement	Plan reference	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
1	4	To compensate for impacts to Murray Cod and Silver Perch, the approval holder must, within 20 business days of commencement of the action, submit a Biodiversity Offset Management Plan (BOMP) for approval by the Minister. If the Minister approves the BOMP, then the BOMP must be implemented	**This Plan**	EPBC Act approval issued 12 June 2020. Operations commenced on 17 June 2020. BOP submitted 15 July 2020, 20 business days after pipeline operation commencement.
2	5	The approval holder must make all reasonable efforts to ensure the BOMP (in full) meets the following requirements and promptly address any feedback from the Department on unapproved versions of the BOMP so that the BOMP is suitable for the Minister to approve within three months of the commencement of the action.		
3	6	The BOMP must:		
	6(a)	be prepared by a suitably qualified ecologist, and be consistent with the Department's Environmental Management Plan Guidelines and the EPBC Act Environmental Offset Policy	**This Plan**, prepared by GHD Senior Ecologists.	Plan completed as per the Department's Environmental Management Plan Guidelines and the EPBC Act Environmental Offset Policy.

Ref	Cond.	Condition Requirement	Plan reference	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
	6(b)	propose an offset package, including direct habitat restoration works and conservation measures relevant to Murray Cod and Silver Perch	**Offset measures** (Section 3.2)	The two offset measures involve developing and implementing an aquatic habitat assessment and re-snagging plan in consultation with DPI Fisheries that will install a minimum of 50 snags, and installation self-cleaning screens on seven existing pumps. Both of these measures provide habitat restoration and conservation measures relevant to Murray Cod and Silver Perch.
	6(c)	include, but not be limited to:		
	6(c)i	specific objectives to demonstrate improvements in habitat quality and conservation outcomes for Murray Cod and Silver Perch over the life of the approval;	**Offset measures** (Section 3.2) **Offset monitoring** (Section 3.4)	Objectives and key performance indicators have been provided to assess effectiveness of offsets measures.
	6(c)ii	specific management actions, and timeframes for implementation, to be carried out to meet the specific objectives to improve habitat quality and conservation outcomes for Murray Cod and Silver Perch;	**Habitat mapping and re-snagging** (Section 3.2.1) **Self-cleaning screen installation** (Section 3.2.2)	Specific management actions have been proposed to meet specific objectives. • Re-snagging: To increase submerged woody habitat known to benefit EPBC-listed fish species) • Self-cleaning Screen installation: To minimise native fish and entrainment in existing pumps.
	6(c)iii	key performance indicators to demonstrate the improvements in habitat quality and conservation outcomes for Murray Cod and Silver Perch;	**Key performance indicators** (Section 3.3) **Offset monitoring** (Section 3.4)	Key performance indicators will be used to assess effectiveness of offset measures.
	6(c)iv	the nature, timing and frequency of monitoring to determine the success of management actions against key performance indicators;	**Offset monitoring** (Section 3.4)	Monitoring of offset measures using methods used during the baseline monitoring will be used to assess effectiveness of the re-snagging program. An inspection and maintenance program of installed pump screens will be followed.

Ref	Cond.	Condition Requirement	Plan reference	Demonstration of how the plan addresses condition requirements and commitments made in the plan to address condition requirements
	6(c)v	indicative corrective actions that will be implemented in the event monitoring activities indicate key performance indicators are not or are unlikely to be achieved;	**Corrective actions** (Section 3.5)	Corrective actions have been provided in response to monitoring program results.
	6(c)vi	the roles and responsibilities for implementing the management actions;	**Responsibilities** (Section 1.3)	WaterNSW is responsible for implementing the management actions identified within this plan
	6(c)vii	evidence of consistency with relevant conservation advices, recovery plans and/or threat abatement plans;	**Applicability and benefit of offsets** (Section 3.1.3)	Measures are consistent with Recovery Actions detailed in State and Federal Recovery Plans for each species and NSW Threat Abatement Plan for removal of large woody debris from NSW rivers.
	6(c)viii	commitments to maintain or improve the extent and quality of habitat and populations of other EPBC Act listed threatened species and ecological communities in the offset area; and	**Offset requirements** Section 3.1	The habitat improvements as a result of the offset measures would also benefit other EPBC Act listed threatened fish, and aquatic fauna, along with indirect benefits for terrestrial fauna. Indirect positive impacts of re-snagging, for example, include creating and maintaining additional refuges during drought conditions.
	6(c)ix	A timeline and legal mechanism for implementing the offset(s).		The timeline and legal mechanism to implement the offsets is provided in Section 3.2.3.

3. Aquatic Biodiversity Offset Strategy

3.1 Offset requirements

3.1.1 Overview

The EPBC Act Environmental Offsets Policy October 2012 (EPBC Act Offsets Policy) (DSEWPaC 2012) states that biodiversity offsets are required for significant residual impacts on threatened species and communities listed under the EPBC Act (i.e. those significant impacts that cannot otherwise be avoided or mitigated through other measures).

In accordance with the Offsets Policy, biodiversity offsets are required for significant residual impacts on Silver Perch and Murray Cod. These species are known within the Namoi River Valley including the Peel River and are likely to be significantly impacted within the Peel River as a result of the operation of the pipeline.

Offsets are not proposed for the Booroolong Frog because further investigations, including expert advice, confirm that this species is not present in the reach of the river that would be impacted by the pipeline operation (GHD, 2019).

WaterNSW has developed an aquatic biodiversity offset strategy based on the proposed offsets listed in Table 4. These measures will be implemented by 28 October 2023. This plan was revised in September 2022 to reflect that the initially approved implementation timeframe of within 2 years of approval could not be met to due to delays caused by high river levels and the COVID 19 pandemic and the need to identify additional offset installation sites.

The offset measures proposed within the offset plan, self-cleaning pump screens and re-snagging, reduce the impacts of pumping river water by licensed water users on fish fry and fingerlings by stopping entrainment and mortality within the pumps and by increasing aquatic habitat by the introduction of structures within the water course.

The habitat improvements as a result of these offset measures will also benefit the other threatened fish, Platypus and other aquatic fauna that make up the Darling River aquatic EEC, along with indirect benefits for terrestrial fauna. Indirect positive impacts of re-snagging, for example, include creating and maintaining additional refuges during drought conditions (Tonkin et al., 2020) and positive impacts of screening pumps will reduce fish mortality in the catchment.

3.1.2 Impact of operation

The magnitude and duration of impact to Murray Cod and Silver Perch cannot be quantified as the potentially extended periods of cease-to-flow conditions, which will occur due to operation, will be temporary and dependent on prevailing catchment/flow conditions at the time of operation.

WaterNSW implemented the drought response project in late 2019 as an emergency response to ongoing drought conditions. As such, baseline conditions are yet to be established. Current conditions, in terms of fish community composition and distribution, will be established through monitoring to be completed under this Plan.

Baseline aquatic habitat conditions have been assessed by NSW DPI Fisheries during 2019, which identified critical refuge pools within the Peel River and within the upper Namoi River (Table 2). These pools will provide refuge for the threatened aquatic species present within the Peel River and the Namoi River under current and predicted lower flow conditions. Key to minimising impacts within the Peel River to Murray Cod and Silver Perch will be to maintain water levels and water quality within these pools during operation of the project, which will be carried out under the Drought Operations – Delivery of Peel Environmental Water Plan.

Table 2 Critical refuge pools – Peel River and Namoi River

Site name	Location	Latitude	Longitude	Approximate depth (metres) October 2019 data
PEE001	419045 D/S Chaffey gauge pool	31.34639	151.1404	8.1
PEE006	Peel at Dungowan (Temp Weir site)	31.21245	151.1003	
PEE007	Private property. 606 Nundle Rd, Piallamore.	31.16054	151.0374	1.1
PEE008	419070 Tamworth Water Supply gauge pool	31.13358	150.967	4.1
PEE010	419024 Paradise Weir gauge pool	31.10117	150.9371	3.5
PEE011	Nr Corner Kable Ave and Roderick St in town	31.09744	150.9331	2.8
PEE012	Under/Near Jewry St Bridge	31.08172	150.9198	2.7
PEE013	D/S of Jewry St Weir, U/S of Peel Anabranch	31.08124	150.9156	
PEE016	Private property. Hallsville	31.01861	150.8544	4
PEE023	Private property. 4404 Oxley Hwy, Somerton. 5km u/s of Carroll Gap.	30.92766	150.5711	2.3
Namoi River				
UNAM001	Rock fishway	-30.74163889	150.7335	2.8
UNAM002	Gum Hole	-30.56349444	150.93227222	4.2
UNAM003	Namoi River Blue Hole U/S Manilla	-30.64575556	150.83709722	4.4
UNAM004	Junction of Manilla and Namoi River	-30.74771944	150.71505556	1.7
UNAM005	Gunnedah town 1	-30.96467	150.24400278	1.5
UNAM006	Gunnedah Town 2	-30.963197	150.24065278	2.3
UNAM007	U/S Gunnedah	-30.959383	150.44270556	Not measured
UNAM008	Rocky Gully Corner	-30.923569	150.43430833	0.7
UNAM009	Pauls Reserve	-30.85605278	150.14993611	2
UNAM010	HM4 (aka DS Pauls Reserve)	-30.85062778	150.15399444	3
UNAM011	HM6 (Nonda Rd)	-30.793706	150.16159722	3.8
UNAM012	Bluevale Rd	-30.945075	150.22506111	2.1
UNAM013	Bluevale Rd Bridge TSR	-30.937525	150.20541944	1.5

As part of monitoring and management, the Peel River will be monitored in six sections. The key water quality monitoring will occur at the key refuge pools listed in Table 2. These sections are summarised in Table 3.

It can be hypothesised that the greatest degree of impact will occur in reaches which do not have tributary inputs. As such, the greatest impact is likely to be observed in Section 1 (7.1 km), followed by Section 2 (15.3 km) and then Sections 3/4 (25.6 km) and lowest impacts are likely to be observed in Sections 5 and 6, which are at the downstream end of the system so will receive increased tributary flows. Table 3 details the number of tributary inputs and the length of Peel River which is likely to be impacted by cease-to-flow conditions, noting that the shorter distances in the upstream reaches are most likely to be impacted.

Table 3 Peel River section lengths and tributary inputs

Section	Refuge Pool	Location on Peel River	Length (km)	Number of major tributary inputs
1	PEE001	Chaffey Dam to Duncan Creek confluence	7.1	0
2		Duncan Creek confluence to Dungowan Creek confluence	15.3	1
3/4	PEE006, PEE007, PEE008	Dungowan Creek to Cockburn Creek confluence	25.6	2
5	PEE011, PEE012, PEE013, PEE016	Cockburn Creek confluence to Bective	42.4	3
6	PEE023	Bective to Carrol Gap	33.5	3

Key fish habitat is based on a sensitivity classification scheme (NSW DPI, 2013) with habitat classified as being of high, medium or low sensitivity. In relation to the Peel River, the following highly sensitive key fish habitat is likely to be present between Chaffey Dam and the Cockburn River confluence:

- *Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants*

A temporary loss of key fish habitat is likely to occur during operation of the project. The loss of key fish habitat is most likely to occur in reaches that do not receive tributary inputs (i.e. upper reaches such as the section of the Peel River prior to the Duncan Creek confluence – Section 1), with loss of habitat less likely downstream of tributaries while they are contributing to the Peel River flows.

The habitat mapping assessment described in Section 3.4.1 will allow for an assessment and confirmation of key fish habitat and assist with the identification of locations to place snags as part of the offset strategy. The habitat mapping will provide the basis for periodic monitoring to identify the type and extent of impacts that are attributed to operation of the project and to assess the benefits of re-snagging.

3.1.3 Applicability and benefit of offsets

The offset measures which will be implemented will assist with the recovery of EPBC-listed fish (Silver Perch and Murray Cod) by providing indirect offsets to mitigate the reduction in flows from Chaffey Dam. In selecting these measures, recommended actions in the following Recovery Plans for each species were taken into consideration:

- NSW DPI (2006) Silver Perch *Bidyanus bidyanus* NSW Recovery Plan
- NMCRT (2010) National Recovery Plan of the Murray Cod *Maccullochella peelii peelii*
- Clunie and Koehn (2001) Silver Perch: A Recovery Plan
- ACT Government (2017) Native species conservation plan - Murray Cod (*Maccullochella peelii*)
- Department of the Environment (2013). Conservation Advice *Bidyanus bidyanus* (silver perch)

In addition, the following Threat Abatement Plan was reviewed to ascertain the current threats to these species:

- NSW DPI (2007) Threat Abatement Plan Removal of large woody debris from NSW rivers and streams

Silver perch were once common in the Namoi River Valley but are now listed as critically endangered. Efforts are being made to re‑establish a sustainable population of them in the Namoi and Peel rivers. (CEWH, 2017). The Murray Cod population in the Namoi River (from the Peel River junction) is listed as an important population that appears to be in good condition (defined as widespread, abundant and recruiting) (NMCRT, 2010). Murray Cod are known to spawn in the Namoi River (NSW DPI 2012) and in the wider Barwon/Darling catchments downstream (Sharpe and Stuart, 2018). The close proximity of the Peel River to the Namoi River indicates that the Peel River is also a potential spawning location for Murray Cod.

The reviewed recovery plans provide the following information, relevant to the offset measures which will be implemented.

Habitat degradation/de-snagging

Murray Cod is considered a main river channel specialist with a strong affinity for woody in-stream structure (Koehn, 2009; Koehn and Nicol, 2016). Murray Cod require snags to complete their life cycle. It is known they make an upstream migration to spawn before returning to the same area they occupied, usually the same snag (Lintermans, 2007).

One of the reasons Murray Cod were listed under the EPBC Act was the negative impacts of de-snagging of rivers and streams - removing woody in-stream structures that provide habitat (ACT Government, 2017). De-snagging has undoubtedly reduced or destroyed prime habitat for adult Murray Cod, and has also led to fragmentation of remaining available habitat (NMCRT, 2010). Murray Cod populations tend to remain in riverine environments that preserve lotic conditions and high loadings of large woody debris (Koehn et al. 2009; Lyon et al. 2019). Breeding Murray Cod use snags as nests, with snags creating hydrodynamic diversity, which increases recruitment success (Sharpe and Stuart, 2018). Snags also provide habitat for prey of each Murray Cod life-stage (zooplankton, macroinvertebrates and smaller fish) (Harris and Rowland, 1996, Baumgartner, 2007).

Drawing on the findings of Lintermans (2007), that Murray Cod undertake an upstream spawning migration and return to the same downstream area they previously occupied, the removal of snags directly impacts the likelihood of Murray Cod spawning success. NMCRT (2010) list re-snagging as a key rehabilitation action. Price and Lovett (1999) recommend restoring snags to loads comparable to natural levels or if this information is not available, then a general rule is 0.01 m^3 for every m^2 of channel. Although not directly related to the Peel River, Tonkin et al. (2020) predicted, on average, a 4-fold increase (95% C.I. 2.03–8.15) in abundance of Murray Cod following a change in instream woody habitat (i.e. snags) density from low levels observed in the study to the predicted natural levels, providing evidence of the quantifiable benefit of re-snagging. In the Murray River, the addition of 0.01 m^3 of woody debris items per m^2 resulted in an increase in native fish including Murray Cod (Nichol et al., 2004). In terms of a temporal prediction of benefits, Cod are known to use snags within 12 months (DEPI, 2014).

The importance of snags for Silver Perch is not known, but it appears they are less dependent on woody debris than other species such as Murray cod, trout cod and golden perch (NSW DPI, 2006). However, Silver perch are omnivorous - their diet consisting of aquatic plants, snails, shrimps and aquatic insect larvae (Lintermans, 2007). The role of woody debris as habitat for macroinvertebrates and algae has been well documented (Nicol et al., 2002). As such, the re-introduction of instream woody habitat is likely to provide shelter and a food source for Silver Perch prey, which will indirectly benefit the species.

NSW DPI (2007) state that some of the reasons for the decline of fish populations in river reaches affected by de-snagging and vegetation clearing include:

- Loss of general habitat for snag-dependent species such as Trout Cod and Murray Cod
- Reduction in pool habitat formed by scouring and debris dams. Pool development, particularly in rivers that have experienced channel enlargement, is instead restricted to river bends
- Loss of spawning sites - hollow woody debris is used as spawning sites by some fish species, particularly River blackfish

Loss of fish to irrigation pumps

The potential for direct loss of native fish into irrigation channels and through pumps is unknown, but could potentially be relatively high (Koehn *et al.* 2004; Koehn 2005b; Lintermans and Phillips 2004 cited in NMCRT 2010). NMCRT (2010) noted that while fish exclusion devices are used elsewhere in the world to avoid fish loss to irrigation systems, no exclusion devices have been fitted to irrigation offtakes, despite the heavy reliance on irrigation water in the Murray Darling Basin. However, in an assessment of screens on pumps in the Murray Darling Basin, Boys et al. (2013) determined that mesh size (either 5, 10 or 20 mm) had little impact on contact or entrainment of small bodied fish and suggested approach velocities are the primary consideration and should not exceed 0.1 m/s.

Although the magnitude of the current threat of irrigation pumps to Murray Cod and Silver Perch is largely unquantified, Baumgartner *et al.* (2009) provide estimates of un-screened pumps on the Namoi River fish population. They reported that up to 232 fish were entrained by a single pump and that small-bodied or juvenile fish were most at risk. Murray Cod, although not killed, were effectively removed from the river system and were unable to return. Boys et al. (2013) determined the presence of screens significantly reduced entrainment of Silver Perch and Golden Perch juveniles, in some cases from a mortality rate of 90% to 2%.

Summary

The offset measures proposed are consistent with Recovery Actions detailed for both Murray Cod and Silver Perch. In addition, the offset measures will contribute to mitigating recognised threats to fish populations in the Namoi catchment.

3.2 Offset measures

Two offset measures will be implemented:

- A re-snagging program
- Installation of pump screens

3.2.1 Re-snagging

Habitat mapping will be used to guide the re-snagging offset measure by identifying specific locations along the river that would benefit by rehabilitation via re-snagging. Snags are trees, large branches and root masses that are found in rivers and are important habitat for aquatic life, particularly native fish. Snags were removed from many reaches of river and re-snagging operations are being undertaken throughout the Murray Darling Basin to improve available fish habitat and river health for fish populations. Re-snagging involves placing large woody debris into the river, which becomes submerged woody habitat for aquatic fauna. Re-snagging is an indirect offset as the impacts to Murray Cod and Silver Perch due to cease-to-flow periods cannot be accurately quantified. The benefits of re-snagging, and the impacts of historical de-snagging are provided in Section 3.1.3.

River habitat mapping commenced during August 2020 for completion during September 2020. The re-snagging program will be completed by WaterNSW and follow principles outlined in Nicol *et al.* (2002).

Section 3.4.1 provides information on the habitat assessment which will be completed prior to re-snagging to identify:

- Specific locations along the river that would benefit from re-snagging (i.e. areas with relatively low density under current conditions)
- Type, size, shape and quantity of snags

The site selection process to identify re-snagging locations will also consider known refuge pools, accessibility and land ownership in its assessment of suitable locations. Position and orientation of each individual snag in the river and type, size, shape and quantity of snags would be confirmed by WaterNSW in conjunction with DPI Fisheries once habitat mapping is complete. A minimum of 50 snags will be installed in the Peel River, providing direct benefit, in terms of key fish habitat, over a distance of 50 km. The indirect benefits are likely to include an increase in spawning/nesting sites (especially for Murray Cod), which will increase the likelihood of spawning and recruitment success, thus benefitting threatened fish populations within the greater Namoi catchment.

3.2.2 Self-cleaning screen installation

WaterNSW has identified potential pumps that would be suited to have self-cleaning screens installed based on their size, their location along the reach of river most likely to be affected by operation of the project, and the pool's suitability for future fish restocking programs. These measures will be implemented and have been developed to address the requirement of DAWE's decision under the EPBC Act and the Minister's Authorisation by providing conservation outcomes for threatened fish species and other aquatic fauna. The offset measure aims to improve the viability of Murray Cod and Silver Peach in the Peel River and Namoi River system and align with the recovery objectives and key actions for threatened species and strategies to respond to key threatening processes (see Table 4). The use of self-cleaning pump screens will reduce the need for maintenance by pump owners, thus increasing efficiency of both pumps and screens.

DPI Fisheries has advised WaterNSW that five of the 12 refuge pools have sufficient depth to be candidates for re-release of captured fish or fingerling release once higher flow conditions return. Improving survival rates of fingerlings will maximise the success of any restocking program and the long term response and recovery of threatened fish within the Peel River and Namoi River. This offset measure will reduce impacts on fish populations within the Peel River and Namoi River and its catchment by reducing mortality due to pump infrastructure.

Installing self-cleaning screens on existing pumps will reduce the risk of the fingerlings being entrained by surface water licence holder's pumps. The proposed offsets will improve the likelihood that fingerlings will survive in the Peel River, downstream from Chaffey Dam so they are able to disperse to the broader Peel and Namoi catchments.

If suitable pumps on the Peel River are not available to receive the self-cleaning pump screens, (for example, unwillingness of pump owner, or lack of suitable pumps) additional sites required to achieve the pump screening target will be investigated and installed on the Namoi River. Site selection criteria will be consistent for all nominated sites across both rivers. Screens will be fitted preferentially and located with proximity to key fish habitat areas and/or river stretches where pools are persistent as identified by DPI Fisheries. Initial candidate sites on the Namoi River are identified in Table 2 and further sites if required are listed in Appendix Table 1.

3.2.3 Timeline and legal mechanism for offset implementation

Agreement with the pump owners will be achieved and implemented through a legally binding contract that specifies ongoing use and maintenance requirements. This mechanism is being followed as it will provide the necessary certainty required to maintain the offset measure for the life of the Approval. Installation and operation of the offset is required to occur within two years from the date of the Biodiversity Offset Plan approval. In September 2022, WaterNSW sought a 12 month extension to the period initially proposed and approved to install the offsets due to delays caused by high river levels and the COVID 19 pandemic and the need to identify additional offset installation sites.

Table 4 Offset measures, recovery objectives and actions

Description of the offset	Benefit / conservation outcome	Recovery objective	Recovery action	Timing	Duration	Scope
A re-snagging plan would be developed in consultation with DPI Fisheries. Habitat mapping of the Peel River between Chaffey Dam and Tamworth (53 km) will be carried out to ensure that locations selected for re-snagging are beneficial to threatened fish species and other aquatic fauna currently inhabiting the Peel River.	Using information from habitat mapping and other criteria, reinstate large woody habitat (snags). The re-snagging would provide habitat that is suitable for juvenile and reintroduced native fish during drought recovery and in perpetuity.	Increase submerged woody habitat known to benefit threatened fish species and their prey/food sources.	Install snags in these locations.	Measure to be completed by 28 October 2023.	Installation of snags commissioned by WaterNSW. No maintenance following installation.	Installation of 50 snags in appropriate locations.
Install pump screens on extraction points along the Peel or Namoi Rivers downstream from Chaffey Dam.	Engage with local land owners who own and maintain pumps within the Peel River or Namoi River downstream from Chaffey Dam and fund the retro fitting of pumps to utilise pump screening technology which is beneficial to native fish. This will benefit native fish populations in the long term by minimising loss of fish, including restocked fingerlings, due to operation of the existing pumps.	Minimise native fish entrainment in existing pumps.	Reduce the loss of native fish through irrigation systems and improve water diversion practices to reduce loss of fish.	Measure to be completed by 28 October 2023.	Installation of pumps commissioned by WaterNSW.	Fit screens to seven pumps preferentially located with proximity to key fish habitat areas or locations where re-stocking may take place, identified by DPI Fisheries.

3.3 Key performance indicators

Key Performance Indicators to demonstrate the improvements in habitat quality and conservation outcomes for Murray Cod and Silver Perch are detailed in Table 5. The KPIs will be monitored as specified in Section 3.4.

3.4 Offset monitoring

Table 5 details monitoring required to assess the success of the offset measures. The primary monitoring method to detect the efficacy of the re-snagging measure will be aquatic habitat assessment, along with fish population monitoring.

Installation of self-cleaning screens and their efficacy will be monitored as an asset for the life of the EPBC Approval.

WaterNSW is responsible for carrying out or commissioning all monitoring activities related to the offset measures. Details of the monitoring to be completed is provided in the following sections.

3.4.1 Riparian and aquatic habitat

WaterNSW has engaged DPI Fisheries to map riparian habitats along a 53 kilometre reach of the Peel River from Chaffey Dam to Tamworth. Data gathered will inform management decision-making by providing information for a range of habitat types, benches and connected creeks and wetlands. This will inform decisions regarding the location for re-snagging to be undertaken as an offset measure in this reach of the river. Monitoring will be completed prior to snag installation and biannually for the life of EPBC Approval 2019/8590.

The primary objectives of the habitat mapping will be to:

- Document the riparian features of the identified reaches of the target valleys, focusing on native vegetation, weed infestation and existing management activities
- Document the stream bed morphology, including the location, length and depth of pools that may act as drought refugia, the instream habitat features and large woody habitat (snag) loading
- Calculate commence-to-inundate flow thresholds of select habitat features where feasible, including benches, cobble/riffle runs, wetland entry/exit points, aquatic macrophytes, large woody habitat and bank overhangs
- Identify and map threats and processes that may influence the extent and condition of aquatic and riparian habitat features
- Make recommendations to protect and improve stream health, threatened species habitat enhancement and improvement of other habitat features

Two methods of field data collection will be implemented, including:

- GPS equipped GIS interface for features above the water surface
- Portable Bluetooth sonar for identification of refuge pools

These techniques will collect the information necessary to record habitat features and their condition in both aquatic and riparian areas along the target valley corridors. Snags mapped as part of the project will also be classified into grades of complexity.

The riparian and aquatic habitat assessment report will include:

- Native fish information for the study area (including identification of key species present and their associated fish functional groups)
- Identification of key flow regime components required to meet native fish objectives and targets in the target valleys
- Analysis of the information to develop ecologically meaningful flow relationships for key habitat features and environmental water requirements (i.e. flow magnitude, volume, duration, seasonality, frequency) for key species at key locations

The habitat mapping will provide the basis for periodic monitoring to identify the type and extent of impacts that are attributed to operation of the project and also to assess the effectiveness of the re-snagging offset measure. The Peel River (and key refuge pools) will be monitored in six sections during operation of the pipeline (see Section 3.1.2). As such, the habitat mapping will provide an understanding of where impacts have occurred in each section.

3.4.2 Aquatic ecological community

Fish community

Key refuge sites and control sites will be monitored to provide an understanding of the fish community response to the offset measures.

Fish population monitoring, using a Before-After-Control-Impact (BACI) study design will provide an additional line-of-evidence to assess the success of re-snagging. Sites will be selected at a reach scale, with Control and Impact sites selected based on equivalent planform, depth and flow characteristics.

To assess the benefits of self-cleaning pump screen installation a Before-After study design will be used to assess fish community structure in refuge pools at pump sites selected for screening prior to installing the pump screens and after installation.

Fish population monitoring will initially be completed for five years following installation. A review of the data will be completed after the fifth year to assess whether ongoing fish population monitoring is required to assess the response of the threatened species to the installations. The baseline monitoring for the project will determine the current status of Murray Cod and Silver Perch fish populations within the Peel River.

To assess the benefits of each offset measure the following methods to assess fish population distribution, community composition and fish health will be followed:

- Environmental DNA (eDNA) to establish current distribution and species present.
- Sustainable Rivers Assessment (SRA)/The Living Murray (TLM) – combination of:
  - Backpack electrofishing (riffles, shallow pools).
  - Boat-mounted electrofishing (deep refuge pools)
  - Baited traps (juvenile/small-bodied fish)

Species identification, enumeration and weight/length/fish health biometrics will be measured and recorded.

Instream woody habitat colonisation

Along with providing habitat for EPBC-listed fish species, the installation of instream woody habitat will provide shelter and habitat for other aquatic flora and fauna that Silver Perch and Murray Cod rely on as food sources. As such, the installed habitat will be assessed to provide an additional line of evidence in terms of their benefits to threatened fish species.

Monitoring will be completed following the instream woody habitat installations.

The following components will be monitored:

- Periphyton/biofilm colonisation
  - Percent composition of green filamentous algae, diatoms, blue-green algae (Cyanophyta) and detritus (Chester and Norris, 2006)
  - Diatom species composition
- Invertebrate community composition
  - Macroinvertebrate and microinvertebrate species richness and abundance (using sampling methods detailed by Growns et al. 1999)

Instream woody habitat monitoring will initially be completed for five years following installation. A review of the data will be completed after the fifth year to assess whether ongoing monitoring is required to assess the ecological response to the installations.

All monitoring will be commissioned by WaterNSW. Fish surveys would be completed by personnel that hold a NSW DPI Scientific Collection Permit.

Table 5 Key performance indicators and monitoring methods for offset measures

Offset Measure	Objective	Key performance indicators	Timeframe	Monitoring method	Location	Frequency
Re-snagging	Increase submerged woody habitat to benefit threatened fish species.	Density of key fish habitat (snags) increases in reaches where snags are installed.	Measure to be completed by 28 October 2023	Aquatic Habitat Assessment (as per methods specified in Section 3.4.1)	Peel River – downstream from Chaffey Dam	Biannually (once every two years)
		Evidence of macroinvertebrate, microinvertebrate and biofilm colonisation on installed woody habitat.	Within five years of installation	Instream woody habitat colonisation monitoring (as per methods specified in Section 3.4.2)	Peel River – downstream from Chaffey Dam	Annually - autumn
		Abundances of native fish species with known affinity to instream woody habitat increase in reaches where snags installed.	Within five years of installation	Fish community monitoring (as per methods specified in Section 3.4.2)	Peel River – downstream from Chaffey Dam	Annually - autumn
Self-cleaning screen installation	Minimise native fish entrainment in existing pumps.	Locations and dates of screen installation documented.	Measure to be completed by 28 October 2023	Installation records created	Peel River – downstream from Chaffey Dam or Namoi River	n/a
		Audits indicate that screens remain present and functional	n/a	Audit records	Peel River – downstream from Chaffey Dam or Namoi River	Annually
		Installed self-cleaning screen reduces removal of small-bodied or juvenile fish from refuge pools	Within 24 months of installation	Fish community monitoring (as per methods specified in Section 3.4.2)	Peel River – downstream from Chaffey Dam or Namoi River	Annually

3.5 Corrective actions

Table 6 details indicative corrective actions that will be taken in the event that monitoring indicates that KPIs are not, or are unlikely, to be achieved. If, after five years, the KPIs have not been achieved, WaterNSW will work with DAWE to review, refine and adapt the monitoring and offset measures.

Table 6 Corrective actions to address KPI

Offset measure	Key Performance Indicator	Monitoring trigger	Potential corrective action	Responsibility
Re-snagging	Density of key fish habitat (snags) increases as a result of offset program.	Habitat assessment indicates an overall decrease in density of snags at the Peel River sites (e.g. due to flooding) or snags not submerged (e.g. due to ongoing dry conditions)	Assess post-flood habitat to ascertain whether new locations are providing habitat in Peel River. Consider re-locating snags if not submerged.	WaterNSW
	Evidence of macroinvertebrate, microinvertebrate and biofilm colonisation on installed woody habitat.	Annual monitoring indicates no colonisation of macroinvertebrate, microinvertebrate and biofilm on installed woody habitat.	Review monitoring program design to establish potential reasons for a lack of effect. In consultation with DAWE, revise monitoring program design if required.	WaterNSW
	Abundances of native fish species with known affinity to instream woody habitat increase in reaches where snags installed.	Annual monitoring indicates no evidence of an increase in abundance of native fish species with known affinity to instream woody habitat.	Review monitoring program design to establish potential reasons for a lack of effect. In consultation with DAWE, revise monitoring program design if required.	WaterNSW
Self-cleaning Screen installation	Locations and dates of screen installation documented	Installation records not created or lost.	Self-cleaning screen installation records held on WaterNSW asset register.	WaterNSW
	Audit records indicate that screens remain present and functional	Screens deemed to be non-functional by inspection.	Owner to ensure fully functional in accordance with original design.	WaterNSW
	Installed self-cleaning screen reduces removal of small-bodied or juvenile fish from refuge pools	No indication that installed self-cleaning screen reduces removal of small-bodied or juvenile fish from refuge pools.	Review monitoring program design to establish potential reasons for a lack of effect. In consultation with DAWE, revise monitoring program if required.	WaterNSW

4. Risk Assessment

The following risk assessment accounts for and provides management actions to minimise the risks of the offset measures not succeeding. Each threat was evaluated in terms of the likelihood of occurrence and the potential consequences. The likelihood of occurrence table (Table 7) is used to identify the most credible likelihood of an event occurring, while the level of consequence (Table 8) is an assessment of what the anticipated impact of the threat/risk would be, either directly or indirectly, to the offset sites. By combining the likelihood of occurrence and consequence, an overall risk rating can be applied to each threat/risk (refer to Table 9).

Table 7 Likelihood of occurrence

Likelihood	Definition
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful
Rare	May occur in exceptional circumstances

Table 8 Level of consequence

Consequence	Definition
Minor	Minor incident of environmental damage that can be reversed
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts
High	Substantial instances of environmental damage that could be reversed with intensive efforts
Major	Major loss of environmental amenity and real danger of continuing
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage

Table 9 Risk matrix

Likelihood	Consequence				
	Minor	Moderate	High	Major	Critical
Highly likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

The risk assessment in Table 10 identifies the current threats/risks to achieving the management intent and outcomes. An initial risk rating is given for the threat in the absence of management measures, with a residual risk rating applied after management measures have been implemented.

Table 10 Risk Assessment – to assess risks of achieving management outcomes

Risk	Risk description	Initial Likelihood	Initial Consequence	Initial risk rating	Management measures	Residual Likelihood	Residual Consequence	Residual risk rating
Inadequate funding	Funding not available to install and monitor beneficial impacts of offset measures.	Possible	Moderate	Medium	WaterNSW will commit to offset measures and monitoring required for the life of the EPBC Approval.	Unlikely	Moderate	Low
Offset measure fall into disrepair	Pump screens not maintained	Possible	Moderate	Medium	Pump screens will be self-cleaning to reduce need for maintenance. WaterNSW will undertake annual maintenance audits of pump screens for the life of the EPBC Approval (See Section 3.4).	Unlikely	Moderate	Low
Lack of commitment from landowners with regards to pump screens	Pumps and pump screens removed/land sold and new owner not committed.	Possible	Moderate	Medium	WaterNSW will enter into legal agreement with land-owners requiring pump screens to remain in place; being retained and operational on the licensed pump and maintained for the life of the EPBC Approval.	Unlikely	Moderate	Low
Re-snagging ineffective – aquatic fauna do not utilise	Fish and other aquatic fauna do not use snags placed in waterway	Possible	Moderate	Medium	Snags installed as per industry standard guidelines in terms of placement, wood type and orientation. Fish and habitat monitoring to be completed as per Section 3.4.1 and 3.4.2.	Unlikely	Moderate	Low
Human trespass	Risk of humans tampering with offset measures	Possible	Minor	Low	Offset measures will be placed in the waterway so likelihood low. Monitoring will assess whether offset measures are in place and working effectively.	Possible	Minor	Low

Risk	Risk description	Initial Likelihood	Initial Consequence	Initial risk rating	Management measures	Residual Likelihood	Residual Consequence	Residual risk rating
Flooding	Major flood event dislodges or damages offset measures (snags and pump screens). Flood event alters the species composition of the waterway/riparian zone, leading to a change in community composition and /or increasing the time to offset realisation.	Possible	Moderate	Medium	Warning bulletin issued by WaterNSW will warn property owners to remove pumps, where safely possible. Pump screens will be installed & maintained as per manufacturer's specifications. Snags will be placed to provide maximum benefit – noting that a flood event is most likely to re-locate the snag downstream (where it will still likely have benefits).	Possible	Moderate	Medium
Bushfire	Fire has the potential to impact snag and pump screens if severe enough. A bushfire alters the species composition of the waterway/riparian zone, leading to a change in community composition and /or increasing the time to offset realisation.	Possible	High	Medium	Snags will be placed to provide maximum benefit, which would mean being submerged as often as possible and within the river channel. Pump screens are likely to withstand fire if submerged.	Unlikely	High	Medium
Operation of pipeline during prolonged drought	Prolonged period without rainfall means that snags and pump screens are not submerged, leading to low efficacy.	Possible	Moderate	Medium	Snags will be placed to provide maximum benefit, which would mean being submerged as often as possible. Snags will continue to provide benefits outside of operation period.	Possible	Moderate	Medium

5. Reporting and review requirements

5.1 Reporting requirements

5.1.1 Update of Plan

Once the first monitoring event has been carried out under this Plan, the following sections of this Plan may be updated to include:

- Figures displaying aquatic habitat features, survey results and offset measure locations and further discussion on potential for impact
- Review and addition of Key Performance Indicators, if applicable
- Review register (as relevant to the updated sections)

5.1.2 Monitoring reports

An initial survey report will be prepared, with monitoring reports to follow subsequent scheduled monitoring events.

The results of baseline and monitoring surveys will be included in the annual compliance reports, as relevant to that year. Baseline data will be compared with monitoring data to measure changes in offset area habitat quality to identify progress of management actions with regards to the performance indicators. Remedial action or adaptive management will be provided based on monitoring results.

Reporting of baseline and ongoing monitoring results (with comparisons to baseline and previous monitoring results) will include:

- Aquatic habitat results
- Fish species richness for each site
- Aquatic flora and fauna colonisation of installed snags
- Evidence of Re-snagging offset measure efficacy - indicated by ongoing presence within the Peel River
- Evidence of Pump Screen offset measure working as intended

5.1.3 Annual compliance report

The results of baseline and ongoing monitoring surveys will be included in the annual compliance reports, as relevant to that year. Baseline data will be compared with monitoring data to demonstrate any changes in offset area habitat quality and for identifying progress against the performance indicators.

Results of the screen installation, monitoring and maintenance will be included in the annual compliance report, as relevant.

5.2 Plan review

This Plan will remain in place under the EPBC 2019/8590 Approval until 10 July 2030 or until approval is rescinded.

WaterNSW may apply to the Commonwealth Minister for the Environment for a variation to the management plan approved by the Minister.

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Appendices

Appendix A – Namoi River pool persistence (sourced DPI Fisheries 2022

Site Name	Common Name	Latitude	Longitude	Pool Number	Actual Depth (m)
LNAM001	D/s Mollee Weir	30°15'49.24"S	149°41'57.04"E	1	2
LNAM002	Mollee crossing	30°15'26.69"S	149°40'54.16"E	2	0.5
LNAM003	Glencoe - Martins Hole (near Wee Waa) (pump site pool)	30°12'8.00"S	149°29'20.40"E	3	3.9
LNAM004	U/S Gunidgera Weir (map has A, B, C points)	30°11'59.59"S	149°26'20.77"E	4	1.2
LNAM005	Blue Hole (Wee Waa)	30°12'18.60"S	149°26'0.51"E	5	2
LNAM006	D/S Blue Hole	?	?	6	0.6
LNAM007	Old Weetah	30°15'9.53"S	149°22'15.24"E	7	2.5
LNAM008	Red Bank pump site pool	30°17'17.12"S	149°19'24.36"E	8	2.1
LNAM009	Milloo 1 (U/S)	30°17'57.96"S	149° 9'0.70"E	9	1.2
LNAM010	Milloo 2	30°18'12.41"S	149° 7'49.74"E	10	1
LNAM011	Milloo Powerline	30°18'16.52"S	149° 7'24.00"E	11	2
LNAM012	U/s Duncan Junction A	30°18'5.22"S	149° 6'35.06"E	12	0.7
LNAM013	U/s Duncan Junction B	30°18'6.28"S	149° 6'30.01"E	13	0.7
LNAM014	U/s Duncan Junction C	30°18'4.74"S	149° 6'26.51"E	14	1.1
LNAM015	U/s Duncan Junction D	30°18'5.99"S	149° 6'23.70"E	15	0.3
LNAM016	U/s Duncan Junction E	?	?	16	0.7
LNAM017	Bugilbone U/S H	?	?	17	1
LNAM018	Bugilbone u/s G	30°17'10.97"S	148°49'27.81"E	18	0.7
LNAM019	Bugilbone u/s F (big round hole)	30°16'56.20"S	148°49'18.29"E	19	2.3
LNAM020	Bugilbone u/s E	30°16'43.90"S	148°49'21.03"E	20	0.9
LNAM021	Bugilbone u/s D	30°16'42.95"S	148°49'15.38"E	21	0.6
LNAM022	Bugilbone u/s C	30°16'41.81"S	148°49'10.23"E	22	0.5
LNAM023	Bugilbone u/s B	30°16'31.32"S	148°49'18.12"E	23	0.7
LNAM024	Bugilbone A (at gauge)	30°16'26.05"S	148°49'16.51"E	24	0.8
LNAM025	Yarradool D	30°15'33.08"S	148°35'45.89"E	25	1.1
LNAM026	Yarradool C	30°15'32.34"S	148°35'41.02"E	26	0.5
LNAM027	Yarradool B	30°15'32.97"S	148°35'38.35"E	27	0.3
LNAM028	Yarradool A	30°15'41.91"S	148°35'30.39"E	28	1.6
LNAM029	Maneroo B	30° 8'6.09"S	148°21'9.53"E	29	0.4
LNAM030	Maneroo C	30° 8'2.98"S	148°21'8.80"E	30	0.3
LNAM031	Maneroo A – Doctor's Hole (ds Goangra approx. 5 km)	30° 8'5.49"S	148°21'4.70"E	31	0.4

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