17 ENVIRONMENTAL ASSESSMENT

CHAPTER SUMMARY AND CONCLUSIONS:

Legislative and permit requirements

- for any of the Reference Projects:
  - an EIS will be required and will be considered a controlled action under the Commonwealth EPBC Act. A number of legislative approvals will be required and the Water Plan and associated documents will require amendment
  - distribution pipelines, if assessed in their own right, would require only limited approvals unless they are included within the "action" which is referred to the Commonwealth or for which a co-ordinated project declaration is sought from the Coordinator-General, as they would be included within "the project"
  - any approvals related to farming areas will be the responsibility of the landholder and are not included in this assessment

Environmental Impacts / Issues for Reference Project 1 and 2

- The inundation area is currently comprised of irrigated and dryland agriculture, native forests and watercourses. There are approximately 30 land parcels and a quarry affected by the small dam and 33 land parcels and two quarries affected by the large dam. Native title determinations exist over a portion of the inundation area.
- There are approximately 170 reported abandoned mines within the dam's catchment area and three operational mines. These may affect water quality though it is generally good and suitable for irrigation of a variety of crops.
- The dam will trap sediment and significantly reduce sediment supply to the Walsh River downstream. However, given the high erosion rates in the catchment, the impact may not be significant.
- Further data collection and a conceptual hydrogeological model will be required to better assess groundwater impacts in irrigation areas receiving additional water.
- The Project area is located within the Walsh River sub-catchment, which is a part of the Mitchell River catchment. Nullinga Dam is 579.6 km from the mouth of the Mitchell River. It controls less than 0.5 per cent of the total catchment area of the Mitchell River and less than 1% of the mean annual flow (MAF).
- Flow in the Walsh River is highly seasonal with more than 90 per cent of the MAF occurring in the four-month summer wet season. The Walsh River at the dam site experiences zero flows approximately 25 per cent of time. The dam will have a significant impact on flows immediately downstream but an operational strategy including environmental flow releases has not yet been determined. Significant recovery of flows is achieved by Flatrock (the end of the MDWSS).
- Water allocation security objectives for existing water users will not be affected.
- The project is in an area affected by occasional cyclones or tropical storms and significant bushfire risk during dry seasons. Construction managers must be prepared for these hazards.

- Preliminary investigation by DSITI (2016) indicated that climate change model predictions are highly variable and uncertain. What is certain is that provision of increased water storage capacity will provide a buffer to the effects of climate change for urban and agricultural communities compared to the present situation.
- A thorough seasonal ecological survey report of 2008 and a current review of literature and databases reveals no Threatened Ecological Communities (TECs) or Endangered or Of Concern Regional Ecosystems (RE's) are present within the inundation areas. The pipeline areas are comprised primarily of disturbed agricultural land, mapped as Category X non-remnant vegetation.
- Least Concern RE's occupy 57 per cent or 1115 ha of the small dam inundation area and 64 per cent or 1784 ha of the large dam inundation area.
- Twelve threatened plant species under the NC Act have the potential to occur in the Study Area (eight of which are also listed under the EPBC Act). Two species, *Cycas platyphylla* (Vulnerable, NC Act and EPBC Act) and *Acacia guymeri* (Vulnerable, NC Act,), were recorded in 2007 within the inundation area. Essential habitat for *Acacia guymeri* and Protected Plants Flora Survey Trigger areas are present in parts of the inundation areas.
- Twenty-three conservation significant fauna species are known or likely to occur within the Project area. Both Spotted-tail quoll (Endangered, NC Act and EPBC Act) and Northern quoll (Least Concern, NC Act and Endangered, EPBC Act) have been recorded within the inundation area and Essential habitat for the Spotted-tail quoll is mapped at the proposed dam site.
- There are no high ecological value waters, wetlands of high ecological significance or threatened aquatic flora or fauna species within the Study Area. The aquatic communities are generally healthy but the noxious fish Tilapia is known from the region.
- The dam will represent a barrier to movement of aquatic fauna (though a fishway will be fitted) and this barrier will add to that of the two existing downstream weirs (as far as Flatrock) which do not have fishways. A number of aquatic weed species are known to occur in the region.
- The environmental offset cost for the dams could be significant (initial estimate $11M to $14.3M) and has been included as part of the cost estimates informing the Economic and Financial analysis of the DBC.
- The six sensitive receptors to air and noise emissions in the dam area all represent residential dwellings. Thirty-five residences and 4 commercial properties are within 1 km of the pipeline centrelines. It is unknown if all of these buildings are occupied. Standard management approaches should be sufficient to mitigate impacts.
- One known site of indigenous cultural heritage significance is within the inundation area but none are on the pipeline routes. No known sites of non-indigenous heritage are expected to be impacted. Field surveys and a CHMP will be required.
- Waste and traffic management plans (amongst others) will be required during construction.

17.1 Purpose

This Chapter identifies and categorises the environmental considerations and impacts of the Reference Projects with respect to the requirements of legislation and policy. It then identifies mitigation and offset requirements which may affect project design, implementation or cost. Broadly, this Chapter summarises a Review of Environmental Factors (REF) prepared for the Nullinga Dam solutions.

17.2 Legislation and permit requirements

Table 17-1 outlines the approvals required for the identified Reference Projects. It is acknowledged that for any of the Reference Projects:

- an Environmental Impact Statement (EIS) satisfying both State and Commonwealth requirements will need to be undertaken
- distribution pipelines, if assessed in their own right, would require only limited approvals unless they are included within the "action" which is referred to the Commonwealth or for which a co-ordinated project declaration is sought from the Coordinator-General, as they would be included within "the project"
- it is assumed that any approvals related to farming areas will be the responsibility of the landholder and are not included in this assessment.

Table 17-1 Potential approvals for the Reference Projects

RELEVANCE	REQUIREMENTS
Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	
The Reference Projects have the potential to impact several MNES including: ▪ listed threatened and species and communities ▪ listed migratory species ▪ Commonwealth marine areas. The use of water could be considered a facilitated impact of the dam operation because of the provisions in s 527E of the EPBC Act. This is most relevant in a reef catchment.	▪ Prepare a referral under the EPBC Act for consideration of the commonwealth Minister for the Environment. ▪ Conduct a targeted flora and fauna assessment as part of Environmental Impact Statement (EIS). ▪ Conduct an impact assessment in line with the EPBC Act Significant Impact Guidelines 1.1 Matters of National Environmental Significance (DoE, 2013). ▪ Undertake assessments relative to meeting targets of Reef 2050
Commonwealth *Native Title Act 1993* (NT Act) and Queensland *Native Title (Queensland) Act 1993* (QNT Act)	
Notification to Registered Native Title holders will be required in relation to the granting of permits by the State which authorise the taking of any surface waters or living aquatic resources. The construction of a dam would be a "device for management of water flows" under s.24KA(2)(i) of the NT Act making it a valid "future act" allowing construction to occur, though providing "reasonable rights" of access.	▪ Undertake detailed assessment and consultation with Native Title holders and other relevant Aboriginal Parties during EIS. ▪ Prepare an Indigenous Land Use Agreement
State Development and Public Works Organisation Act 1971 (SDPWO Act)	
The Reference Projects may apply for a 'coordinated project' declaration to allow the preparation of an Environmental Impact Statement (EIS) or Impact Assessment Report under the SDPWO Act.	▪ Request pre-lodgement meeting with the Office of the Coordinator General. ▪ Prepare an Initial advice statement to facilitate 'coordinated project' status.

RELEVANCE	REQUIREMENTS
	▪ Prepare EIS under Bilateral agreement with Commonwealth (to simultaneously address EPBC Act issues)
Planning Act 2016 **(Planning Act) and Planning Regulation 2017**	
Development approvals will be required for matters identified in the MSC Planning Scheme as well as matters of state significance. The likely development approvals required include: ▪ material change of use for environmentally relevant activity (for the dam) ▪ operational work for – reconfiguration of a lot (for the dam) – taking or interfering with water (for construction water) – waterway barrier works (for the dam and pipeline) – clearing native vegetation (for clearing/inundation of regional ecosystems and expansion of agricultural areas) – removing quarry material (for construction materials) – referable dam (for the dam) – particular dams (for the dam) ▪ building work (for site construction facilities) ▪ any other development permits required by the relevant planning schemes (for the dam).	▪ Prepare development applications following completion of the EIS process. ▪ Investigations during the EIS phase should attempt to satisfy the evidentiary requirements of the subsequent development applications.
Environmental Protection Act 1994 **(EP Act)**	
Contaminated land ▪ A disposal permit to treat, remove and/or dispose of contaminated soil from land on the Environmental Management Register and Contaminated Land Register. A site remediation plan and site management plan may be required for contaminated sites impacted by the Reference Project/s. Environmentally Relevant Activities (ERAs) ▪ Environmental authority for a prescribed ERA. ERAs may be applicable, including regulated waste transport, chemical storage (over a particular threshold), sewage treatment (for construction compounds or station facilities over a particular threshold), and extractive and screening materials. These may be held by the construction contractor, or other contracted parties (i.e. waste removal contractors). ▪ Registered suitable operator status to allow application for environmental authority.	▪ Undertake contaminated land investigations during EIS. ▪ Register as a suitable operator ▪ Consider Environmental Authority application type (standard, variation or site-specific) for any relevant ERA's conducted as part of the dam construction and/or operations
Nature Conservation Act 1992 **(NC Act)**	
Protected Plants ▪ It is an offence to take protected plants without authorisation. There is one protected plant area marked as high risk on the flora survey trigger map over the Nullinga Dams inundation areas. If Endangered, Vulnerable or Near Threatened plant species are identified during survey, a protected plant clearing permit will be required. Species Management Program	Conduct a targeted flora and fauna assessment as part of EIS.

RELEVANCE	REQUIREMENTS
▪ A low-risk or high-risk Species Management Program species would be required if breeding habitat is to be disturbed	
Vegetation Management Act 1999 (VM Act)	
The dam inundation area and pipelines support remnant vegetation and least concern high-value regrowth vegetation. Clearing of native vegetation including the inundation of native vegetation would require approval	Undertake detailed flora assessments as part of EIS
Aboriginal Cultural Heritage Act 2003 (ACH Act)	
There is a general requirement for the project to comply with the ACH Act Duty of Care Guidelines and may require a Cultural CHMP or agreement.	Undertake a cultural heritage assessment and consultation as part of EIS
Water Act 2000 (Water Act) and *Water Supply (Safety and Reliability) Act 2008*	
Relevant to dam and irrigation area Certain approved entities (including government departments and water service providers under the WSSR Act) are exempt from obtaining a Riverine Protection Permit (RPP) under the RPP Exemption Requirements and would need to comply with the requirements of the exemption with respect to excavating and filling within a watercourse. Where this is not possible, a Water Licence and potentially Quarry Material Allocation may be required. Taking of water for use in construction may require water permits under the Water Act though it is unlikely. Other Water Act approvals that may be required include: ▪ amendment to the Water Plan (Barron) 2002, Water Management Protocol, Operations Manual and Resource Operations Licence ▪ application for quarry material allocation ▪ application by an entity for licence to interfere with flow by impounding water ▪ operational works for a referable dam ▪ certification for dam safety.	▪ Review the currency of exemptions during later project phases. ▪ Complete Failure Impact Assessment and Emergency Action Planning in accordance with regulatory requirements.
Fisheries Act 1994 (Fisheries Act)	
The development of a new dam or raising an existing dam will constitute waterway barrier works and will require approval. Construction of the pipelines may be 'accepted developed' though if requirements cannot be satisfied, approval would be required.	Undertake detailed assessment of the impacts to fish movement.
Forestry Act 1959	
A permit for taking quarry material which is owned by the State from land outside a watercourse may be necessary for material for the construction of the dams. If material is sourced from existing suppliers, this would not be necessary	Review requirements for any quarry material above high-water mark
Environmental Offsets Act 2014 (EO Act)	
Offsets may be required under s 8 of the EO Act, where there is a 'significant' residual impact on a MNES, MSES or MLES	Offset requirements will be identified following completion of detailed impact assessment in the EIS

RELEVANCE	REQUIREMENTS
Transport Infrastructure Act 1994 (TIA)	
Road closures, temporary closures to accommodate works, or road corridor permits may be required	Requirements for road closures to be developed during detailed design. Ongoing liaison with the relevant state, local or other road authority to continue

17.3 Identification of Environmental Impacts

This section provides an overview of environmental considerations and potential impacts associated with the Reference Projects.

17.3.1 Planning and land use

The Nullinga Dam site is located within MSC region. The relevant aspects of the State Planning Policy have been integrated into the MSC Planning Scheme[126] to ensure that state planning interests are protected. The Nullinga Dam:

- proposal/s are consistent with the economic development strategic outcomes outlined in the MSC Planning Scheme in that it provides infrastructure to facilitate agriculture and primary industry growth
- is unlikely to conflict with the intent of any themes or zoning under the MSC Planning Scheme
- site is:
  - within a Rural zone
  - does not impact any protected areas such as National Parks or State Forests or local conservation areas
  - approximately 12.5 km from the nearest protected area (Baldy Mountain Forest Reserve and Herberton Range National Park)
  - approximately 10 to 20 kms from the nearest townships (Mutchilba, Mareeba, Dimbulah).

These characteristics would be subject to further investigation during an EIS.

Existing land uses within the inundation areas will cease and be replaced by water storage. The lost agricultural uses will be compensated through a far more significant expansion of irrigation and agricultural production as a result of the Reference Project.

Land use within the nominated dam site is primarily irrigated agriculture and plantations (82.4%), water (12.4%) and conservation and natural environments (5.1%). The pipeline routes are dominated by production from relatively natural environments (68.3%) and irrigated agriculture and plantations (28%).

Collins Weir is located within both inundation areas on the Walsh River at AMTD 269.1 km. It is owned by Sunwater, is part of the MDWSS and will be decommissioned if Nullinga is built. Access to the weir is via Collins Weir Road which is also owned by Sunwater and will be inundated by the water storage areas. The area is a popular informal swimming and camping area although no facilities are provided and its recreational use is not regulated by Sunwater.

[126] MSC forms part of the Far North Queensland Regional Plan. The Far North Queensland Regional Plan is a statutory Plan that provides a framework with which to manage growth, change, land use and development in the region to 2031

Other potential environmental issues and/or impacts include:

- quarries
  - two active gravel quarries are within the inundation areas but are not within Key Resource Areas, (Springmount Quarry and Walsh River Quarry)
  - no quarries within the pipeline routes.
- existing services to be relocated, including Ergon powerlines and Telstra telecommunications infrastructure servicing existing dwellings
- some restrictions on land use within the flood buffer (the extent of which has not yet been confirmed).

The impact of the pipelines on land use is likely to be minimal with the pipe located underground and the disturbed construction easement to be rehabilitated to closely replicate the pre-existing state.

17.3.2 Property impacts

Land tenure within the proposed inundation areas is largely freehold and lands lease, with a large proportion of watercourse and a reserve (State reserve land (Lot 492 on HG759), for the purpose of "Experimental Farm" and held by the Department of Agriculture and Fisheries).

Land tenure along the pipeline routes contains a similar proportion of freehold land, though a greater area of road corridor and State land and less leasehold or watercourse.

Table 17-2 Land tenure for Nullinga Dam solutions

LAND USE	AREA %		
	REFERENCE PROJECT 1	REFERENCE PROJECT 2	PIPELINES
Freehold	54.77	55.77	54.53
Lands lease	24.81	24.04	5.11
Road corridor	1.03	0.88	29.51
State land – reserve	5.12	7.33	-
State land	-	-	8.47
Unlinked parcel	-	-	0.07
Utility easements	0.24	0.23	0.15
Watercourse	14.03	11.75	0.12

Native title determinations exist over a portion of the inundation area of both dam options in favour of the:

- Bar Barrum People #4 (QCD2016/004 DET)
- Bar Barrum People #6 (QCD2016/010 DET)
- Bar Barrum Rivers Claim (QCD2017/009 DET).

Properties subject to the approved Native Title determinations are Lot/Plan 619OL72, 492HG759 and the Walsh River.

There are no native title determinations in either pipeline area.

It is expected that Sunwater will obtain freehold ownership of land within FSL and establish an easement or reserve for the flood buffer. There may be some restrictions on land use within the flood buffer. Sunwater

will establish new easements over the pipeline routes where the pipelines are located outside of existing easements.

Expected upgrades of access roads and new communication and power infrastructure will also result in changes in tenure (e.g. reserves and easements), however the latter will be the responsibility of the service provider.

Delivery of the smaller dam, Reference Project 1 would:

- affect 30 land parcels
- result in closure of Springmount Quarry

Reference Project 2 would:

- affect 33 land parcels
- result in closure of Springmount Quarry and Walsh River Quarry

Either Reference Project is anticipated to:

- inundate 100 per cent of between 9 and 11 parcels
- inundate 50 to 99 per cent 8 to 10 parcels
- require decommissioning of Collins Weir
- require closure of Collins Weir Road which is a local no-through road.

A land purchasing strategy would be developed for the acquisition phase of the NDMIP, subsequent to funding approval. The decision as to full or partial acquisition of land parcels will be based on the degree of impact caused by the selected Reference Project and negotiations with individual landholders. The practical utility of severed land parcels will be taken into consideration. Some reconfiguration of lots to foster continued use may be possible.

A total of 47 land parcels may be impacted by the distribution pipelines operational easement. Wherever possible, the pipelines have been located within or contiguous with existing local road easements and road corridors. The pipeline routes do not intersect any State controlled roads, and no State controlled roads are within the inundation areas of either Reference Project.

17.3.3 Topography, geology, soils and contaminated land

The proposed Nullinga Dam site is located within a constriction of the McLeod Hills. Topography surrounding the inundation areas comprises primarily alluvial flats, with sections of undulating ridges and more moderate slopes on adjacent ranges. High points on adjacent mountain ranges are located on both the eastern and western side of the site. The topography surrounding the inundation areas extends from 800 m AHD in the south (tail of the dam) to 550 m AHD in the north (dam wall). The profile of the terrain along the alignment of the pipelines is basically flat, comprising alluvial flats dominated by agricultural land uses. The topography of these areas ranges between 550 m at the dam to 500 m AHD.

Surface geology mapping[127], indicates the left and right abutments of the main dam wall are dominated by rocks of the Parada Granite, a Late Carboniferous aged unit. A rhyolitic dyke swarm occurs within the Parada Granite, striking northwest and of relatively consistent separation, averaging between 120 – 180 m between dykes. Surficial geology below the remainder of the inundation areas is dominated by alluvial and colluvial deposits.

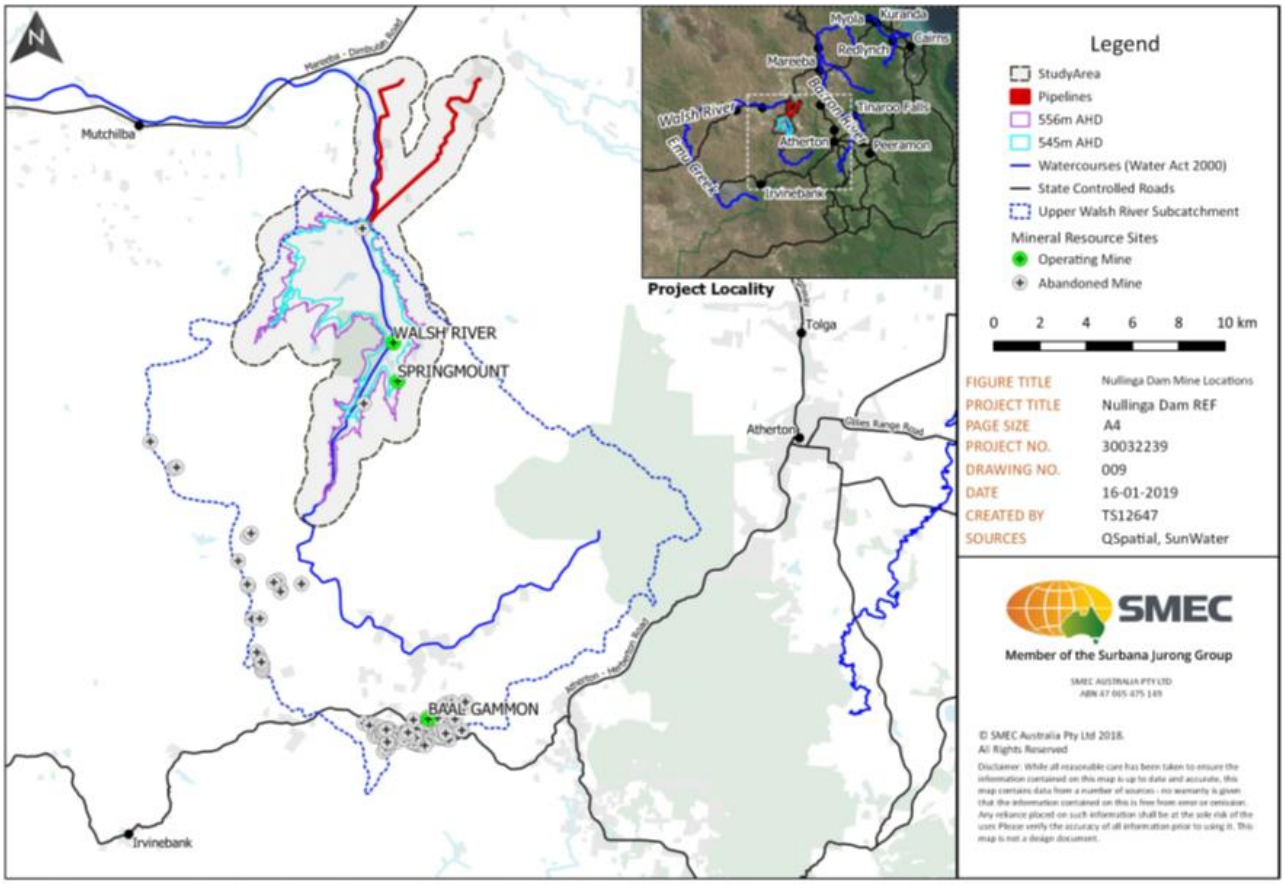
[127] 1:100k provided by DNRME via QSpatial

Soils in the northern extent and centre of the dam inundation areas are classified as Chromosols within the channel of the Walsh River, and Ferrosols on the adjacent ridges (dam abutments) while at the southern end they are Tenosols. These soils offer no particular erosion hazard.

One EMR listed lot and plan was identified within the inundation areas due to notifiable activities including 'livestock dip or spray race'. It is not known if the contaminated part of the lot will be impacted by the project.

There are approximately 170 reported abandoned mines within the dam's catchment area and three sites classed as operational mines (the two quarries and the Baal Gammon copper mine in the very headwaters; Figure 17-1).

Figure 17-1 Active and abandoned mines



A search of available UXO mapping[128] showed one lot and plan has an area of mapped UXO within the inundation areas. This classification indicates that the area was used for military training during and after World War II. It is not known whether these UXO activities occurred within the boundary of the inundation areas.

Surficial geology below the pipelines areas is dominated by alluvial and colluvial deposits. The northern most extent of the eastern pipeline is also underlain by areas of Ferricrete. Soils within the pipeline areas are classified as Sodosols and are vulnerable to erosion. One EMR listed lot and plan was identified within the pipeline areas due to notifiable activities including 'chemical storage: petroleum product or oil storage'.

[128] Department of Defence UXO mapping

There are no mineral resource sites within the distribution pipeline routes.

17.3.4 Water quality

Groundwater

Water quality information was not available for registered groundwater bores within the Study Area. High level groundwater salinity modelling, indicated that the Study Area is likely to have low electrical conductivity (EC) values (as a measure of salinity).

Over time, rising groundwater levels and increasing salinity have been recorded in nearby long-term irrigation areas of Dimbulah and Mutchilba in the MDIA and Cattle Creek immediately north of the Study Area. Bores within coarse material such as alluvium, sands or granites reported very low (< 600 µS/cm) EC values. By contrast, bores which reported extreme (>8,000 µS/cm) EC values intercepted groundwater that is contained within shale.

Based on desktop assessments of groundwater in the region, increased irrigation in the northern part of the Study Area as a result of improved water supply from the proposed dam is likely to raise the groundwater table and EC levels. This area was assessed as a moderate risk, defined as 2-5 m groundwater depth and steady or falling, or 5-10 m depth and rising. However, the risk assessment was based on limited data.

Further data collection and a conceptual hydrogeological model will be required in later stages of the project.

Surface water

Specific Water Quality Objectives (WQOs), local reference data, and regional water quality guidelines have not been established for the Walsh River so default to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality: The Guidelines (ANZECC & ARMCANZ, 2018). ANZECC guideline values were used in the REF as per Queensland Water Quality Guideline recommendations.

Salinity and pH levels in the Walsh River upstream of the inundation area reported by DES (2018) indicate the water quality is suitable for irrigation of a variety of crops. Electrical conductivity was recorded as very low (below 600 µS/cm) and pH was above 6, indicating limited corrosion potential in accordance with ANZECC. DNRME surface water quality data from gauging stations at Nullinga and Flatrock also indicated very low EC with median pH levels of greater than 6.

GHD (2008) determined that, within the proposed inundation area, water quality was generally within the objectives defined in the ANZECC guidelines and Queensland Water Quality Guidelines for the protection of aquatic ecosystems. Parameters that did not meet the objectives included:

- copper and zinc at some sites on the Walsh River in the dry season
- pH, which was slightly acidic at some sites on the Walsh River in the wet and dry seasons
- dissolved oxygen, which was high in the wet season (saturated) and low in the dry season
- turbidity was also generally high in the wet season but did not consistently exceed the guidelines.

The townships at Dimbulah, Mutchilba, and several other peri-urban precincts are sources of water quality pollution downstream of the proposed dam, including sediment and nutrients. Hillslope erosion is an issue in the headwaters of the Walsh River (Rustomii, Shellberg, Brooks, Spencer, & Caitcheon, 2010). The constructed dam is likely to capture sediment from these erosive upper catchments and allow for settling of suspended solids and associated nitrogen and phosphorus. The dam will reduce sediment supply to the Walsh River downstream of the dam. This is likely to lead to some erosion of the downstream channel,

which will affect water quality. The extent to which this will occur has not been assessed, though would be considered as part of an EIS.

Much of the upper reaches of the Walsh River sub-catchment has also been impacted by active and abandoned mining activities. This is probably linked to the high levels of some metals in river water. One active mine upstream from the dam site was recently subject to investigation regarding release of contaminated water to a watercourse. The contamination apparently did not reach Collins Weir . Two gravel quarries are located within the proposed dam footprint.

Construction will have temporary impacts that will be managed at the source.

17.3.5 Hydrology

The Water Plan (Barron) 2002 (the Barron Water Plan) applies to the Study Area and the MDWSS with the western boundary of the plan at Flatrock on the Walsh River (Queensland Government, 2016a). Beyond Flatrock, groundwater is regulated under the Water Plan (Mitchell) 2007 (the Mitchell Water Plan) (Queensland Government, 2016b).

Groundwater

While there are Groundwater Management Areas identified in the Barron Water Plan, none are within either the Study Area or down gradient in the MDWSS.

Required outcomes under the Barron Water Plan include the management and allocation of groundwater to maintain contributions to the flow of water in watercourses, lakes and springs and to groundwater dependent ecosystems (Queensland Government, 2016a). Strategies to achieve these outcomes include regulating the taking of groundwater via licence entitlements.

The Study Area is located in the upper catchment of the Walsh River. As the Walsh River is a prescribed watercourse under the Water Act 2000, groundwater under it is managed as water in the watercourse.

There are currently 13 existing registered groundwater bores located within the Study Area (within 1 km of the reference projects or associated pipelines), all of which have a stated use as ‘water supply’.

The majority of the bores are located within 300 m of the Walsh River or smaller waterways, suggesting some lateral connectivity between surface and groundwater to at least that distance. Two bores are located within the inundation areas. A review of the 13 bore reports identified that the bores are sub-artesian and relatively shallow. The majority intercepted groundwater between 9 m and 30 m.

CSIRO (2009) determined that groundwater discharge plays an important role in maintaining dry season flows in the Walsh River and its tributaries. CSIRO included consideration of data from the Walsh River at Nullinga gauging station, with an estimated annual baseflow index (BFI – the ratio of baseflow to total flow over time) of 0.24 and a dry season BFI of 0.49.

State mapping (DES) shows no Groundwater Dependent Ecosystems (GDEs) within the Study Area, which is somewhat inconsistent with the DSITIA (2013) assessment, which identified potential terrestrial GDEs along the Walsh River based on regional ecosystem (RE) mapping. Field survey to date corroborates the DES mapping, with no evidence of surface or subsurface GDEs in the Study Area.

Surface water

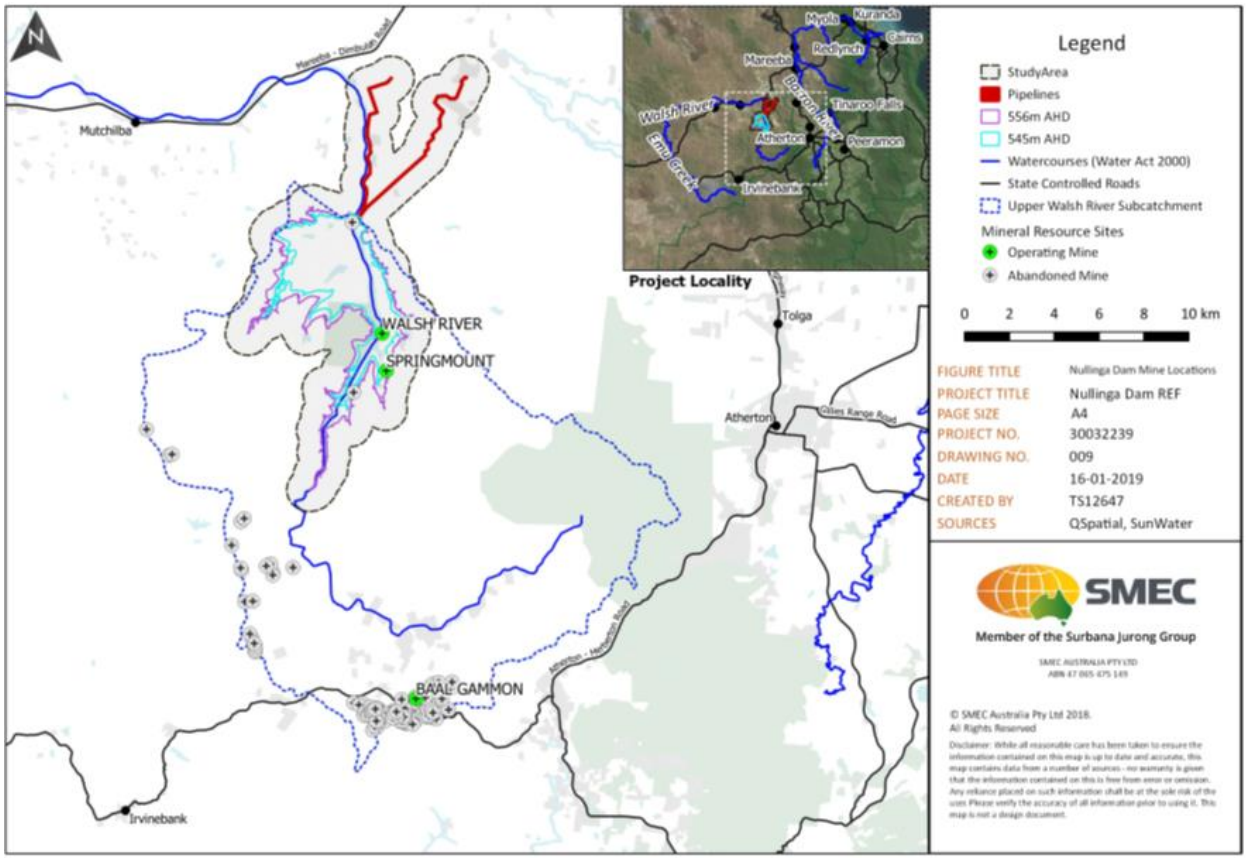
The Reference Project/s will potentially have a number of hydrologic impacts including:

- inundation of waterways upstream of Nullinga Dam
- changes to the downstream flow regime
- changes to the Water Plan objectives, specifically the WASOs and EFOs
- changes to water quality (addressed above).

Waterways and Flows

Nullinga Dam site is located within the Walsh River sub-catchment, which is a part of the Mitchell River catchment. The Walsh River joins the Mitchell River 320 km (AMTD) upstream of the mouth of the Mitchell River. The Mitchell River flows into the Gulf of Carpentaria within the Northern Gulf region. The Mitchell is a very large catchment and river. Nullinga Dam is proposed at 259.6 km AMTD on the Walsh River, making it 579.6 km from the mouth of the Mitchell River. It controls less than 0.5 per cent of the total catchment area of the Mitchell River and less than 1 per cent of the mean annual flow (MAF).

Figure 17-2 Barron Water Plan Catchments and sub-catchments



There are three weirs located on the Walsh River – Collins, Bruce and Leafgold, while Solanum Weir is on Eureka Creek, a tributary which enters below Leafgold Weir. Multiple tributaries enter the Walsh River downstream of the proposed Nullinga Dam, including Cattle Creek and Spring Creek east of Dimbulah and Eureka Creek and Snake Creek west of Dimbulah.

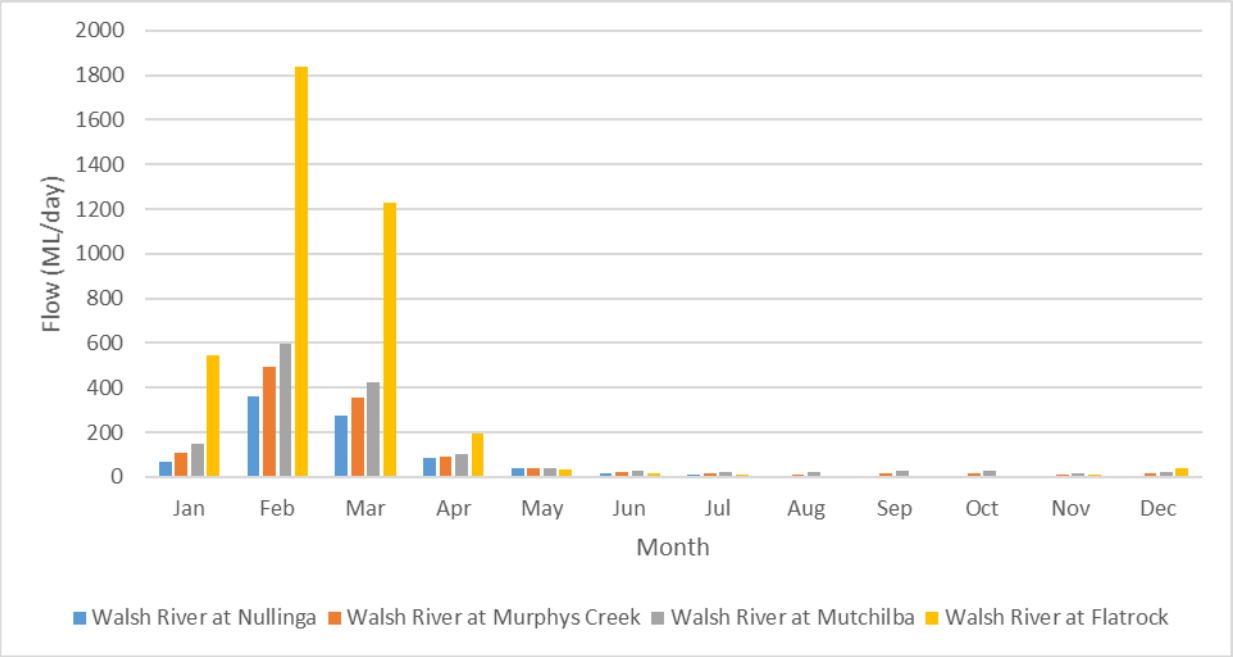
Tinaroo Falls Dam currently supplies the Walsh catchment part of the MDWSS via constructed irrigation channels commencing with the West Barron Main Channel which supplies the Walsh Bluff Main Channel.

This continues to just downstream of the proposed dam where it meets the South Walsh Main Channel (which commences at Collins Weir) and it continues west till termination at three points; Solanum Weir, near Leafgold Weir and as the South Walsh 30 channel west of Dimbulah.

Water from Tinaroo Falls Dam is transferred into the Walsh River from the South Walsh Main Channel to supply approximately 40 irrigators .

Flow in the Walsh River is highly seasonal with more than 90 per cent of the Mean Annual Flow (MAF) occurring in the four months of January-April. Increasing flow with distance downstream of the dam is also evident from Figure 17-3. The BFI for the Walsh River at Nullinga has been calculated as 0.26 (Petheram, Watson, Brooks, Spencer, & Caitcheon, 2018), which is relatively low and consistent with the ephemeral nature of the waterway.

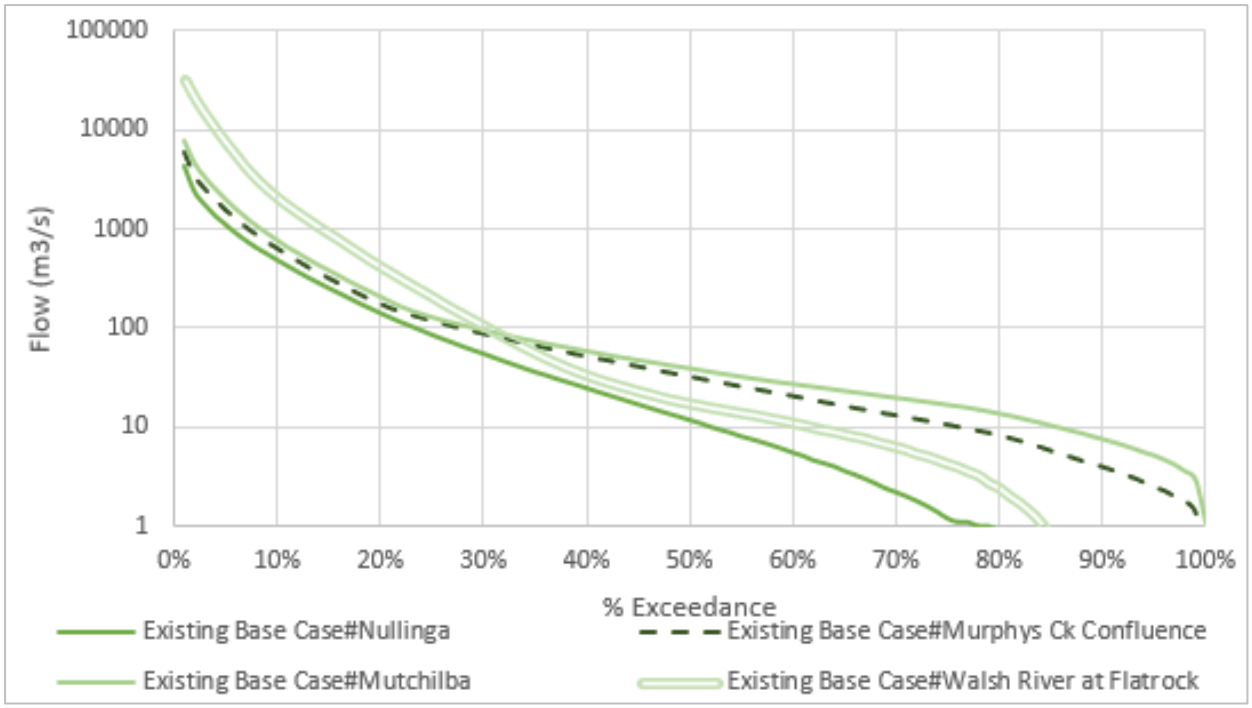
Figure 17-3 Base case median monthly flow



Flow duration curves (Figure 17-4) show that the Walsh River experiences zero flows approximately 25 per cent of time at Nullinga and approximately 15 per cent of the time at Flatrock.

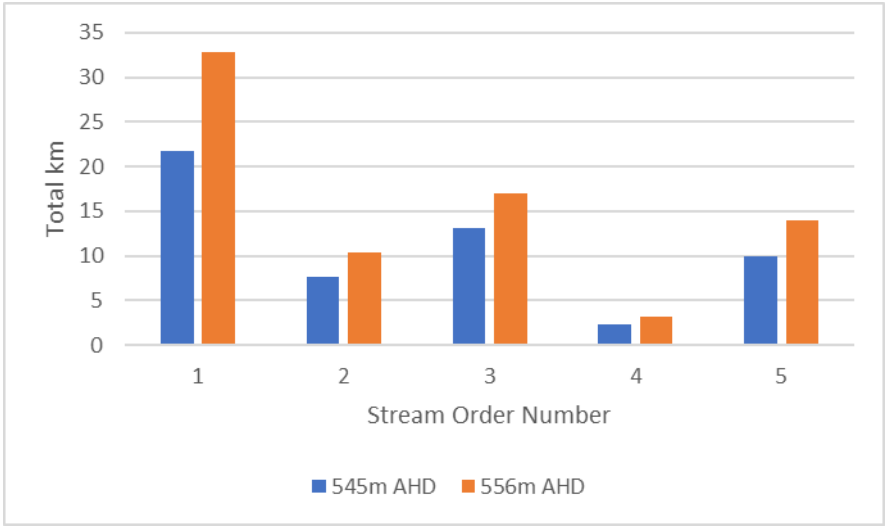
Flood flow volumes progressively increase down the catchment. For instance, the 1 in 10-year daily flow at Nullinga is approximately 30,000 ML/day, while at Flatrock it is approximately 120,000 ML/day.

Figure 17-4 Base case flow duration curve



The dam will inundate the Walsh River, Catherine Creek, Pandanus creek and a number of unnamed tributaries. The inundation of watercourses is summarised in Figure 17-5 by stream order. The small dam will inundate about 54 km of upper catchment streams, while the large dam will inundate about 77 km, the majority of which are intermittent Order 1 streams.

Figure 17-5 Length of watercourse impacted by stream order



The proposed Project will utilise a combination of the existing channel delivery infrastructure and new pipelines to distribute the majority of water with only minor release to the Walsh River, which means there will be a reduction in flows immediately downstream of the dam. Yield modelling undertaken for this study did not include allowance for any environmental releases. Therefore, flows downstream of the dam as currently modelled will primarily be made up of fish attraction flows to operate the fishway, inflows from downstream tributaries, and occasional spills when the dam fills.

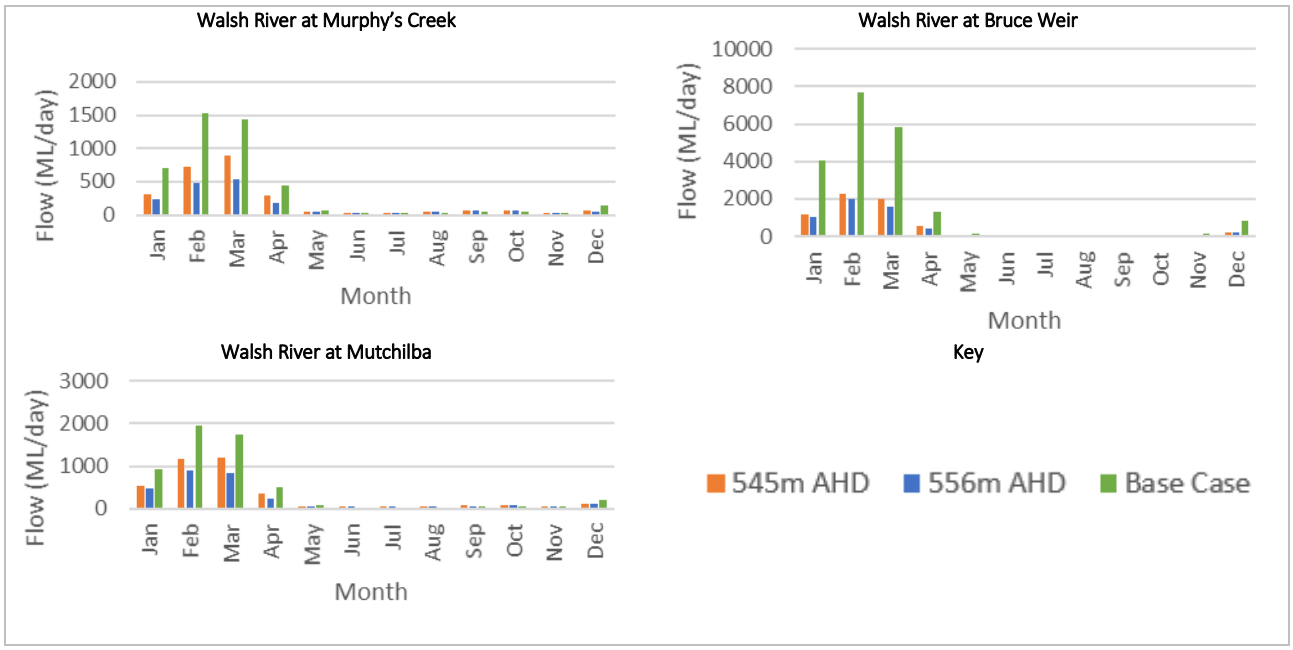
Under this distribution scenario the modelled MAF at Nullinga will be reduced to 50 per cent of pre-development by the small dam and 26 per cent by the large dam. However, by Flatrock, these figures will return to 88 and 84 per cent. The influence of the Project on flows will continue to diminish with distance downstream, becoming negligible by the time the Walsh River joins the Mitchell River.

As flows are essentially made up of tributary inflows and spills, the natural seasonal flow pattern will be retained.

Mean monthly flows at three locations along the Walsh River are presented in Figure 17-6. It is apparent that the seasonal flow pattern has been retained, but that the flow magnitude is reduced by operation of the dam. As expected the larger dam leads to greater reduction in flow.

As the dam will take flows into storage into will reduce the level, duration and volume of downstream floods. For example the 1.5 year ARI event at Nullinga will be reduced to 15 per cent of pre-development levels by the small dam and to 13 per cent by the large dam. By Flatrock this returns to 94 per cent in both cases.

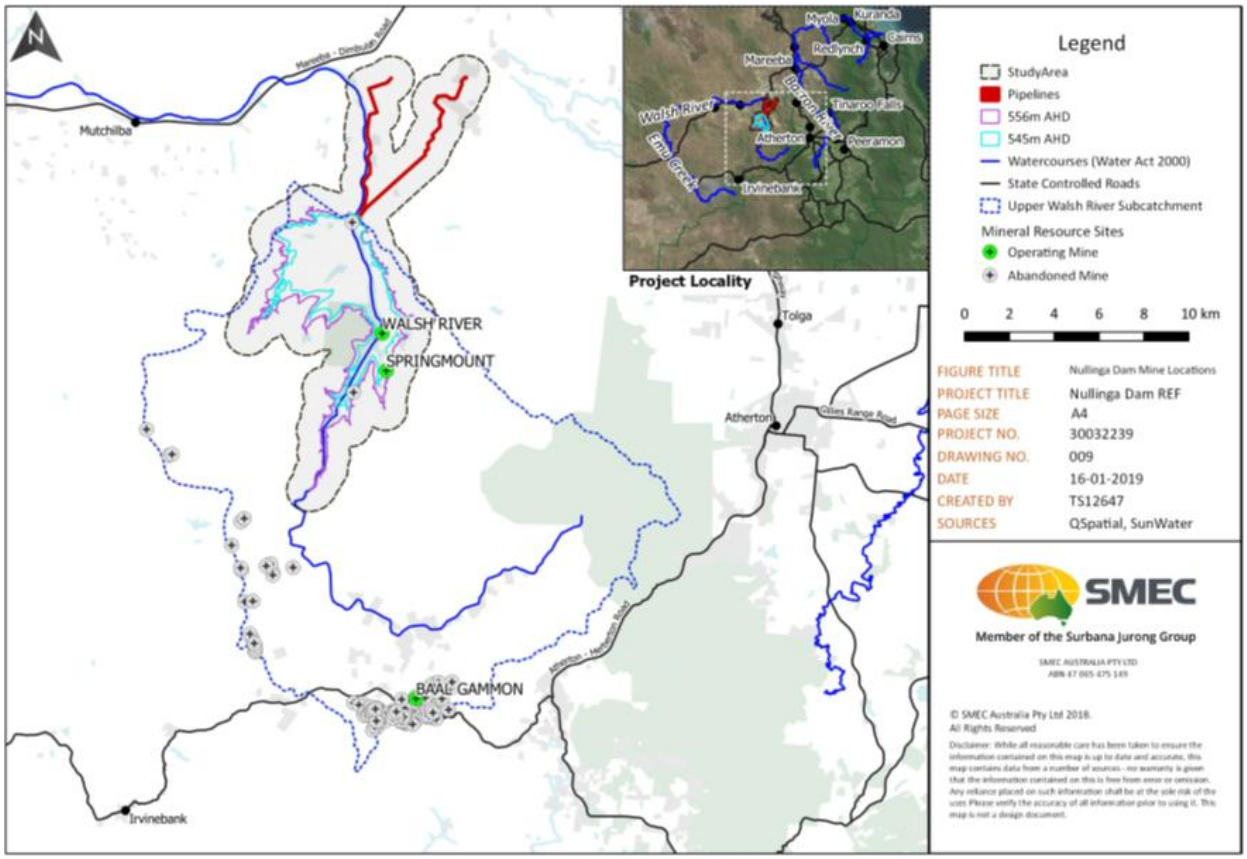
Figure 17-6 Walsh River mean monthly flows



Water Plan compliance

The Water Plan (Barron) 2002 includes all of the Barron River catchment plus the upper Walsh River as far as Flatrock so includes the entire project area.

Figure 17-7 Barron Water Plan Catchments and sub-catchments



The frameworks utilised in the Barron Water Plan include water allocation security objectives (WASOs) and environmental flow objectives (EFOs). The WASOs define a minimum reliability of supply for MP and HP allocations. The EFOs specify flow properties that must be achieved at defined locations. EFOs in the Walsh River are provided for Node 10 (Nullinga) and Node 11 (Flatrock).

Use of waters within the Walsh River downstream of Node 11 is regulated under the Water Plan (Mitchell) 2007 (the Mitchell Water Plan). The required outcomes under that water plan are for sustainable management of water and include:

- to provide for the use of all water entitlements
- water available for irrigated agriculture
- water allocation and management in the upper Walsh River and the upper Mitchell River which is compatible with the Barron Water Plan to the greatest practicable extent (Queensland Government, 2016b).

Water from the NDMIP will include irrigation supply to the MDWSS and urban supply to Cairns. The MDWSS lies partly in the Mitchell River catchment and partly in the Barron River catchment. The Barron River catchment lies to the east of the Project area and discharges into the Pacific Ocean. Modelling showed that the inter-catchment transfer to Cairns would not breach any EFO's in the Barron River.

A yield assessment, in 2018, for the dam options was undertaken based on achieving yield which does not impact on current supply performance for existing allocations (i.e. no adverse impact on existing users) as measured by WASOs.

All unsupplemented WASOs specified within the Water Plan relate to allocations located upstream of Tinaroo Falls Dam and as such cannot be impacted/affected by Nullinga Dam.

In undertaking integrated quantity and quality modelling of compliance with the Water Plan, it was found that Base Case model results, using the officially provided software, show a number of 'failed' EFOs under the provided ROP model (i.e. the base case model), as well as no 'buffer' between model results and EFO criteria specified for several key EFOs. These apparent and relatively small inconsistencies between Water Plan defined targets and model results from the official Departmental model are effectively due to required software changes and upgrades over the period (10+ years) since development of the original catchment model and Water Plan. The implication of these apparent inconsistencies is that it is not possible to assess any form of water supply development project and meet the Water Plan EFOs if strictly applied.

Also, as Nullinga Dam is not provided for within the Water Plan, any scenario assessed against current EFO criteria for the Walsh River would fail (even if the model performed as intended). As noted above, yield modelling undertaken for this study did not allow for any environmental releases so is likely an over-estimate of saleable yield given discussion of the changed flow regime above. It is likely that potential alterations to the currently modelled release strategy (viz releasing more water to the river to satisfy downstream demands rather than to channels) would assist in meeting future EFO's with less impact on saleable yield.

There is a need to establish Walsh River EFO's for the proposed development and to determine an environmental release strategy for the dam.

17.3.6 Climatic influences and climate change

Section 5.4.4 details predictions of future climatic influences in the region. It is predicted with high or very high confidence that temperature and evaporation will increase but the extent and the timeframe over which it will occur is uncertain. Changes to rainfall are possible but the direction and magnitude of change is unclear. Droughts, floods and cyclones will change in frequency and intensity but the net result is unclear. These changes will impact on the yield and reliability of the dam and those impacts will be less predictable. What is certain is that increased water storage capacity and diversity of water supply sources will assist to buffer users from the decreased predictability of supply.

17.3.7 Terrestrial flora and fauna

Flora

A desktop assessment was conducted to identify mapped vegetation communities, previous flora species records, and species protected under the EPBC Act and NC Act that have potential to occur in the Study Area based on habitat requirements.

As part of previous investigations regarding Nullinga Dam, wet and dry season surveys were completed in 2007 covering terrestrial and aquatic flora and fauna (GHD, 2008). The terrestrial surveys comprised standardised quantitative surveys of listed and commonly occurring species and an evaluation of their distribution within the Study Area. The aquatic surveys comprised quantitative surveys of riparian vegetation and aquatic fauna species and communities, assessment of habitat using AUSRivAS and Tropical Rapid Appraisal of Riparian Condition, and an assessment of water quality conditions in the catchment. As the condition of the Study Area has changed little since that time, the results are regarded as relevant and very appropriate for use.

Within the Study Area there are various associations of ironbark and bloodwood sclerophyll open woodlands, with grass and sparse shrub understorey (GHD, 2008). The integrity of this habitat is variable, depending on the degree of exposure to fire, weed invasion, grazing and vegetation clearing.

Vegetation in the Study Area intersects a State-wide biodiversity corridor. Vegetation within this area should ideally be retained as much as practically possible.

No Threatened Ecological Communities (TECs) were identified within the inundation areas in the desktop assessment or field surveys. The "Broad leaf tea-tree (*Melaleuca viridiflora*) woodlands in high rainfall coastal north Queensland" TEC is predicted to potentially occur within 10 km of the Study Area. However, *M. viridiflora* was not recorded in the Study Area, and the TEC is considered highly unlikely to occur in the area.

Sections of the Study Area are within Protected Plants Flora Survey Trigger areas. A Protected Plant Trigger area is centred on records of threatened flora with a 2 km buffer and requires a Protected Plant Survey (PPS) to be conducted within the clearing impact area plus a 100 m buffer. This would entail a PPS within the parts of the inundation area, pipeline area and any areas affected by construction activities.

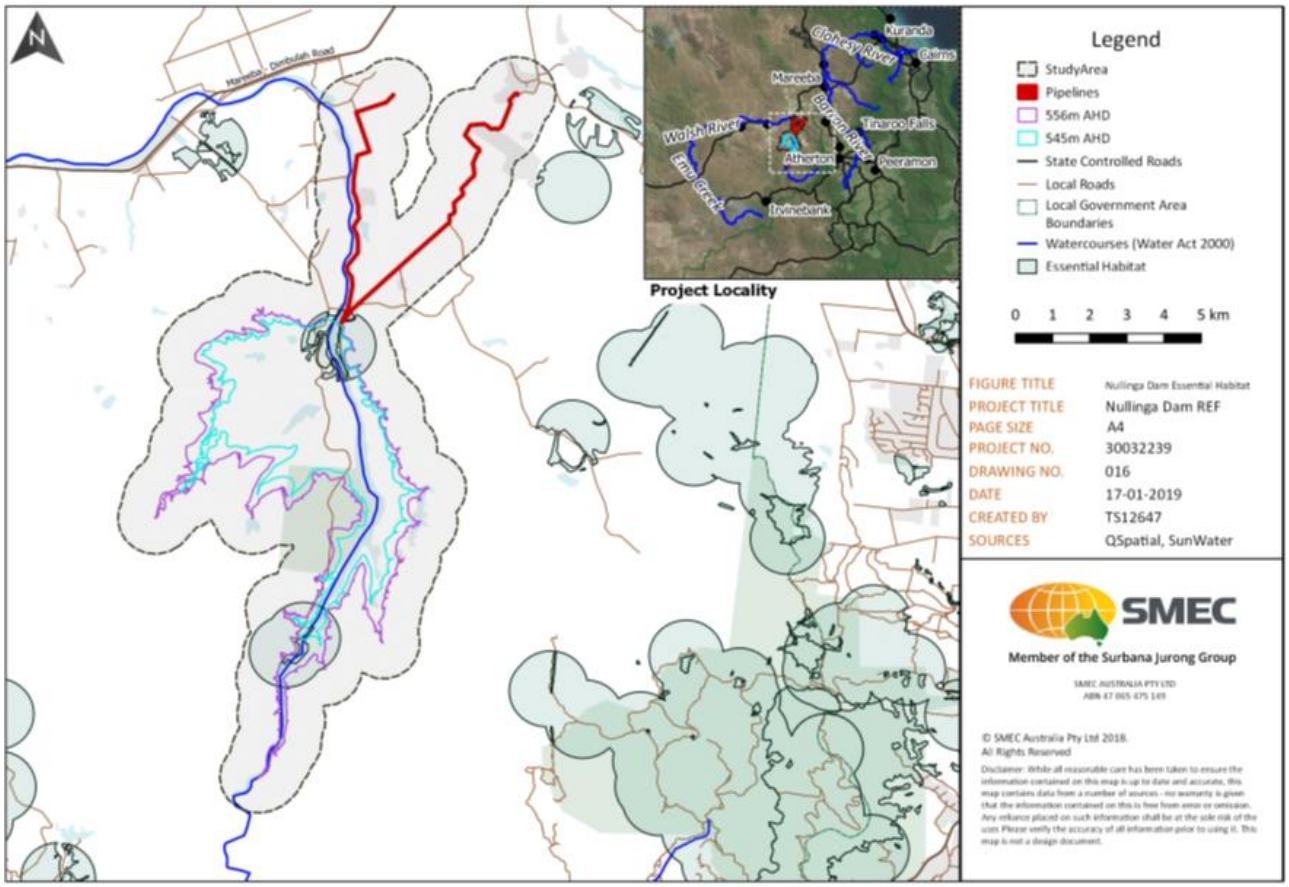
The Wildlife Online database lists ten threatened flora species that have previously been recorded within 10 km of the approximate centre of the Study Area; a further ten were predicted to occur by the EPBC Act Protected Matters Search Tool. A likelihood of occurrence assessment indicated 12 threatened species have the potential to occur in the Study Area (eight of which are also listed under the EPBC Act). Eleven of these species have been previously recorded within the Study Area, but only two species, *Cycas platyphylla* (V, NC Act and EPBC Act) and *Acacia guymeri* (V, NC Act,), were recorded by GHD (2008). Six of the species are more likely to be found on upper slopes and ridges and are less likely to occur in the inundation area. The remaining six species (*Acacia longipedunculata* (NT, NC Act), *Cajanus mareebensis* (E. NC Act and EPBC Act), *Cycas platyphylla, Grevillea glossadenia* (V, NC Act and EPBC Act), *Macropteranthes montana* (V, NC Act and EPBC Act), and *Tylophora rupicola* (E, NC Act and EPBC Act)) occur more broadly on slopes and/or along creek lines and are more likely to be at risk within the pipeline area.

Essential habitat for *Acacia guymeri* is present in the southern section of inundation area.

There is no endangered or of concern remnant vegetation mapped in the inundation areas. Fourteen least concern RE's in various mixed associations make up the remnant vegetation within the inundation areas. Areas of remnant vegetation comprise approximately 57 per cent or 1115 ha of the small dam inundation area and 64 per cent or 1784 ha of the large dam inundation area.

The pipeline areas are comprised primarily of disturbed agricultural land, mapped as Category X non-remnant vegetation. No endangered or of concern regional ecosystems are present within this area.

Figure 17-8 Essential habitat Nullinga



Fauna

The database searches returned 43 conservation significant species which may occur within 10 km of the Study Area. Of these, 21 are known or likely to occur and seven have been recorded within the Project area. GHD (2008) also recorded the Squatter Pigeon (*Geophaps stricta*; Vulnerable, NC Act and EPBC Act) and possibly the Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus*; Endangered, NC Act and Vulnerable, EPBC Act). The remaining 14 species have a moderate likelihood of occurrence.

Both Spotted-tail quoll (Endangered, NC Act and EPBC Act) and Northern quoll (Least Concern, NC Act and Endangered, EPBC Act) have been recorded within the inundation area. Essential habitat for the Spotted-tail quoll (large tracts of rainforest occasionally adjacent to wet sclerophyll forest) is mapped at the proposed dam site (i.e. in the most northern part of the inundation area and at the start of the pipelines; Figure 2-7).

A number of additional native species and special least concern fauna listed under the NC Act have been recorded within a 10 km radius of the centre of the inundation area. The likelihood of Koala occurring is considered Low. They were not recorded by GHD in 2008 and no scats or traces were observed.

17.3.8 Aquatic flora and fauna

There are no high ecological value waters or wetlands of high ecological significance classified as MSES within the Study Area

Desktop searches did not identify any threatened aquatic flora or fauna species that are known or have potential to occur in the Study area.

Fish surveys in the region and associated with the Project have recorded 25 species across the inundation and pipeline areas. All species are common in Queensland. Russell et al. (2003) investigated fish assemblages between the Mitchell and Barron catchments, including ten sites in the Walsh sub-basin downstream of the proposed Nullinga Dam site. The results suggest an overall healthy fish community. Spotted tilapia (*Tilapia mariae*), which is a restricted invasive species has been recorded in the Walsh River north of Chillagoe and near Bruce Weir.

Saw-shelled turtle (*Elseya latisternum*) was recorded at the dam site by GHD (2008) .

Desktop searches did not indicate any records of platypus (*Ornithorhynchus anatinus*) in the inundation or pipeline areas and no individuals or burrows were recorded by GHD (2008) despite targeted searches.

Aquatic Conservation Assessment wetland mapping (Aquatic Biodiversity Assessment and Mapping Method – AquaBAMM) indicates that a number of waterways in the Study Area are classified as being of very high conservation significance. Despite the AquaBAMM classification, the Walsh River and its tributaries are not in pristine condition. Extensive sand mining and quarrying for gravel in the inundation area has resulted in modified bed and bank morphology, with some riparian areas highly disturbed and a diversion of the low flow channel at the Nullinga gauging station (DNRM, 2001; GHD, 2008). Adjacent agriculture and the presence of waterway barriers has also impacted habitat condition.

Exotic aquatic flora and fauna species that are known to or may occur in the Project area and downstream include:

- Aquatic weeds – Cabomba (*Cabomba caroliniana*), Hymenachne (*Hymenachne amplexicaulis*), Water Hyacinth (*Eichhornia crassipes*), and Salvinia (*Salvinia molesta*) (all of which are category 3 restricted matter)
- Fish species - Spotted Tilapia (*Tilapia mariae*; restricted noxious fish in categories 2, 3, and 4), Guppy (*Poecilia reticulate*; not prohibited or restricted), and Gambusia (*Gambusia holbrooki*; restricted noxious fish in categories 3, 5, 6 and 7)
- Cane Toad (*Rhinella marina*).

The Department of Agriculture and Fisheries (DAF) 'Queensland waterways for waterway barrier works' spatial layer classifies the Walsh River and Oaky Creek in the study area as major risk waterways and Catherine Creek, White Gully and an un-named creek are classified as high-risk waterways. There are also a number of moderate and low risk waterways in the Study Area.

There are a number of existing man-made barriers to fauna passage in the Walsh River and its tributaries within and downstream of the Study Area, but no records of naturally occurring waterway barriers. Collins Weir, which is upstream of the Nullinga Dam site but within the inundation area, causes a minor reduction in low flows but does not drown out (DNRM, 2001). It acts as a barrier to both aquatic fauna and sediment transport (DNRM, 2001). Bruce and Leafgold Weirs, which are barriers to passage downstream of the dam site, both drown out in moderate to large floods (DNRM, 2001). None of these structures are fitted with fishways. The Walsh River regularly ceases to flow (DNRME, n.d.) and it is classified as non-perennial in State government mapping (Queensland Globe). Low flow conditions in the Study Area are therefore also likely to be a natural barrier to fish movement.

The proposed pipelines cross:

- 1 major risk (purple) waterway – Oaky Creek, a minor, non-perennial watercourse
- 1 high risk (red) waterway – White Gully, a minor, non-perennial watercourse

- 3 moderate risk (amber) waterways – Middle Creek, Murphys Creek and an un-named creek, all of which are minor, non-perennial waterways
- 8 low risk (green) waterways – mostly small, un-named, ephemeral 1st or 2nd order tributaries.

17.3.9 Environmental Offsets

This is a high-level assessment of possible offset requirements and associated costs, and the results are indicative only. Offset calculations will require further assessment as part of the EIS assessment, following completion of more detailed ecological assessments.

For the purposes of assessment, all impacts were assumed to be significant and require an offset. Only direct impacts resulting from the dam and pipeline construction are assessed and not impacts related to consequential or secondary actions, as these development areas are yet to be defined and the offset may be incurred by those undertaking those actions.

Calculation of offset costs was based on an assessment of the Project's offset requirements for Matters of State Environmental Significance (MSES) and those Matters of National Environmental Significance (MNES) that could be assessed. There are no Matters of Local Environmental Significance (MLES). The assessment suggested the only direct impact on MNES would relate to threatened species. The presence of threatened species within the Project area has not yet been confirmed. As a result, impacts to both MSES and MNES threatened species have not been included in this analysis. It is often the case that offsets for threatened species can be co-located with offsets for clearing of remnant vegetation so not incur further costs.

Environmental offsets for impacts to MSES has been calculated in accordance with the requirements of the Environmental Offsets Policy 2018 (Department of Environment and Science, 2018) and used the Queensland Government's 'Financial settlement offset calculator' tool.

The offset cost for the dams could be significant (initial estimate $11 M to $14.3 M) and has been included within prepared estimates.

17.3.10 Air quality, noise and vibration

Sensitive receptors in the project area all represent residential dwellings, of which up to 6 are located within 1 km of the dam construction area and up to 35 within 1 km of the pipeline centrelines. It is unknown if all of these buildings are occupied. Four commercial buildings are also within 1 km of the pipelines.

No quantitative assessments of ambient noise or dust have been undertaken. The region is rural and background air and noise quality is expected to reflect that environment. However, parts of the Study area are affected by nearby mining and quarry operations (including within the proposed inundation area), and a sugar mill and waste management facility are in the Arriga area near the eastern pipeline.

The main sources of noise and dust associated with the Project are likely to be from construction activities (land clearing and excavation), machinery and blasting (at the quarry and possibly for dam foundations). At the dam and quarry sites, impacts will last for the construction period (2-3 years) while along the pipeline impacts will be transient as the work-front progresses. It is noted that two quarries currently operate in the area and the existing commercial buildings are also sources of existing noise and emissions. Operations phase impacts will be minimal and primarily related to pumps along the pipeline.

Management plans will be developed based on more detailed information obtained during EIS studies should the project proceed.

17.3.11 Landscape and visual

The nominated site and surrounding lands are characterised by rural agricultural holdings, native vegetation, forest reserves and resource extraction areas. There are scattered residential dwellings and rural roads.

Visually sensitive receptors essentially comprise the same residents as those potentially affected by noise and dust. The location of the dam work site is such that the view of construction activities from nearby rural properties and the local road network would be limited. During the operations phase travellers through the area will be able to see the finished dam and the inundation area if they intentionally visited the site. Rehabilitation of works areas will assist in reducing impacts.

Pipeline construction phase work areas will be more visible given the flatter terrain but the work front and associated machinery will move quickly along the alignment. In the operations phase, above ground infrastructure will be visible but its scale represents minimal impact. Rapid easement rehabilitation will be required.

17.3.12 Cultural heritage

Database records show one known site of indigenous cultural heritage significance within the inundation area but none on the pipeline routes and no sites of non-indigenous heritage. The large areas or relatively undisturbed land and the presence of watercourses suggests a moderate likelihood of discovery of sites or items of indigenous cultural heritage significance within the inundation area. Areas of the pipeline routes which have been subject to ground disturbance, such as developed road reserves, would have a low likelihood.

A CHMP will need to be developed with the Bar Barrum People (the Native Title holders) for matters under the Aboriginal Cultural Heritage Act 2003 prior to development of the Project. A field survey will be undertaken as part of the CHMP or to inform the CHMP.

For non-indigenous heritage, a discoveries procedure for the entire Project area will be implemented to ensure compliance with archaeological requirements of the Queensland Heritage Act 1992.

17.3.13 Waste management

Dam construction and clearing of the inundation area can create waste streams including:

- dam construction waste (including transport and packing wastes, concrete, rock, gravel, excess spoil, scrap metals, cable, wire, insulation, plastics and bitumen. Decommissioning of Collins Weir could generate substantial concrete waste
- regulated waste (including paints, resins, solvents, tyres, batteries, oil filters, grease trap wastes, waste fuel and oil, and sewage from the offices and camp)
- office and domestic waste (including that related to messing facilities) and domestic wastewater
- wastewater (including that from site run-off, vehicle wash down, ablutions and kitchens)
- demolition and decontamination waste related to dwellings and farm infrastructure within the inundation area
- green waste (from clearing of the works and inundation area).

The isolated nature of the site dictates that no existing waste management services are on site[129].

[129] The Springmount Waste Management facility is only a few km from the Nullinga Dam site

Much less waste will be generated by pipeline construction and trench spoil can usually be re-used on site.

A Waste Management Plan will be developed for the construction phase and will follow the Waste Management Hierarchy (avoid, reduce, re-use, recycle, recover, treat and finally safe disposal). Large volumes of waste can generally be re-used, recycled or safely disposed of on site. Regulated wastes are usually removed by a licensed contractor and disposed of at appropriate regional facilities.

Operational waste would be minor and disposed offsite.