Guideline for Development Adjacent to the Upper Canal and Warragamba Pipelines

September 2021

Document Control

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WaterNSW

WaterNSW is the State-owned corporation responsible for managing bulk water supply, including management of the Upper Canal and Warragamba Pipelines critical water supply infrastructure. WaterNSW also acts to protect Greater Sydney's drinking water catchment through protecting the quality of the water supply.

More information about WaterNSW is at www.waternsw.com.au.

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Glossary and Acronyms

Term	Definition
Activity	Same meaning as in Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).
Affected Land	The lands identified on the *State Environmental Planning Policy (Infrastructure) 2007* Water Supply Infrastructure Maps Affected land includes both the Upper Canal corridor and its associated drainage catchment and buffer, as well as the Warragamba Pipelines corridor and its associated buffer.
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.
Consent authority	The council, government agency or person having the function to determine a development application for land use under Division 4.2 of the EP&A Act.
Controlled areas	An area of land for the time being declared under the *Water NSW Act 2014* to be a Controlled Area. Areas declared include the Upper Canal and Warragamba Pipelines Corridors, inclusive of all land and the water supply infrastructure owned by or vested in WaterNSW.
Determining authority	A Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out (EP&A Act).
Development	Same meaning as in section 1.5 of the EP&A Act.
Emergency works	Works carried out in response to— (a) a sudden natural event, including a storm, flood, tree fall, bush fire, land slip or coastal inundation, or (b) accident, equipment failure or structural collapse, or (c) damage caused by vandalism, arson or a pollution incident.
EP&A Act	NSW *Environmental Planning and Assessment Act 1979.*
Frac-out	A release of drill slurry at a fracture zone which has occurred on the surface through the building up of pressure in the borehole.
LGA	Local Government Area
Upper Canal corridor	The corridor of land owned or vested in WaterNSW that supports the water supply canal that runs from the Upper Nepean to Prospect Reservoir, which includes the canal, aqueducts, tunnels, associated infrastructure and the surrounding corridor (curtilage to curtilage).
Warragamba Pipelines corridor	The corridor of land owned or vested in WaterNSW that supports the two water supply pipelines, which run from Warragamba Dam to Prospect Reservoir, including the pipes, associated infrastructure and the surrounding corridor (curtilage to curtilage).
Water Supply Infrastructure	The infrastructure serving the management and operation of the Upper Canal and Warragamba Pipelines, together with any other facilities or property owned, leased, occupied or used by WaterNSW.

1. Introduction & Background

1.1 About WaterNSW

WaterNSW is the State-owned corporation responsible for protecting water quality and managing bulk water supply, including management of the Upper Canal and Warragamba Pipelines critical water supply infrastructure. Protection and maintenance of this infrastructure is essential to ensure the supply of drinking water to people in Greater Sydney and surrounding regions.

The *Water NSW Act 2014* (the Act) and associated *Water NSW Regulation 2020* include controls, restrictions and penalties designed to protect the water supply infrastructure and drinking water quality from pollution, damage, unauthorised entry or other unauthorised activities.

1.2 WaterNSW Corridors

The Upper Canal and Warragamba Pipelines infrastructure and their associated corridors (the Corridors) are located in south west and western Sydney (Figure 1), and are owned and managed by WaterNSW. The corridors are classified as 'Controlled Areas' under the Act.

To find out more about the Greater Sydney Water Supply network, visit WaterNSW's website and view the interactive map. Locate our major dams and reservoirs, water supply weirs and see the boundaries for the drinking water catchment, Special Areas and Controlled Areas. To assist authorities and applicants with identifying the water supply infrastructure boundaries, GIS shape-files of the Corridors are available on request.

Upper Canal

- The Upper Canal begins at Pheasants Nest Weir on the Nepean River and transfers water 64 kilometres from the Upper Nepean Dams to the Prospect water filtration plant. The Canal Corridor traverses the Wollondilly, Campbelltown, Camden, Liverpool and Fairfield local government areas (LGAs).
- The Upper Canal Corridor should be referred to consistently throughout any documents (in the text as well as all figures and tables) as the 'WaterNSW Upper Canal'.

Warragamba Pipelines

- The Warragamba Pipelines transfer water from Warragamba Dam to the Prospect water filtration plant traversing the Wollondilly, Penrith, Fairfield and Blacktown LGAs.
- The Warragamba Pipelines Corridor should consistently be referred to throughout documents (in the text as well as all figures etc) as the 'Warragamba to Prospect Water Supply Pipelines'.

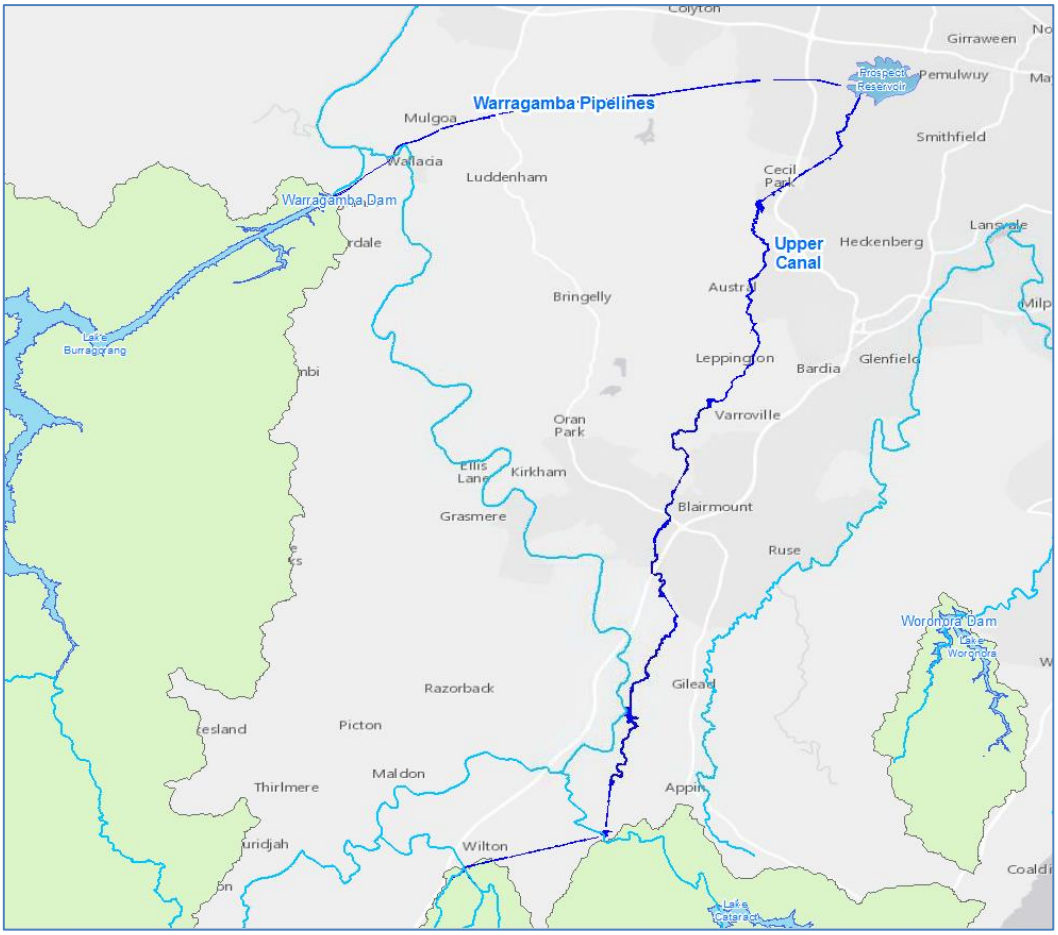


Figure 1 - Location of the Upper Canal and Warragamba Pipelines

1.3 Asset Information - about the Warragamba Pipelines and Upper Canal

The average width of the Upper Canal and Warragamba Pipelines Corridors (the Corridors) is 40 metres, but in some locations can vary between 20 and 80 metres. The infrastructure within the Corridors lies both above and underground.

The Warragamba Pipelines form the most crucial pieces of water supply infrastructure carrying water from Warragamba Dam to Prospect Water Filtration Plant (Figure 2). The two pipelines that originate at the valve house at Warragamba are the primary method of water release from Warragamba Dam. Of the two pipelines, one is 2.1 metres in diameter (referred to as pipeline 1), the other 3 metres in diameter (referred to as pipeline 2). Construction of the smaller pipeline was completed in 1954, while the large pipeline was completed in 1969. Each of the pipelines is 27 kilometres long and combined can transport 2,600 megalitres of water a day, providing on average 80% of Sydney's water supply.

The Upper Canal, constructed in the 1880s, and as depicted in Figure 3, is a precise piece of engineering and is still the only way of transferring water to Sydney from the four Upper Nepean Dams (Cataract, Cordeaux, Avon and Nepean), supplying on average 20% of Sydney's water supply. The Canal is 64km in length comprising of tunnels (19km), aqueducts (1km) and open water channel (44km). The Canal is built from a variety of materials, depending on the nature of the landscape it passes through. Where the ground is soft, the Canal is trapezoidal in shape and the sides lined with unreinforced concrete slabs. In other sections, the Canal is u-shaped and the sides are lined with sandstone masonry. Where the Canal is cut into solid rock, it is unlined.

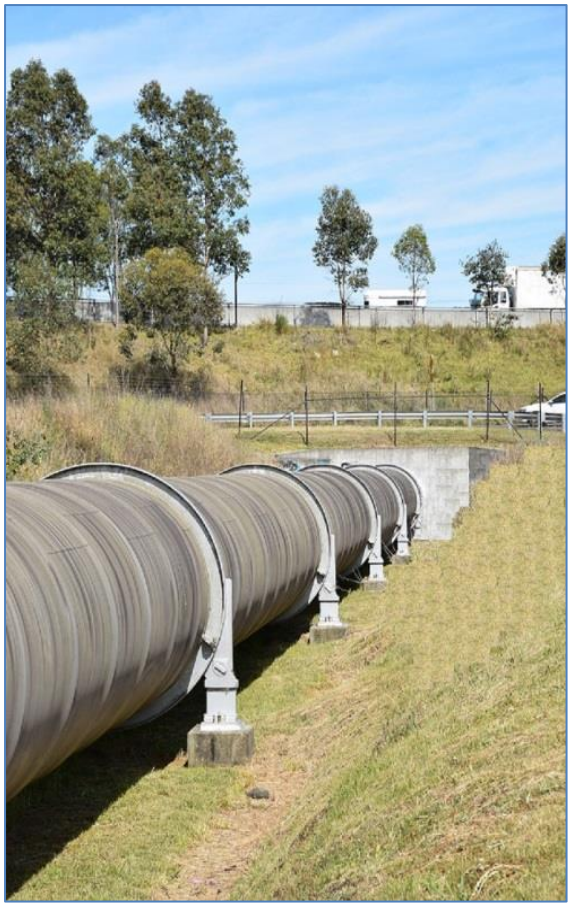


Figure 2 - The Warragamba Pipelines extending underground to run under a road

Figure 3 - The Upper Canal runs above and below ground

1.4 Purpose of the Guideline

The potential for impacts on the Corridors and associated infrastructure is likely to increase as the surrounding land becomes more urbanised. Figure 4 shows the extent of development around the bulk water supply infrastructure. A reduction in natural vegetation buffers and an increase in hard surfaces, traffic, population and other consequences associated with urbanisation will increase the potential for contamination, damage and unauthorised entry to occur.

This guideline has been prepared for use by planning and consent authorities and applicants of development activities which occur on land identified as 'affected land' in the *State Environmental Planning Policy (Infrastructure) 2007* Water Supply Infrastructure Maps. The guideline offers a range of solutions or options that are based on risk management principles, to help applicants better plan and construct works on or near the Corridors.

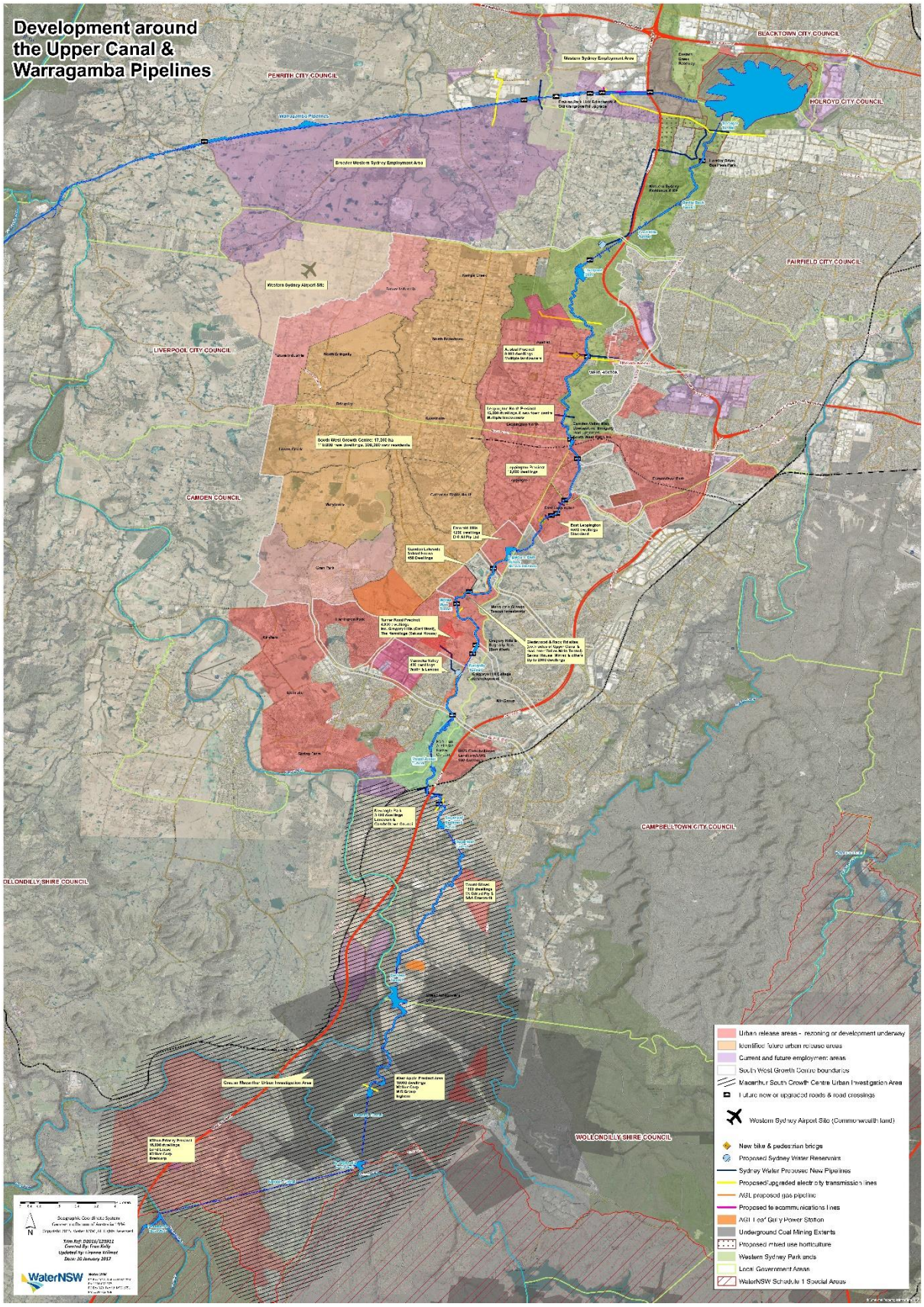


Figure 4 - Summary of development, urban release and employment areas along the Warragamba Pipelines and Upper Canal Corridors

1.5 Infrastructure SEPP

In September 2021 *State Environmental Planning Policy (Infrastructure) 2007* (the Infrastructure SEPP) was amended to include provisions to protect the integrity and stability of the existing bulk water supply infrastructure in Western Sydney.

The amendment identifies 'affected land' for the Upper Canal and the two Warragamba Pipelines and introduces a new clause under *Division 24 Water supply systems* that triggers the consideration of this guideline for new developments within the mapped 'affected land'.

This clause prescribes that, before determining a development application located on 'affected land', the consent authority must be satisfied that the development is consistent with this guideline. The provisions can be accessed here.

The updated provisions ensure there is an appropriate level of consideration given to matters affecting the integrity of the Upper Canal and Warragamba Pipelines. They ensure that new development does not compromise water quality, or the effective operation and function of the bulk water supply infrastructure, in supplying bulk raw water to Sydney.

1.5.1 Identification and mapping of Water Supply Infrastructure

For the purposes of consideration under the Infrastructure SEPP, reference to Bulk Water Supply Infrastructure and 'affected land' is as per the *State Environmental Planning Policy (Infrastructure) 2007* Water Supply Infrastructure Maps approved by the Minister for Planning & Public Spaces. The maps can be accessed through the same link as the provisions above, with Figure 5 providing a high-level overview of the 'affected land'.

The 'affected land' contained within the Water Supply Infrastructure Maps comprises WaterNSW owned land (the Corridors) and a defined buffer area. It is important to note the 'affected land' is not always a linear feature due to:

- different lot sizes occurring within the Corridors;
- the presence of other infrastructure such as ventilation shafts (e.g. where the Upper Canal lies underground in a tunnel);
- the upstream catchment to open waters (e.g. the water transferred via the Upper Canal is mostly open water, and therefore potentially influenced by runoff from areas upstream of the Canal);
- gaps in ownership of WaterNSW land; and
- different defined buffer areas for the Upper Canal and the Warragamba Pipelines.

Note: For the Upper Canal Corridor, the buffer area is based on an upstream catchment area, where there is a reasonable risk of overland flow/contaminated water entering into the corridor and open waters of the canal. This is based on all of the upstream drainage that potentially impacts the Upper Canal and can range from 25m to approximately 1.4km. For areas not at risk from incoming overland flow, and for areas on the downstream/ downslope side the Canal, the Upper Canal buffer defaults to a 25m buffer.

As the Warragamba Pipelines are not subject to runoff impacts, a conservative 25m buffer distance has been prescribed from the pipelines corridor property boundary. The 25m buffer distance is consistent with similar existing provisions within the Infrastructure SEPP.

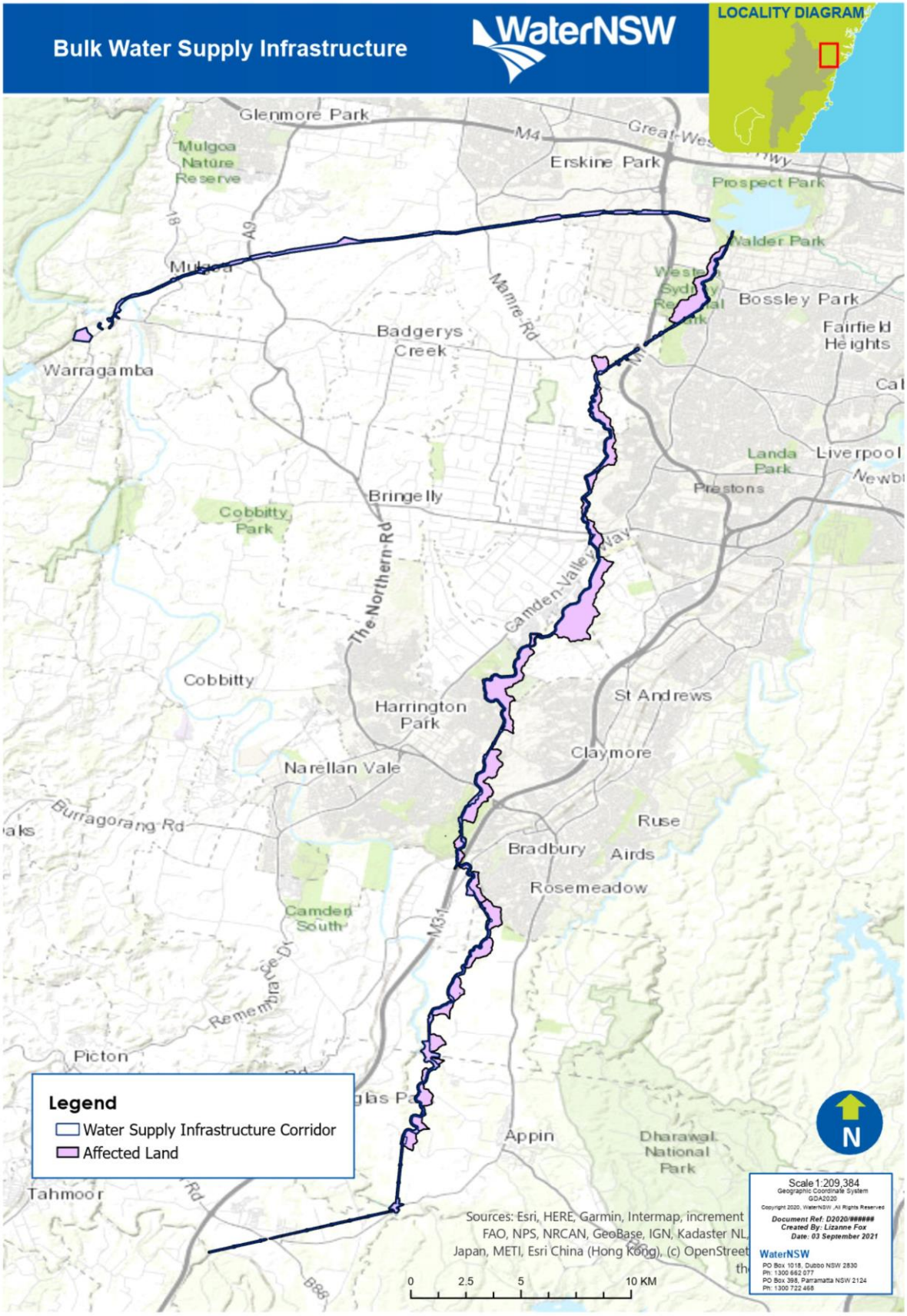


Figure 5 – Bulk Water Supply Infrastructure Map showing the Bulk Water Supply Infrastructure Corridors and Affected Land.

1.6 Guiding principles

Overarching principles (Appendix 1) have been adopted by WaterNSW to ensure safe and reliable water distribution, both now and into the future, and the protection of WaterNSW infrastructure.

When reviewing a development application that is located on 'affected land', the consent authority should take into account this Guideline and specifically:

(a) the potential effects of the development on —

(i) the safety, security and structural integrity of bulk water supply infrastructure

(ii) the safety of WaterNSW staff and contractors working within the Corridors

(iii) access to bulk water supply infrastructure for maintenance and operation by Water NSW (and Sydney Water Corporation and their contractors)

(iv) the risk of illegal access to the bulk water supply infrastructure

(v) stormwater management and flooding risk to the bulk water supply infrastructure;

(b) for land identified as 'affected land' near the Upper Canal Corridor, whether the development will have a neutral or beneficial impact on water quality; and

(c) any proposed treatment and control measures for the effects identified.

When planning and designing development proposals on 'affected land', the applicant should demonstrate due consideration of the following key factors:

- no adverse impact on water quality within the open waters of the Upper Canal at any stage of the development;
- no increase in groundwater or surface water flows into or across the Corridors or the creation of any impediments to existing flow;
- demonstrated avoidance of damage to the water supply infrastructure, including the stormwater structures currently serving the Corridors;
- no accelerated degradation is to occur to the water supply infrastructure due to the interaction of the new development with the existing assets;
- 24-hour all-weather access to the Corridors should be retained or provided for WaterNSW staff and contractors;
- no public entry into the Corridors is permitted at any time, in order to ensure the security and safety of the water supply infrastructure. If entry is required by the applicant and/or their contractors for any purpose during the development process, the Consent of WaterNSW will be required;
- urban subdivision design should provide a boundary road, road reserve or other public open space area between proposed housing lots and Upper Canal and Warragamba Pipelines Corridors;
- the heritage values of the State Heritage listed Upper Canal must be taken into consideration and protected at all stages of the development.

Figure 6 - The Warragamba Pipelines traversing the Western Sydney Employment Area (2018)

1.6.1 Neutral or beneficial impact on water quality

A consent authority must not grant consent to any land in the Western Sydney Parklands unless the consent authority is satisfied that development will have a neutral or beneficial impact on the quality of the water in the bulk water supply infrastructure *(clause 13 - State Environmental Planning Policy (Western Sydney Parklands) 2009)*. This clause is relevant as the Upper Canal is bulk water supply infrastructure.

For the remainder of the Upper Canal and the length of the Warragamba Pipelines, development proposals should not result in an adverse impact on water quality flowing onto or within the Corridors. WaterNSW advocates for demonstrated improvement to water quality for the Corridors.

1.6.2 Adverse impacts from increases in water quantity

Developments that increase or change surface water flows, flood levels and velocity, or interact with groundwater within or through the Corridors, will not be supported by WaterNSW, due to the amplified risk of failure to WaterNSW assets and infrastructure.

WaterNSW requires that post-development flows that *enter or are conveyed across* the Corridors is equal to or less than the pre-development flows and velocity for each storm event up to and including the 1% AEP event.

1.7 Consultation with WaterNSW

Development within the Upper Canal and Warragamba Pipelines Corridors

Any development within or proposing to cross the Upper Canal or Warragamba Pipelines Corridors will require the approval of WaterNSW.[1] It is highly recommended that consultation with WaterNSW occur as early as possible, to ensure key issues relevant to particular locations are identified for the benefit of the applicant or authority. Early consultation also assists applicants with the preparation of Consent applications to WaterNSW (see Section 1.8 for more information on Consents).

Development on Affected Land

Applicants and consent authorities are recommended to consult with WaterNSW when a development is proposed on 'affected land', adjacent to the Corridors (as identified on the *State Environmental Planning Policy (Infrastructure) 2007* Water Supply Infrastructure maps).

This should occur as early as possible, as early consultation will assist in the identification and assessment of relevant environmental factors specific to developing near water supply infrastructure. In some instances, it may be necessary for a consent authority to include requested conditions of consent from WaterNSW in a development approval. WaterNSW appreciates the opportunity to be consulted during application exhibition.

All contact should be made using the email address:
Environmental.Assessments@waternsw.com.au

Figure 7 - New suburbs under development near the Upper Canal (2018)

[1] The consent of WaterNSW is required to work within 'controlled areas' in accordance with the *Water NSW Regulation 2020* (see Section 1.8 of the Guildeline).

1.8 Entry requirements into the Corridors

1.8.1 WaterNSW Consent to enter and undertake activities within the Corridors

Under the *Water NSW Act 2014*, and associated Regulation, entry to the Upper Canal and Warragamba Pipelines Corridors is strictly prohibited for security and safety reasons, except when permitted through the written Consent of WaterNSW.

Applicants of development and associated infrastructure and services may need to apply for written Consent from WaterNSW for entry to the Corridors for the purpose of inspections, surveys, and assessments.

WaterNSW consent is also required for the carrying out of any construction or other works within the Corridors. This can be applied for at the same time as any lease, licence or easement required for that purpose (see below for further information).

Where escorted entry by WaterNSW is provided for site inspections, the written Consent of WaterNSW is not required, provided the applicant or authority is escorted by WaterNSW personnel at all times.

When applying for Consent, the applicant must follow the Consent Application process, which includes submitting an on-line application covering the assessment and/or construction periods. The application form can be found on WaterNSW's website.

Consider contacting WaterNSW before submitting a Consent Application

https://www.waternsw.com.au/water-quality/catchment/manage/special-areas/access

A Consent Application may take up to 28 business days to process, depending on the completeness of information supplied with the application. The minimum information that will need to be supplied with a Consent Application includes:

- a detailed map or description of the location;
- a copy of any relevant approvals issued under the EP& A Act;
- a Safe Work Plan specific to the type of activity and location – including a detailed methodology, risk assessments, and safe work method statements, and/ or include the Review of Environmental Factors (REF); or other Environmental Impact Assessment (EIA) for the activity, and Construction Environmental Management Plan (CEMP), if relevant;
- a Certificate of Currency in relation to public liability insurance (minimum $20 million).

Allowance should be made for processing time when calculating the proposed first date of entry on the application form. If the application is incomplete or more information is needed, then the assessment period will start from the time all required information is received (note that the application may be refused if the information is not received).

Additionally, unless Consent is obtained, the Corridors are not permitted to be used to access adjacent development sites, store materials or equipment, or for maintenance activities post-development.

Receipt of the Consent Application will be acknowledged by email and the determination will be given in writing. If the application is successful, the Consent will include conditions of entry that will need to be satisfied throughout the period of the Consent.

Apply for Consent at least 28 business days before entry is planned.

Make sure all relevant supporting information is attached.

Not complying with any conditions may be an offence under the *Water NSW Act 2014* or *Water NSW Regulation 2020* and may even result in a breach of the *Protection of the Environment Operations Act 1997*, and associated regulations. WaterNSW can also revoke or modify the Consent at any time.

1.8.2 Inductions

Every person who enters the Corridors must complete a WaterNSW induction prior to entry, unless escorted by WaterNSW personnel. The on-site supervisor must have in their possession a copy of the Consent, any environmental assessments, Statutory Approvals and associated Conditions of Approval, any related environmental management plan, the Safe Work Plan and a copy of all licences, permits and other approvals that are required in relation to the activities within the Corridors.

Where required, WaterNSW also recommends that contractors include a separate item in their own site induction process to acknowledge the importance of the Corridors and any associated special requirements when working in the 'affected land'.

1.8.3 Leases, licences and easements

For any development that proposes new permanent infrastructure, such as a road, pedestrian or service crossing, in the Corridors, the applicant must enter into a separate lease, licence, or other formal property agreement with WaterNSW.

Applicants should contact the Lands Administration team at WaterNSW to discuss arrangements at the same time as applying for Consent.

2. Factors to be considered

WaterNSW recommends planning and consent authorities and applicants address the factors discussed in this Section when planning, designing or assessing a proposal located within the 'affected land'.

Any proposal to construct or upgrade infrastructure or for urban development within the 'affected land' should address these factors to the satisfaction of the consent authority. For the Corridors, as a minimum, applicants must comply with WaterNSW standards and policies. The onus is on the applicant to demonstrate that the development will not lead to failure mechanisms of the Upper Canal or Warragamba Pipelines.

Appendix 2 provides an outline of the potential risks to the Corridors and preferred documentation to be included with any application for review that is within the 'affected land'.

2.1 Maintaining access for WaterNSW staff and contractors

WaterNSW and their contractors require safe 24-hour vehicular access into and along the land corridors serving the water supply infrastructure, for security and emergency purposes. Operational and security vehicles, including trucks with trailers and tractors with implements also need to be able to safely cross public arterial roads from one section of the Corridor to another.

Any works on 'affected land' should be designed, constructed and operated in a manner that does not prevent or impede WaterNSW or WaterNSW contractors from accessing, maintaining and operating the water supply infrastructure within the Corridors.

Requirements:

- Access must not be blocked for vehicles or machinery entering or exiting the Corridors, or along the existing management roadways within the Corridors;
- External development must not permanently block traffic into the Corridors. Temporary changes to access conditions may be considered by WaterNSW, only if WaterNSW is notified in advance and approve the changes;
- Ensure that heavy vehicle and plant machinery is not impeded from undertaking future upgrades/ refurbishment/ replacement works proposed by WaterNSW in the Corridors (see Figure 8);
- Approach angles of roads, exiting load constraints and bridge heights must be accommodated in access requirements, including the space requirements needed to transport large sections of pipe;
- Corridor exit and entry points must be designed in compliance with Austroads and Roads and Maritime Services (RMS) guides, technical directions and specifications, and WaterNSW requirements;
- Ensure that all vehicle types can safely enter/ exit WaterNSW property, including pulling off safely from public roads with adequate room to open or close gates:
    - The typical design vehicle should be a single truck (12.5m), with a 13m layback from road edge. However, these requirements may change due to site constraints or servicing requirements.
    - Warragamba Pipelines Corridor - for cross section elements and turning paths into primary access areas of the corridor (min. 2 lane local road), a 19m Prime Mover and Semi-Trailer right of way vehicle is required as the design vehicle.
    - Where less than 13m is available, electrically operated gates (to WaterNSW specifications) may be offered as a suitable alternative.

Figure 8 - Heavy vehicle access into the Corridors is often required to carry out repair and maintenance work

Where a development proposal may impact WaterNSW's access the Corridors, it is highly recommended that consent authorities consult with WaterNSW early in the planning and development process for each individual site. This consultation will allow suitable consideration of operational access routes and entry/exit gates and guardrails that will be maintained or provided for WaterNSW to carry out its business in a safe and efficient manner.

Figure 9 - Entry / exit point at Mamre Road

2.2 Land use planning and landscaping

Land uses and landscaping along the Upper Canal and Warragamba Pipelines Corridor boundaries is an important consideration for applicants and authorities when planning new development precincts on 'affected land'.

The once rural farmlands, the lands surrounding these Corridors now consist of housing and industrial developments. Where possible WaterNSW would like to see the historical land use characteristics maintained and incorporated into landscaping and estate design.

2.2.1 Subdivisions

Requirements:

- For surveillance and security reasons, new housing developments should be separated from Corridor boundaries by means of a local public road, road reserve or public open space. Where roads are proposed, a soft landscaped verge, and/or footpath/bicycle path should be provided as a further buffer between the corridor boundaries and the local road carriageway;
- Subdivisions that locate residential lots directly abutting the Corridors are not supported by WaterNSW. This is because there is minimal ability to manage, control or prevent unauthorised uses from occurring on adjoining individual properties, that could directly impact on the Corridors. If there is no other option than to locate individual residential properties directly abutting the Corridors, building setback controls and additional security fencing should be used to minimise risk;
- For the sections of the Upper Canal that are entirely underground in tunnels, the land in WaterNSW ownership should be excluded from *all* development (including open space calculations). With any proposed crossings to be negotiated with WaterNSW.
- The Corridors should be bordered by roads rather than housing lots;
- Retaining walls and footings to be constructed clear of the Corridor property boundaries;
- All asset protection zones and fire mitigation measures must be located entirely within the development site. WaterNSW does not accept any encroachment upon WaterNSW land.

2.2.2 Landscaping

Requirements:

- Tree planting along the Upper Canal or Warragamba Pipelines Corridor boundaries is not supported by WaterNSW. To prevent potential damage to boundary fencing and infrastructure from deep-rooted trees and falling branches, trees should not be planted closer to the boundary than the expected drip line of the outer foliage at maturity. The exact distance will depend on the tree species;
- WaterNSW's preference is for low-growing shrubs and grasses to be utilised in plantings immediately adjacent to the Corridor boundaries;
- WaterNSW prefers Landscape Plans that propose the use of Cumberland Plain Woodland grassland revegetation mix or equivalent adjacent to the Corridor boundaries, to recognise the historical vegetation type and allow for passive surveillance and security of the boundary;
- The use of sandstone materials around the Upper Canal Corridor is encouraged, as it represents the materials used during construction of the Canal in the 1880s and promotes the heritage significance of this Corridor.

2.3 Security and public safety

Under the *WaterNSW Act 2014* and *Water NSW Regulation 2020*, the public is prohibited from entering the Corridors for safety reasons and to ensure a continuous supply of uncontaminated drinking water.

Open parts of the Upper Canal present a danger to people and animals should they fall or jump into the Canal waters. The sides on many sections are steep, and the fast-flowing water can trap them with no easy way to climb out. The possibility of drowning is real.

Other adverse incidents such as rubbish dumping, vandalism, arson and threats to WaterNSW staff or contractors are all issues that can arise if the public is not adequately excluded from the Corridors. As a priority, WaterNSW requires corridor security be maintained from trespassers and public dumping during construction works.

2.3.1 Fencing

The current fencing along the Corridors is a mix of rural fencing, chain-link fencing, 358 mesh and palisade fencing.

For any new adjacent development where the use of the land is being intensified, WaterNSW requires appropriate, secure fencing to be constructed, as identified below, complying with WaterNSW's "*Barriers, Fences and Gates – Installation and Maintenance Manual*" (WaterNSW reference CD2011/547) and fencing specifications.

Any fencing should be erected by the developer at their own cost, to replace any existing fencing that is of a lesser security standard e.g. rural-styled fencing in undeveloped areas.

Maintenance and management of fencing is the responsibility of the adjacent landowner, not WaterNSW.

Figure 10 - Rural fencing

Figure 11 - '358' fencing

Figure 12 - Chain-link fencing along the Corridors

Figure 13 - Palisade fencing

WaterNSW's preferred standard of fencing along the Corridors is dependent upon the proposed land use, as this has implications for risk. Generally, the following standards apply:

- **Chain wire fencing** - 2.1 metre chain-link wire fencing topped with three barbed wire strands for a total height of 2.4 metres – where the adjacent land use is residential, environmental conservation, commercial, retail or industrial.
- **Palisade fencing** - 2.1 metre (minimum) prefabricated palisade fencing, comprising hot-dipped galvanised posts, pales and rails - where the adjacent land use is residential, or on request for environmental conservation, commercial, retail or industrial adjacent land uses.
- **358 fencing** - to a minimum height of 2.4 metres – where the adjacent land use is of the following types: early education and care facility, educational establishment, transport corridor, community facility, hospital, recreation area, or recreation facility.

Requirements for fencing the Corridors:

- Fencing should be installed in a manner that does not leave any ‘gaps’ between the new fence and any existing fencing on adjoining properties, regardless of the fencing type;
- Fencing and gates should be made from quality material, be robust, secure and vandal proof;
- Temporary construction fencing of sufficient standard to prevent entry onto WaterNSW land is acceptable and should also be installed within the development site boundary to maintain security until permanent fencing is erected;
- Permanent security fencing should be installed prior to the occupation of any new adjacent developments or earlier if security is likely to be compromised;
- Any fencing being replaced should be removed and disposed of at a waste management facility licensed to accept the waste;
- Any new or upgraded road or pedestrian bridge – including approaches – across the Corridors should be adequately fenced;
- Fencing should minimise the likelihood of vehicles entering the corridor in the event of a traffic accident. Where required, the fencing should be supplemented with barriers to the appropriate standard capable of restraining a B-Double truck;
- Fencing and screens should be constructed to restrict items being thrown into the corridor from the roadway or pedestrian overpass. In these instances, WaterNSW prefer the screens to be constructed of anti-climbing mesh and cranked at the top towards the overpass.

With prior written agreement of WaterNSW, alternative fencing standards may be acceptable providing the risk of unauthorised entry is not greater than that achieved by the above standards.

Applicants and authorities should discuss security and fencing requirements with WaterNSW on a site by site basis, including the potential requirement for signage and approval from Heritage NSW for fencing along the Upper Canal Corridor.

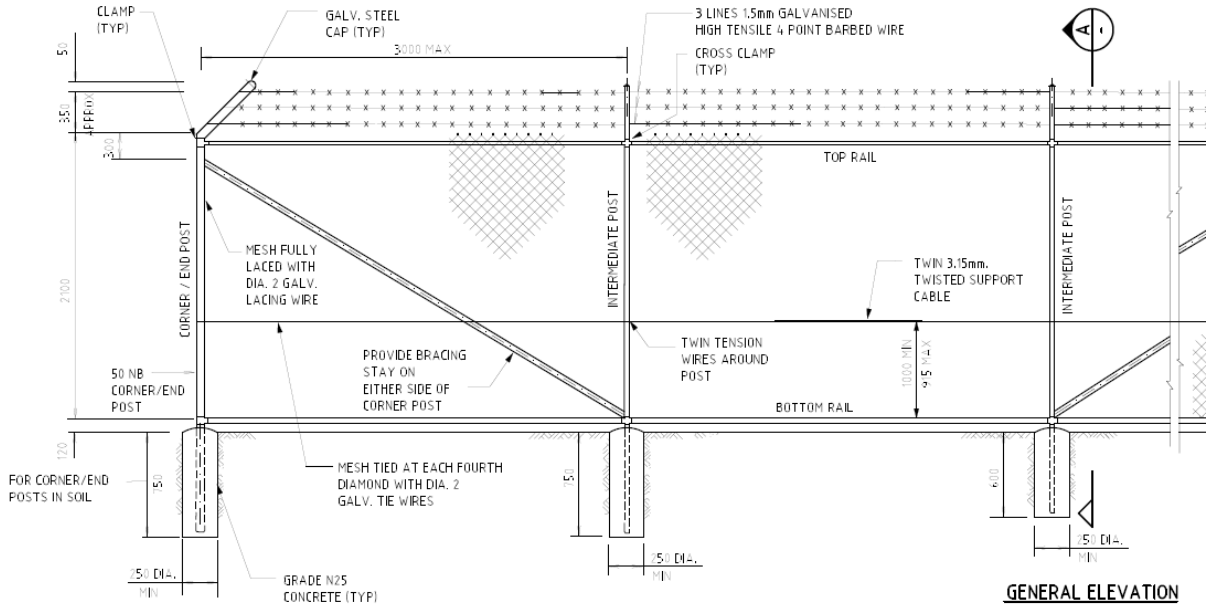


Figure 14 - Chain link fence drawing (WaterNSW ref: PL2019/264)

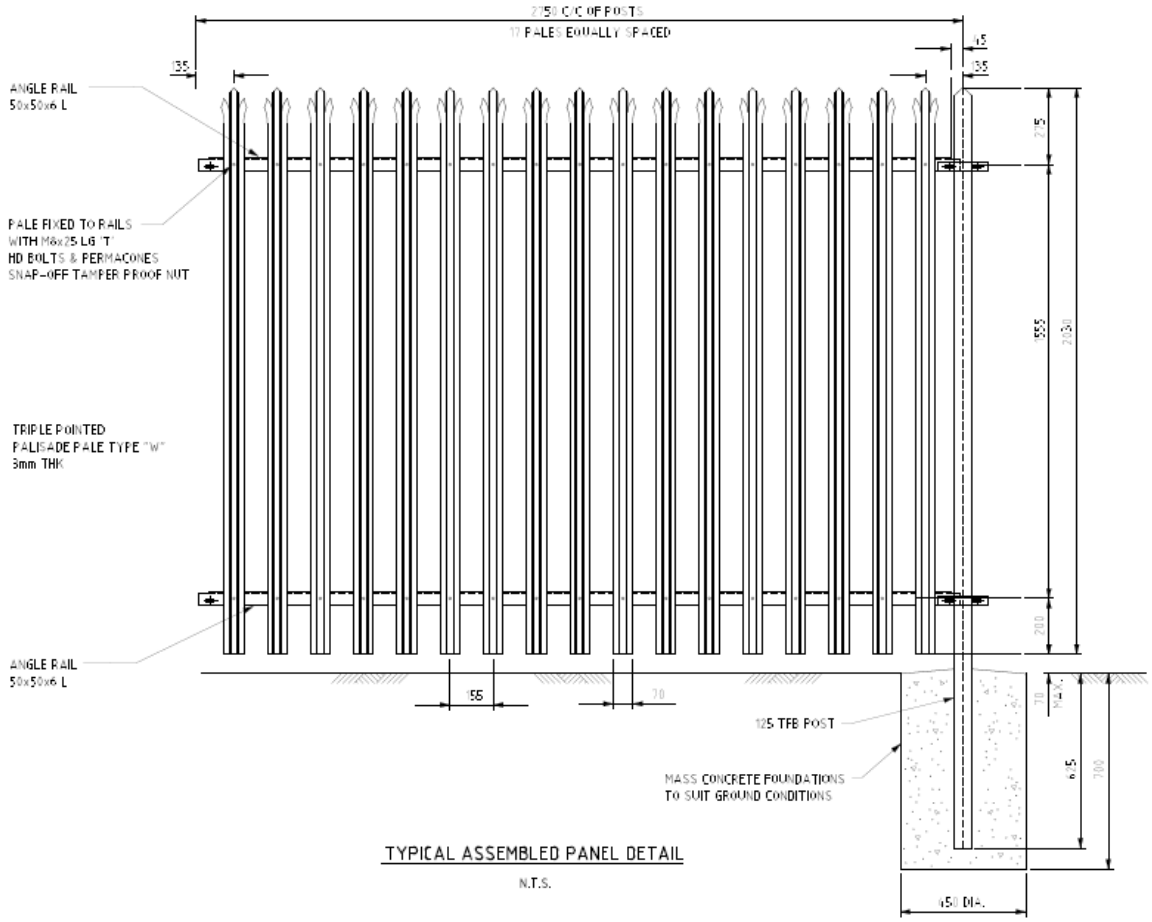


Figure 15 - Palisade fence drawing (WaterNSW ref: PL2019/254)

2.4 Road and pedestrian crossings

There are many existing vehicular and pedestrian crossing locations in and around the Corridors, providing connections between both public and private land on either side. Some crossings are not open for use by the public, some have been built at grade, while others are overpasses.

Every new or upgraded public crossing of the Corridors increases the potential for adverse impacts on the water supply infrastructure. Where new crossings of the Corridors are essential (e.g. to connect two sides of a development precinct) WaterNSW directs applicants and authorities to plan and design them where existing crossings are already located.

For the Upper Canal, which is open for most of its length, the construction or upgrade of bridges for vehicle or pedestrian access introduces the risk of pollutants and other foreign materials such as litter entering the Canal, while even small changes to the ground conditions can damage the fragile structure.

For proposals involving road, pedestrian or any other service or infrastructure crossing the Corridors, you must first consult with WaterNSW

Where crossings are considered essential infrastructure, applicants must provide justification up front as to why they meet this criterion, with regards to crossing the Corridors. Applicants should include advice on the alternative options explored and why they were dismissed.

Requirements:

- Detailed explanation of the crossings purpose and benefit;
- Any new crossing infrastructure (including footings, inspection pits and piles) is not supported by WaterNSW within the Corridors;
- Safe 24-hour access to all parts of the Corridors for WaterNSW management and maintenance activities both during construction of the new development and operation of the infrastructure. See Section 2.1.4;
- In order to meet operation, maintenance, future augmentation requirements and emergency access requirements, each new crossing of the Corridor must include sufficient separation to facilitate continuous access along and within the Corridors for all vehicles, and be outside of the zone of influence of any water supply infrastructure;
- Unless otherwise agreed, the following minimum vertical clearances are required over WaterNSW infrastructure:
    - Warragamba Pipelines - a typical minimum vertical clearance of 7.5m from the top of the pipelines to the bottom of the structure is recommended for design planning. Overhead clearance is subject to type of structure being built, location of the crossing, and elevation of the pipelines relative to surrounding areas.

      The encasement of the pipelines in concrete below the bridging structure is a potential option, to allow for a lower structure.
    - Upper Canal – overhead clearance of at least 3m is required over the path of the vehicle track along the Upper Canal.
- Where upgrades to existing road networks impact on pipeline concrete encasements, fatigue effects from increased traffic movements must be addressed;
- Ensure road or pedestrian crossings comply with all relevant design standards and enable staff and contractor vehicles to directly and safely exit or enter the Corridor. Load ratings and approach angles of crossings should accommodate WaterNSW vehicles and allow for construction and maintenance activities. See also Section 2.2.1 for fencing and barrier requirements;
- Land beneath at-grade crossings should be paved or concreted to prevent soil erosion and should allow for suitable pedestrian access to enable visual inspections and maintenance of the corridor and structure e.g. bridge bearings;
- Appropriate drainage should be installed to prevent additional surface run-off and groundwater from entering the Corridors;
- A licence, lease or easement is also required from WaterNSW for any permanent structures crossing the Corridors. This will include a standard market value annual fee;
- Geotechnical, engineering and other assessments should demonstrate that the structural integrity of WaterNSW infrastructure is maintained, risk has been assessed, that adequate stormwater and drainage controls are in place, and that construction impacts are identified. See Section 2.4 on Construction Risks for further detail.

Figure 16 – Example of land treatment beneath bridge crossing – near Kenny Hill Depot

Applicants and authorities are advised to discuss road and pedestrian requirements with WaterNSW on a site-by-site basis

Figure 17 - Pedestrian overpass in Western Sydney Parklands

Figure 18 - The Hume Highway crossing the Upper Canal at Menangle Park

2.5 Construction risks

The site preparation and construction phase of a development can pose particular risks to the infrastructure of the Upper Canal and Warragamba Pipelines. Issues include vibration, erosion and sedimentation, stormwater impacts, damage to heritage items, contamination, windblown rubbish and illegal storage of construction materials on WaterNSW land.

As critical components of Sydney's water supply system, applicants and authorities must ensure the Corridors including all support structures, are adequately protected from damage during construction. Any damage that does occur to water supply infrastructure or land in the Corridors, as a result of development or activities, will be the responsibility of the developer or builder to rectify to the satisfaction of WaterNSW.

Figure 19 - Embankment slippage along the Warragamba Pipelines Corridor

2.5.1 Excavation

Excavation is the process of moving earth, rock or other materials with tools, equipment or explosives and includes earthworks, trenching, wall shafts, bore holes and tunnelling. Specific attention must be exercised when excavating on 'affected land' to avoid disturbance or damage to the Corridors.

Particular care must be applied when undertaking works to protect the stability of earth embankments within the Corridors and vice versa to protect the infrastructure within the Corridors from earth embankment works.

The risk managed construction plan may include an engineering investigation into the potential damage caused by excavations. Excavation methods should limit potential settlement or damage to existing pipelines, canal structure or associated infrastructure.

Any construction work carried out within five (5) metres of the water supply infrastructure is considered 'high risk' and WaterNSW will require additional justification that the risk profile will not increase, and that sufficient controls or exclusions are applied.

Geotechnical investigation may include design of embankments and excavation including methods of excavation and compaction to limit foundation movement to a minimum. Mitigation actions may include shoring of excavations.

Requirements:

- All excavation work should be completed with reference to the Work Health and Safety (Excavation Work) Code of Practice by Safe Work Australia;
- All works in accordance with Australian Standard (AS3798:1996) Guidelines on earthworks for commercial and residential developments;
- Unobstructed access allowed to all existing embankments within the Corridors for ongoing maintenance;
- Within the Corridors, all plant to be kept at least 1 metre from the crest of an embankment or from water supply infrastructure.

No excavation is to be made within a five-metre buffer of the water supply infrastructure without prior engineering analysis of the structural stability and effects excavation accepted by WaterNSW

Geotechnical assessment

Depending on the nature of the proposed work, WaterNSW may require an assessment to be undertaken of the geotechnical conditions and the materials in which construction or directional drilling is proposed within the Corridors.

Geotechnical assessment should be prepared in accordance with the following relevant guidelines and standards:

- Australian Standard 1726 Geotechnical Site Investigations
- Australian Standard 1289 Methods of Testing Soils for Engineering Purposes.

The geotechnical investigation should consider the effect of the proposed installation on water supply infrastructure and be undertaken by a qualified geotechnical engineer.

Requirements:

- The geotechnical investigation report should include (but not be restricted to) the following:
    - boreholes or test pits at entry and exit points to a minimum depth of 1000mm below the base of the proposed excavation entry/exit points

- site description and results of investigation
- groundwater levels

note: the Upper Canal leaks at an unknown rate, potentially recharging the groundwater and changing the level of groundwater close to the Canal structure

- an accurately surveyed cross-section along the alignment showing current ground surface, water infrastructure levels/positions, position of proposed bore line, any existing underground services, borehole or test pit information and correlation lines of subsurface layers between boreholes or test pits, and any other relevant information
- prediction of possible ground subsidence/ settlement during the directional drilling and installation of any pipeline and/or casing, especially if non-cohesive soils are present

note: WaterNSW cannot accept <u>any</u> settlement in the Corridors without justification that the risk profile will not increase

- recommendation and justification for the minimum cover between the proposed installation and the water supply infrastructure
- recommendation for the most suitable installation method
- recommendation for the most suitable monitoring methods and limits
- provision of suitable control measures to demonstrate no change to the risk profile will result from the works
- an assessment as to whether a geotechnical engineer should be in attendance during construction to monitor any suspect ground conditions and ground movement.

There have been incidents of frac-out causing damage and contamination of the Upper Canal from horizontal directional drilling (HDD) activities. As such WaterNSW will only accept the use of drilling fluids when the Upper Canal is dewatered under a planned outage. Any damage under any circumstance will be the responsibility of the developer or builder to rectify to the satisfaction of WaterNSW.

Drilling fluids/muds must not be used while directional drilling under the Upper Canal, while it is in operation. Drilling using fluids/muds may only be undertaken, with prior approval from WaterNSW, during an Upper Canal outage, when the Canal is dewatered.

Figure 20 - Reconstruction of Upper Canal wall collapse (2008)

2.5.2 Utility infrastructure design factors

Continued urban development around the Corridors leads to the increased demand for utility and related services over, under and beside the Corridors. Of particular concern to WaterNSW is the proximity of services to our infrastructure and the increased risks this can pose, such as electrification of metal pipelines transferring water and the immediate and long-term settlement and ground movement resulting from underground drilling activities.

To ensure the effective protection of the Corridors from utility installation, design, delivery and operation, the following requirements are essential for any works within the Corridors.

General

- No new utility infrastructure (including footings, inspection pits and piles) should be located within the Corridors;
- Sufficient separation between the utility infrastructure and water supply infrastructure is required, i.e. outside of the zone of influence of any WaterNSW infrastructure;
- Drilling fluids/muds must not be used during any directional drilling under the Upper Canal Corridor when it is in operation;
- Consideration should be given to installing two isolating valves either side of the WaterNSW boundary on pressure pipelines and pipelines carrying combustible liquids and flammable fluids to isolate the main in the event of a leak or rupture or if WaterNSW needs to undertake significant work within the corridor;
- Any pits that must be located within the Corridors, should be designed for heavy road vehicle loads. The minimum pit class must be Class D, and pits must be visually inspected and cleared of debris at least every 12-24 months.

Settlement

- If the works will induce settlement within the Corridors, the total ground surface and differential settlement limits are to be agreed upon prior to works commencing;
- Pre-construction and post-construction assessments should occur to validate settlement assumptions;
- Any damage identified within the settlement trough or zone of influence of water supply infrastructure must be remediated on a ‘like for like’ basis, or to the satisfaction of WaterNSW;
- Outer annulus grouting is highly recommended to ensure a uniform contact between the casing pipe and the excavated ground to prevent the ground settlement over time;
- For works that have the potential to impact on the Corridors, the applicant should submit a ground deformation monitoring procedure, settlement management plan and grouting procedure to WaterNSW for review prior to the commencement of the work.

Carrier and encasing pipes

- Encasing pipes are highly recommended for all pipelines conveying high voltage cables, pressure pipelines and pipelines carrying combustible liquids and flammable fluids (excluding gas). The need for an encasing pipe for underground pipelines in the Corridors will be assessed on a case by case basis;
- All underground pipelines in the Corridors must be designed and constructed to withstand heavy road vehicle loads.

Electrical installations

- The applicant must demonstrated how any proposed new electrical installation does not present a safety risk to personnel and potential damage to water supply infrastructure or the Corridors, including but not limited to risk from:
    a) Earth Potential Rise (EPR) and step and touch potentials being above acceptable limits;

b) Load current and Fault current Low Frequency Induction (LFI);
c) Capacitive coupling during storage, handling, and construction of pipeline.
d) A.C. and D.C. Traction systems; and
e) accidental contact of pipelines with other electrical systems such electrical distribution or traction systems.

- Any electrical installation should not increase stray currents and where risk is identified, testing should be undertaken:
  a) prior to construction and energisation (baseline measurement);
  b) post construction and energisation; and
  c) under normal operational load conditions.
- Requirements of AS/NZS4853 Electrical Hazards on Metallic Pipelines standard, should be addressed (where applicable);
- Requirements of AS 2832.1 Cathodic Protection of Metals, Part 1: Pipes and Cables standard, should be addressed (where applicable);
- Future excavation and construction works planned by WaterNSW must not be impeded by earthing grids of electrical infrastructure from external development (see also section 3);
- Notification to WaterNSW of any new or altered electrical conditions within 1km of the Warragamba Pipelines (this includes new substations and transmission lines).

2.5.3 Vibration and settlement

Vibration impacts from construction activities such as jackhammering, pile driving, or earthmoving may cause indirect damage to the Corridors and associated water supply infrastructure. Mitigation actions may include limitations on the use of rock breakers, vibrating rollers, or any other equipment that will cause vibration to the foundations and the pipeline.

The Upper Canal is particularly susceptible to vibration and settlement due to its age. Similarly, the Warragamba Pipelines can be impacted due to their inner concrete lining, footings and expansion joints.

At present, no Australian Standards exist for the assessment of damage caused by vibration. WaterNSW accepts Line 3 of Table 1 from the current *German Standard DIN 4150 – Part 3 - "Structural Vibration Part 3: Effects of vibration in structures"* as the maximum allowable limit of vibration acceptable at water supply infrastructure.

WaterNSW is also concerned with the immediate and long-term settlement and ground movement resulting from changed conditions within the 'affected land'. Permissible deformation limits will depend on the sensitivity of the asset.

Requirements:

- All proposals where vibration and settlement risks have been identified to the Corridors, should confirm velocity limits and/ or total ground surface and differential settlement for the proposed activity and the impact the works will have on the Corridors prior to works commencing;
- Where required, a vibration monitoring procedure and management plan should be submitted to WaterNSW for review;
- Where an identified risk to the Corridors has been raised, pre-construction and post-construction assessments must occur to validate assumptions;
- Excavation methods (including rock breaking) must not trigger the maximum allowable limits set within the Standard when measured at or in the Corridors;
- Where an identified risk to the Corridors has been raised, vibration and settlement monitoring prior to and during construction must occur;

- Vibration and settlement monitoring reports are to be provided to WaterNSW;
- Any damage identified within the settlement trough or zone of influence should be reinstated on a 'like for like' basis, or to the satisfaction of WaterNSW.

The German Standard DIN 4150-3:2016 'Structural Vibration Part 3: Effects of Vibration in Structures' should be used to assess vibration effects. The guideline vibration velocity levels to be adopted for WaterNSW structural assets are those listed in line 3 of Table 1.

2.5.4 Load bearing

Not all sections of the Upper Canal, Warragamba Pipelines or associated infrastructure are able to tolerate load. For example there are some Upper Canal tunnels that can allow loads, but others need to be spanned, and pipeline encasements are built to withstand a certain load. Care should be taken not to damage water supply infrastructure from heavy load placement, including from mobile crane outriggers or similar heavy lift or earth moving equipment.

Any buried footing, piles or load supporting member must not induce load onto the Upper Canal walls and slab or Warragamba Pipelines infrastructure. In some cases, this may require sleeving the component to isolate it from the surrounding soil. Where activities induce load on water supply infrastructure, fatigue effects must be addressed and suitable mitigation measures applied.

2.5.5 Suspended loads

WaterNSW heavily restricts suspended loads being conveyed over water supply infrastructure. The use of cranes adjacent to the Corridors should mitigate against the potential to damage water supply infrastructure from dropping loads or crane failure.

Requirement:

- No items are to be lifted directly over the Warragamba pipelines at any time while the pipelines are in operation. Lifting directly over a pipeline is only permitted when the pipeline is dewatered and where direct written approval from WaterNSW is obtained.

Figure 21 – bridge girder suspended over the dewatered pipeline at Erskine Park

2.6 Stormwater Management

Management of stormwater during and after the construction of new development sites should be a major consideration for applicants and consent authorities for all development types located within the 'affected land'.

WaterNSW requires that post development stormwater flows that enter or are to be conveyed across or under the Corridors, are equal to or less than the pre-development flows for each storm up to and including the 1% AEP event.

Existing stormwater controls within the Corridors were designed to deal with runoff from rural land. For example, the Upper Canal is currently protected by a system of surface drains, flumes and stormwater culverts that prevent the flow of stormwater into the Canal.

A consequence of urban development from a predominantly rural landscape is an increase in impervious area. Without adequate controls in place, stormwater flowing in increased volume and velocity could enter the Corridors, overloading the existing drainage system resulting in erosion, flooding, water pollution and damage to infrastructure through scouring (eroding the soil) and undermining, potentially leading to collapse or failure. It is important that bulk earthworks are designed and undertaken in a manner that does not increase or impede surface water and groundwater draining to and from the Corridors.

The *Water NSW Regulation 2020* states a person must not cause the pollution of waters on land in a Controlled Area (the Corridors). As such, WaterNSW considers if polluted waters, including sediment laden waters, are carried downslope into the Corridors, that this may constitute a pollution incident.

Any development or construction proposal and related works should be designed, constructed and operated in such a way that does not increase stormwater flows into the Corridors.

Requirements:

- Stormwater systems should be designed so that post-development flows entering the Corridor are no greater than pre-development stormwater flows, in both volume and velocity for all storm events up to and including the 1% AEP storm;
- The stormwater design is to clearly demonstrate how all flows are conveyed, and how stormwater systems serving the proposed development meet the pre-development state, including the assessment of upstream catchment areas and downstream impacts;
- Stormwater directed across or under the corridor should not be impeded and should be accommodated by downstream stormwater systems;
- Development should not prevent the natural flow of stormwater drainage run-off;
- Where dam dewatering is required, a methodology should be included for review:
    - water leaving the site during dam dewatering should not exceed pre-development capacity.
    - water leaving the site should comply with ANZECC Water Quality Guidelines.
- Model for Urban Stormwater Improvement Conceptualisation (MUSIC modelling) should be undertaken, as part of the preparation of a soil and water management plan, for all development proposals greater than 2,500m^2 which are located within the 'affected land';
- WaterNSW should be notified of any diverted flows or drainage discharge activities (e.g. from a dam or basin dewatering) across, or under the Corridors.

Specifically, drainage systems should:

- Direct run-off away from the Corridors to avoid overloading existing stormwater systems;
- Inhibit surface water from coming in contact with bulk water in the Upper Canal as:
  - it may contain chemical and pathogen contaminants
  - backflow can increase turbidity and Total Suspended Solids (TSS) within the Upper Canal that is detrimental to drinking water quality.

It is recommended to consult with WaterNSW early in the concept and design stage of the new proposal to discuss how stormwater from the development will be managed to prevent additional impacts on the Corridors.

WaterNSW occasionally dewaters the Upper Canal and Warragamba Pipelines during shutdown periods and these flows are directed into existing downstream drainage systems. Specifically:

- Developments should accommodate the extra water from dewatering activities, with an allowance of an additional 25% dewatering flow accommodated in the design for possible future increases in capacity.

Dewatering can occur at anytime without notice

Adequate provision must be allowed downstream of the corridor to allow free drainage.

Figure 22 – Examples of Upper Canal drainage systems (left – culvert, right – steel box flume)

On request, WaterNSW can provide maps showing the location of its stormwater and scour systems contained within the Corridors.

2.7 Erosion and sediment control

The risk of eroded sediment being carried downslope into the Corridors from adjacent development sites on 'affected land' is of concern to WaterNSW and should be appropriately managed. The highest risk will be during the construction phase when the removal of vegetation and disturbance of groundcover in the existing greenfield areas will expose the soil and increase the risk of erosion.

Sediment entering the Corridors has the potential to impede drainage resulting in increased ground saturation and flooding risk. This in turn can impact water supply infrastructure and reduce operational access. Developers and builders working on a subdivision or major development sites within the 'affected land' should adopt and demonstrate the practices and controls detailed in 'Managing Urban Stormwater: Soils and Construction' (the 'Blue Book' Vol.1 – Landcom, 2004 and Vol. 2 – DECC, 2008).

Requirements:

- An Erosion and Sediment Control Plan (ESCP) for sites <2500m^2, or Soil and Water Management Plan (SWMP), for sites >2500m^2, should be prepared in accordance with the Blue Book and clearly identify how sediment will be prevented from blocking or entering the Corridors;
- Adequate and effective erosion and sediment controls should be in place before construction and site preparation work begins to prevent soil, sand, gravel or other construction site material impacting on the Corridors;
- Erosion and sediment controls should be checked and properly maintained on a regular basis and after every rainfall event to ensure they are working properly. The controls should not be removed until the site is stabilised, and no exposed soil or disturbed area remains;
- Cut and fill activities in the immediate area of the Upper Canal should be avoided or minimised, due to the potential damage such works could have on the Canal structure.

Figure 23 – Examples of suitable erosion control adjacent to the Upper Canal

2.8 Heritage

The Upper Canal is listed as the 'Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)' (item number 1373) on the State Heritage Register under the *NSW Heritage Act 1977* (Heritage Act). The listing includes the entire length and area of the Upper Canal Corridor, as well as related water supply components, landscaping features and drainage items such as flumes and culverts.

It is important to note that the entire Upper Canal corridor is heritage listed from boundary to boundary (including the fencing), not just the Canal structure alone. A useful reference prepared by the Government Architect's Office is the *Upper Canal Pheasants Nest to Prospect Reservoir Conservation Management Plan, 2016*. This document should be referenced in any heritage assessment that relates to the Upper Canal Corridor.

The State Heritage Database, managed by Heritage NSW, also provides detailed information and maps showing the heritage curtilage of the Upper Canal System. The information can be found on the NSW Heritage website: (www.heritage.nsw.gov.au).

From 1 December 2020, new standard exemptions came into effect under section 57(2) of the Heritage Act, so that scheduled items are exempt from approval or notification to Heritage NSW. It is the applicants or consultants responsibility to determine if the activity meets one of the scheduled exemptions. If not, separate approval under section 60 of the Heritage Act is required. The onus is on the applicant to determine the appropriate level of approval required.

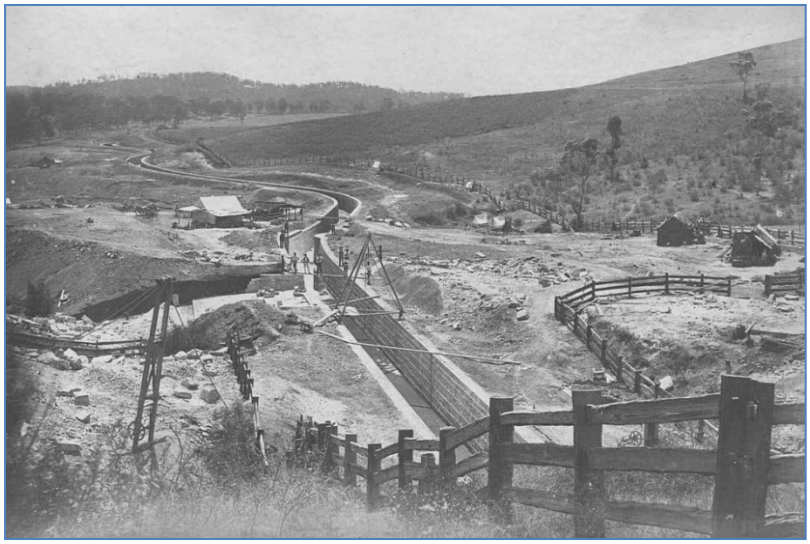


Figure 24 (left) – The Upper Canal during construction in the 1880s north of Sugarloaf Hill

Figure 25 (right) - The Upper Canal during construction in the 1880s south of Narellan Road

The Warragamba Pipelines have been assessed as having State Heritage significance and are listed on the WaterNSW's heritage and conservation register, but are not listed on the State Heritage Register.

WaterNSW requirements:

- All activities or work undertaken adjacent to the Upper Canal corridor should be carried out in a manner that will protect the fabric of the heritage item from damage or interference;
- All heritage impacts to listed heritage items must be considered and addressed, including an unexpected finds protocol.

Further detailed information on the heritage significance of the Upper Canal and Warragamba Pipelines is available from WaterNSW's website or upon request.

Any development that could potentially affect the heritage significance of the Upper Canal requires separate approval under section 60 of the Heritage Act 1977 from NSW Heritage, unless it meets one of the 20 exemptions and relevant standards under section 57(2).

The onus is on the applicant to decide if it meets any of the exemptions and evidence must be presented to WaterNSW via the 'Standard Exemption Record of Use' form to show this.

If works occur on WaterNSW owned or vested land, the Consent of WaterNSW, as landowner, is required to submit a section 60 application. Any requests for landowners consent must be accompanied by a Statement of Heritage Impact.

Figure 26 - Leafs Creek Aqueduct sometime between 1886 and 1888 showing the temporary Hudson's scheme aqueduct

2.9 Construction Environmental Management Plan (CEMP)

Consent authorities may require the preparation of a Construction Environmental Management Plan (CEMP) or WaterNSW may request a CEMP as a condition of development consent for new large subdivisions and major development activities within the 'affected land'.

The CEMP should be a practical plan that communicates in a concise and clear way the key environment and heritage risks of a project and the proposed mitigation measures to avoid or control these risks, to as low as reasonably practicable.

WaterNSW requests that an assessment of the following (where applicable, but not limited to) be incorporated into any developed CEMP and that WaterNSW be consulted during its preparation:

- Incident and spill management procedures, including measures designed to avoid spillages and details of how spillages will be contained and the proper disposal of contaminated material.
- Vibration controls and monitoring
- Ambient air quality
- Traffic management
- Heritage management, including unexpected finds protocol
- Bushfire management
- Landscape and vegetation management
- Waste management
- Contamination management
- Stormwater protection and pollution prevention, including any dewatering procedures
- Sediment and erosion control, including stockpile management
- Induction procedures for staff that acknowledge the Corridor and its significance.
- Incident notification and management
- Emergency Management.

Any CEMP should consider the 'Guideline for the Preparation of Environmental Management Plans' (DIPNR, 2004) produced by the former NSW Department of Infrastructure, Planning and Natural Resources.

Major projects are required to consider the Environmental Management Plan Guideline (DPIE, 2020)

2.10 Other considerations when working on WaterNSW land

WaterNSW may require the following, to ensure good planning outcomes, the reduction of risk to our assets and to comply with the applicable planning instruments, including the *WaterNSW Regulation 2020*.

2.10.1 Incident notification

WaterNSW requires notification of any health, safety or environmental incident minor or major, e.g. contact with, accident, spill, leak, rupture or fire within or potentially affecting the Corridors. All incidents are to be reported to the WaterNSW Incident Notification Number **1800 061 069** (24-hour service).

Report all incidents to WaterNSW on 1800 061 069

2.10.2 Works scheduling

Each year, always in winter when Sydney's water demand is lower, WaterNSW undertakes maintenance work along the Pipelines corridor. All works that could impact on the operation of the Pipelines is encouraged to occur within that timeframe.

Routine maintenance of the Upper Canal usually occurs in autumn and spring each year and the type of works will determine if the Canal is better filled with water or dewatered at the time of the project. This is determined on a case by case basis.

2.10.3 Surveys and condition assessments

WaterNSW may require the preparation of a condition/ structural dilapidation report, both prior to works commencing and on completion of works. The purpose a condition assessment/ dilapidation survey is to inspect, measure and evaluate the structural components and potential areas impacted by the proposal in a non-destructive way.

2.10.4 Remediation/rectification

WaterNSW expects that where damage to WaterNSW lands, assets or infrastructure has occurred as a result of the project, the applicant carryout rectification at its expense and to the reasonable requirements of WaterNSW. Alternatively, the applicant may pay compensation for the damage as agreed with WaterNSW.

2.10.5 Specialist studies and plan certification

WaterNSW may require specialist studies be undertaken to demonstrate no impact to bulk water supply infrastructure. Where the applicant has undertaken additional studies, WaterNSW may also request third party verification.

Further, any plans requiring certification must be completed by a suitably qualified and experience practitioner, for example engineering design certification is required by a Chartered Professional Engineer (CPEng).

2.10.6 Endorsement by WaterNSW

Where the applicant or consent authority requires WaterNSW to provide confirmation that the works have occurred to our satisfaction (i.e. construction sign off/ practical completion), the following should occur:

- WaterNSW to receive a certified copy of the Works as Executed Plans (WaEX).
- a site visit at least two weeks prior to confirmation;
- validation from the applicant that works have been completed as per approved plans and consent conditions;

2.10.7 Cost recovery

Applicants of development or activities within the Corridors may be required to bear any additional costs to WaterNSW arising from the proposal. This may include, but not be limited to, inspections, meeting attendance, review of plans, costs for technical or specialist studies, third party review of documents and technical or specialist studies, additional security measures, additional asset protection measures, additional stormwater management measures, construction oversight requirements, the planning and registration of easements and financial compensation for access rights and easements.

3. WaterNSW plans into the future

3.1 The future of the Upper Canal

Over the longer term WaterNSW plans to replace the Upper Canal. Until the final decision is made regarding the type of replacement, applicants will need to allow in their design for WaterNSW to carry out repairs, maintenance and replacement or augmentation.

Applicants should consult with WaterNSW regarding where aspects of the development (including any crossings) may or may not be located, depending on site constraints.

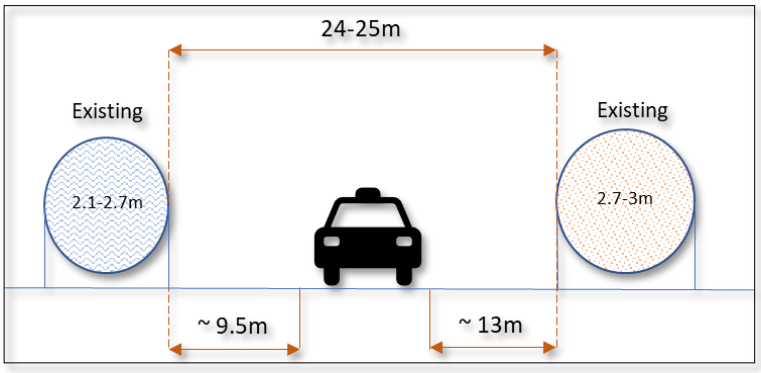
3.2 The future of the Warragamba to Prospect Reservoir pipelines

Over the longer term, WaterNSW expect that the current pipeline configuration will require augmentation to cater for the increasing demand for Sydney's drinking water supply.

Until the final decision is made regarding the type of augmentation, applicants will need to allow in their design for WaterNSW to carry out repairs, maintenance and construction activities within the Corridor. Applicants should consult with WaterNSW regarding the required exclusion zone where aspects of the development (including any crossings, above or below ground, assets / infrastructure) may or may not be located, depending on site constraints.

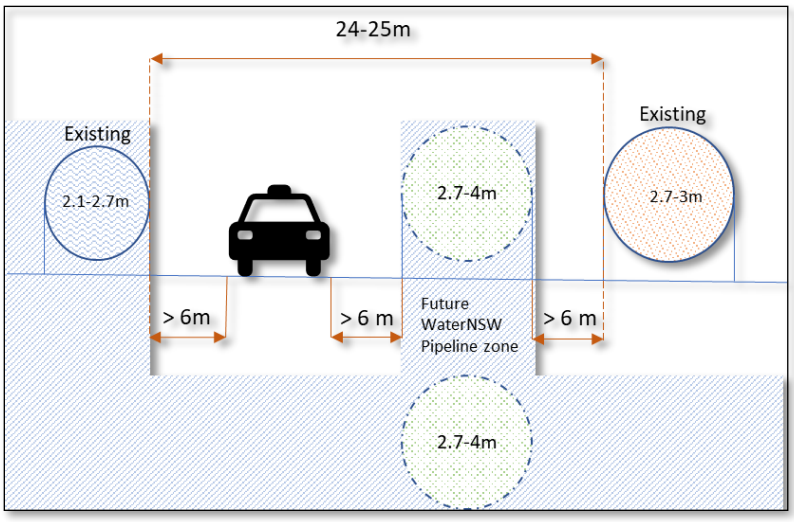
Augmentation scenarios could require installation of a 3rd pipeline (>4m diameter), which may include locations above or below ground, to the North, Centre or South of the existing Pipelines.

To enable installation of future pipeline configuration, WaterNSW require a minimum vertical clearance of at least 7.5m above the top of the Pipelines (unless otherwise agreed), see additional requirements in Section 3.3.



Existing configuration*

Note: this is an approximate configuration of the pipeline's corridor. It varies along the 27km alignment, therefore site-specific analysis is required.



Possible augmentation scenario

APPENDIX 1– Guiding Principles

1. The Upper Canal and Warragamba Pipelines Corridors are essential public infrastructure whose key purpose is the supply of drinking water to the Greater Metropolitan Sydney region. Water supply infrastructure must always be safe and serviceable[2].
   a. WaterNSW will not approve development proposed by external parties *within* the Corridors unless:
      i) the development is for the purpose of essential infrastructure[3] and services that cannot be feasibly located elsewhere; and
      ii) the applicant can ensure to the satisfaction of WaterNSW that there will be no adverse impact on the Upper Canal and Warragamba Pipelines infrastructure. Infrastructure and services should not compromise WaterNSW's future proposals for Canal and Pipeline infrastructure.
   b. WaterNSW will not support development or planning proposals within the 'affected land', unless it can be shown that there will be no adverse impact on the Upper Canal and Warragamba Pipelines infrastructure.

2. Water quality, quantity and asset reliability, availability and maintainability within the Upper Canal and Warragamba Pipelines Corridors should be maintained and protected.
   a. WaterNSW will not approve infrastructure and services proposed by external providers *within* the Corridors unless the providers can ensure to the satisfaction of WaterNSW that there will be no adverse impact on water quality, quantity and asset reliability, availability and maintainability.
   b. WaterNSW will not support development or planning proposals within 'affected land', unless it can be shown that there will no adverse impact on water quality, quantity and asset reliability, availability and maintainability of the Corridors.

3. Applicants of development or activities within the Corridors may be required to bear any additional costs to WaterNSW arising from requirements under the above principles. This may include, but not be limited to, costs for technical or specialist studies, additional security measures, additional stormwater management measures, construction requirements, the planning and registration of easements and financial compensation for access rights and easements.

[2] Safe means no danger to users who are present, serviceable means available for its intended use.

[3] Essential Infrastructure means services that are for public use such as water supply.

APPENDIX 2 – Risk to WaterNSW assets and documentation required for review

Most proposals occurring within the 'affected land' will warrant consideration of the following risks. Where applicable WaterNSW expect to review (but not limited to) the below preferred deliverables to ensure water supplies, associated infrastructure and WaterNSW lands are always safe and serviceable. The criteria, testing or other approved form of verification required by WaterNSW to assess performance and to ensure consistency across the solutions are to be developed to meet requirements.

Risk	**Preferred Deliverable**
Additional loads on our structures	• Drawings/Plans • Engineering report • Geotechnical report
Changes to groundwater	• Groundwater monitoring and modelling including quality and quantity of water & groundwater depth
Contamination	• Contamination Assessment report
Heritage Impact	• Heritage Impact Assessment or statement, including unexpected finds protocol
Security	• Fencing plan
Sedimentation and Erosion	• Erosion and Sediment Control Plan or Soil and Water Management Plan (can be contained within CEMP)
Settlement/ subsidence	• Geotechnical report • Geotechnical modelling
Stormwater runoff	• Flood modelling detailing: - Quality and quantity of water, including Probable Maximum Flood (PMF) level - Flow, depth and velocity - Comparison of pre and post development figures for all events up to 1% AEP • Stormwater Management Plan, including any dam dewatering protocols
Use of proprietary construction products on WaterNSW land (e.g. pipe segments)	• Engineering report • Manufacturer details
Vibration	• Assessment of the potential effects of vibration • Vibration monitoring plan (can be contained within CEMP)