Upper South Creek Advanced Water Recycling Centre – Response to Request for Information

1 June 2022

Table 1 Department of Planning and Environment

<table>
<tr><th>Issue</th><th>Response</th></tr>
<tr><td>Construction program
Provide an indicative construction program for Stage 1 works that clearly displays proposed construction works across the entire 36-month construction period.</td><td>Sydney Water's current indicative construction program for Stage 1 of the project is included below. The detailed construction program will be developed by the construction contractors after contract award.

Advanced Water Recycling Centre
<table><tr><th></th><th>Start</th><th>Finish</th></tr><tr><td>Contract award</td><td></td><td>31-Aug-22</td></tr><tr><td>CEMP</td><td>Sep-22</td><td>Mar-23</td></tr><tr><td>Groundworks design</td><td>Oct-22</td><td>Mar-23</td></tr><tr><td>Detailed design</td><td>Oct-22</td><td>Oct-24</td></tr><tr><td>Construction mobilisation</td><td>Mar-23</td><td>Apr-23</td></tr><tr><td>Bulk earthworks</td><td>Apr-23</td><td>Nov-23</td></tr><tr><td>Civils and structures</td><td>Aug-23</td><td>Jun-24</td></tr><tr><td>Mechanical and pipework</td><td>Mar-24</td><td>Feb-25</td></tr><tr><td>Electrical works</td><td>Mar-24</td><td>Feb-25</td></tr><tr><td>Backfill and reinstatement Works</td><td>Feb-24</td><td>Jan-25</td></tr><tr><td>Testing and commissioning</td><td>Dec-24</td><td>Jun-25</td></tr></table>
Pipelines
<table><tr><th></th><th>Start</th><th>Finish</th></tr><tr><td>Contract award</td><td></td><td>31-Aug-22</td></tr><tr><td>CEMP</td><td>Sep-22</td><td>Mar-23</td></tr><tr><td>Detailed design</td><td>Oct-22</td><td>Oct-23</td></tr><tr><td>Construction mobilisation</td><td>May-23</td><td>Jun-23</td></tr><tr><td>Brine pipeline construction</td><td>Jun-23</td><td>Jan-25</td></tr><tr><td>Treated water pipeline construction</td><td>Jun-23</td><td>Jan-25</td></tr><tr><td>Testing and commissioning</td><td>Dec-24</td><td>Mar-25</td></tr></table></td></tr>
<tr><td>Green space area
Provide further detail and site specific concept design to support development of a green space area at the AWRC site, including indicative landscape plans, photomontages, and information on key components of the green space area.</td><td>Attachment A includes further information about an indicative concept for the green space area that was developed during the project's reference design phase. This provides an indication of Sydney Water's future intention for the green space area but does not represent exactly what will be delivered. Photomontages were not developed as part of this work and were limited to those created for the project's visual impact assessment in Appendix T of the EIS.

As part of the tender process, Sydney Water has provided AWRC proponents with the high level concepts referenced above and the successful</td></tr>
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Issue	Response
	tenderer will develop a master plan for the AWRC site, including the green space area, landscape plans, staging and other key components of its design and ultimate use. This includes, but is not limited to the following core elements as the minimum to be delivered as part of Stage 1 construction: • Riparian planting along South Creek and Kemps Creek that may include wetlands, native grassland, trees and shrubs. • Water Sensitive Urban Design (supporting site drainage). • Walking access to riparian areas. • Protection or fencing to protect existing radio-telescopes. • Planting / streetscape along emergency / fire access track. • Any structures and architectural treatments that may be developed in the green space (subject to permissibility and flood treatment) to support public access and heritage interpretation. The successful tenderer will also develop the Urban Design and Landscaping Plan (management measure UD01 in Appendix B of the Submissions Report) consistent with this master plan and in collaboration with relevant stakeholders (management measure UD02). The attached high level concept includes features related to public recreation, such as walking tracks, heritage interpretation and informal outdoor education areas. However, as noted in section 5.2.1 of the EIS, public recreation is not currently permissible in much of the green space area under what is now State Environmental Planning Policy (Precincts – Western Parkland City) 2021. This means delivery of the public recreation elements depends on the outcomes of the planning approval. The specific features and landscape elements associated with public recreation would depend on stakeholder consultation to ensure they align with adjacent landuse and the NSW Government's ultimate vision for South Creek.
Solar energy Provide further detail on solar energy production	As outlined in Table 15-5 of the EIS, one of the project outcomes of Stage 1 is to supplement 50% of the

Issue	Response
proposed at the AWRC site, including project layout plans and details on the quantity and primary components of the solar panels.	electricity use by self-generating renewable energy through a combination of solar photovoltaics and recovering biogas to fuel co-generation. The information below is based on solar energy generation of 4MW as outlined in the EIS. As noted in section 4.13.1 of the EIS, Sydney Water is seeking flexibility in the proportion of renewable energy generated from different sources, so the numbers below may ultimately be higher or lower. For Stage 1 there is estimated to be about 8,000 ground mounted solar panels, with up to three inverters and active power of about 4,000 kWac. There may also be opportunities to install roof mounted solar on some operational buildings. However, ground mounted solar will provide the majority of solar generation at the AWRC. Ground mounted solar systems are more flexible and cost effective than roof mounted solar systems. The final layout and location of the ground mounted solar panels will be determined during detailed design. However, they will be located in the operational area of the AWRC site (Figure 4-1 of the EIS) and cover about six hectares. Figure 4-1 of the EIS shows an indicative location and layout based on the project's reference design. Attachment B includes some example images of roof mounted and ground mounted solar infrastructure. This is not intended to represent exactly what will be installed on the AWRC site as the solar energy systems would be designed during detailed design. Ground mounted solar systems typically comprise the following: • Solar photovoltaic panels. The panels will have antiglare coatings to reduce reflectivity that may be a distraction to pilots. • Mounting system. The panels are mounted on metal rails or poles (often aluminium) and secured to the ground either by screw piles or on concrete foundations. • Tracking system. The fixed panels can be rigidly connected to the mounting system, or incorporate a tracking system that enables the panels to adjust their angle to track the sun. Tracking systems increase the output relative to land used by the system, but increase

Issue	Response
	maintenance requirements. • Ancillary components. These include inverters to convert the power generated to meet the requirements of the system that will consume the power. Cabling is also required to connect the system components and the consumer. Roof mounted solar systems comprise photovoltaic panels that are typically supported on aluminium rails and attached to the roof structure.

Table 2 Department of Planning and Environment - Environment and Heritage Group

Issue	Response
Biodiversity Credit summary report needs to be provided for Wollemi IBRA subregion given the data entry option chosen in the BAM Calculator. Submission notes there are two options for data entry and that Sydney Water has chosen option 2: • Option 1 – All project data is entered into a single BOAMS 'child case' and the IBRA subregion selected should be the one where the largest proportion of impact will occur. • Option 2 – the project data is split across multiple BOAMS 'child cases' and the relevant IBRA subregion is selected for each case.	Sydney Water's consultant has entered all project data into a single BOAMS 'child case'. The Cumberland IBRA subregion has been selected, given impacts in that subregion are substantially more than for the Wollemi IBRA subregion. This is consistent with Option 1. A separate un-finalised BOAMS 'child case' for Wollemi IBRA was created. Although it is related to the same 'parent case' as the finalised Cumberland case, it was only used to generate the list of Species Credit Species associated with the Wollemi subregion to ensure they were considered in the assessment. Sydney Water's consultant is not able to delete this case in the system but has updated the name and description to make clear it has only been used to generate Species Credit Species.
Impacts to biodiversity Although biodiversity impacts have been reduced, this is considered is minor and with no reduction in the level of impact to the vegetation zone of highest conservation significance, intact Cumberland Plain Woodland CEEC. The DPE Planning Group will need to assess whether the benefits of the proposal outweigh the likely losses of critically endangered and endangered ecological communities and habitats for a number of threatened species.	As outlined in the response to this issue in section 5.4.38 of the Submissions Report, Sydney Water has sought to minimise the project's biodiversity impacts during options assessment and reference design. This included a range of measures (outlined in more detail in Chapter 3 of the EIS) including: • tunnelling under some waterways • realigning some sections of pipeline to avoid sensitive vegetation • reducing construction corridor widths through sensitive vegetation. Sydney Water has identified a range of management

Issue	Response
	measures including seeking opportunities to reduce impacts, rehabilitation and offsets. In addition, the project will result in some biodiversity benefits through the enhancement of biodiversity in the green space area on the AWRC site, particularly along riparian corridors.
Threatened species and communities Previous comments on threatened species and communities remain relevant.	The main comment on threatened species and communities in DPE EHG's submission was that DPE disagrees with the conclusion that the project will not have a significant impact on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and the Spiked Rice-flower (*Pimelea spicata*). As noted above Sydney Water has minimised impacts during the reference design process. Sydney Water has also committed to seeking further opportunities to minimise impacts during detailed design, and offsetting impacts on this community and species.
World and National heritage - outstanding universal values (OUV) In response to a request for expanded assessment of OUV values to include indigenous relationships, water systems and natural beauty, the Submissions Report states that Table 4.2 in Appendix Q of the EIS includes additional significance assessment. However, Table 4.2 lists the values/attributes without undertaking an assessment of the proposal's likely impacts on these values.	Sydney Water's response in section 5.4.24 of the Submissions Report was intended to convey that the existing values and attributes in Table 4.2 in Appendix Q of the EIS capture Indigenous relationships, water systems and natural beauty. Sydney Water's response cross-referenced how these three elements are captured by the unofficial values and attributes contained within the *Blue Mountains National Park Plan of Management*, *Values for a new generation* and the nomination for the Greater Blue Mountains Area – Additional Values. Where these sources did not provide attributes against which impacts could be assessed, the assessment defined attributes. Table 4.2 is not an assessment of significance of project impacts. Sydney Water acknowledges this could have been an interpretation based on the wording of the response's introductory sentence in section 5.4.24 of the Submissions Report. Table 5.2 in Appendix Q of the EIS identifies where the project may interact with the attributes in Table 4.2 and cross references sections of the report where the impacts and their significance are assessed. Tables 6.3 and 6.4 assess impacts to the official and unofficial values against the Significant Impact Criteria 1.1. Table 6.5 summarises the impacts.

Issue	Response
World and National heritage - threats to wholeness and intactness Considers there are impacts to wholeness and intactness of World Heritage property given there are releases to waterways and impacts on terrestrial and aquatic ecosystems. It notes that changes to wetted perimeter described in the Submissions Report would affect wholeness and intactness of the World Heritage property.	Table 5.4 in Appendix Q of the EIS assesses the integrity (a term used to measure the wholeness and intactness of a heritage place) of the heritage values. The levels of impact identified in section 6 are adjusted to reflect the integrity of each value. Paragraph 88 of the UNESCO World Heritage Policy Compendium provides three points against which the integrity of World heritage should be assessed. These are: • **includes all elements necessary to express its OUV.** The project does not remove any elements of the Greater Blue Mountains Area (GBMA) necessary to express its OUV. • **is of adequate size to ensure the complete representation of the features and processes which convey the property's significance.** The project does not change the size of the GBMA and has negligible effect on its features and processes as outlined in Appendix Q of the EIS. • **suffers from adverse effects of development or neglect.** The World heritage assessment in Appendix Q of the EIS considers the significance of the project's impacts on the GBMA. The assessment concludes that impacts range from slight (biodiversity) through none (geodiversity and geomorphology and Indigenous or historical heritage sites) to slightly beneficial (water quality and aquatic ecology). Treated water releases to Nepean River will increase water surface elevation. When the water surface rises, there is a corresponding increase in wetted perimeter. The wetted perimeter is defined as the length of the river cross-sectional area that is 'wet', meaning in contact with the flow. This metric is used to understand changes in the area inundated by river flow. When the riverbank is steep, the water level rise may result in only a small change in wetted perimeter. However, when the slope of the riverbank is relatively flat, for example where a bench or in-channel bar exists, changes to wetted perimeter are higher. Changes in water surface elevation are predicted to

Issue	Response
	be minor. An average increase of about three centimetres in water surface elevation is predicted for the section within the GBMA. Corresponding changes in wetted perimeter are generally minor (less than one metre). There is a section about 500 m downstream of the confluence of Warragamba and Nepean Rivers, where the increase in wetted perimeter is up to seven metres. The flows remain below bankfull so the changes in wetted perimeter only relate to areas within the main river channel that are already subject to periodic inundation from natural processes and flow variations, but the frequency of inundation will increase. For example, the area between the current low flow extent (25 ML/day) and the current median flow extent (229 ML/day) is currently inundated greater than 50% of the time. With an increase of 50 ML/day into the river system, the frequency of inundation is predicted to increase to greater than 63% of the time. The water flows are assessed in Table 5.4 of Appendix Q of the EIS as having low integrity and low value as the Warragamba and Nepean Rivers are controlled waterways and do not operate as natural rivers. As noted in section 5.4.21 of the Submissions Report, increases in the flow regime have potential environmental benefits of counteracting the presence of the upstream weirs and dams and water extraction from the river by ensuring more regular flows downstream. The Biodiversity Development Assessment Report (Appendix J of the EIS) considered that the magnitude of potential impacts on the riparian vegetation as a result of the altered hydrological regimes are minor in nature, even when considering the integrity of the biodiversity values is assessed as being high. The Aquatic Ecology Impact Assessment (Appendix H of the EIS) noted that the increases in wetted perimeter may provide a small benefit to instream aquatic ecology by increasing habitat. The project's small benefits may assist in increasing the integrity of this value. Given that the predicted impacts are negligible to

Issue	Response
	minor and restricted to within the existing river channel, the 'wholeness and intactness' of the World Heritage area is not predicted to be impacted.
World and National heritage – State of Conservation Report 2004 Greater Blue Mountains Area The previous submission recommended consideration of this report. This was to highlight that development outside a World Heritage property can have an impact on World Heritage values, which does not appear to have been acknowledged in the Submissions Report. The Submissions Report also notes (section 5.4.26) that given negligible impacts have been assessed, the project is not considered to be an undesirable action. However even negligible impacts can be adverse and so it is recommended that this assessment needs revisiting.	Given no project infrastructure is located in the GBMA, Sydney Water considers that the main purpose of the World Heritage assessment in the EIS is to assess the impacts on World Heritage values of development outside a World Heritage property. Sydney Water considers that relevant project components are assessed, that is the treated water releases to Nepean River and potential impacts of the nearby release structures, including visual impacts. All other project components will not impact on the GBMA because they are: • underground pipelines running from between about 1 - 35 km from the GBMA • the AWRC site, about 14 km from the GMBA. Section 1.2 of Appendix Q of the EIS describes how the study area has been established. Sydney Water understands that negligible impacts can be adverse or beneficial, as outlined in section 1.5.1 of Appendix Q of the EIS, which uses the nine-point scale within ICOMOS (2011). This scale includes negligible-adverse category and negligible-beneficial categories. Using the methodology outlined, and evidence about project impacts, Sydney Water has not identified any impacts as negligible-adverse. The negative impact identified relates to terrestrial biodiversity. Other impacts are considered neutral, except water quality and hydrology, which was assessed as negligible-beneficial.
World and National heritage – use of modelling in determining flow and nutrient load impacts Section 5.4.21 of the Submissions Report reiterates the prediction "that AWRC releases will have an overall positive impact on the…GBMA". However, flows near the upstream boundary of the GBMA are predicted to increase by an average of about 25%, with daily loads of total phosphorus entering the GBMA predicted to increase by an average of about 7% and total	**Flow** Sydney Water confirms that flows will increase by an average of about 25%, which will result in minor increases to surface water elevation and wetted perimeter (discussed in detail above) and negligible changes to velocity and shear stress. The Ecohydrology and Geomorphology Impact Assessment (Appendix G of the EIS) predicted that the geomorphic implications of the releases are minor given the small changes in the hydraulic metrics and the planform-controlled nature of the

Issue	Response
nitrogen predicted to increase by an average of about 20%. Given these predictions in particular, concerns remain over the interpretation of these impacts as a positive impact on the GBMA.	channel and banks. As noted in section 5.4.21 of the Submissions Report, increases in flow have potential environmental benefits by counteracting the presence of the upstream weirs and dams and water extraction from the river and ensuring more regular flows downstream. **Nutrient loads** As noted by DPE EHG, the release of treated water to Nepean River will have the potential to increase nutrient loads to the overall river system. As outlined in section 5.4.21 of the Submissions Report, this equates to a predicted daily average load increase of 7% for total phosphorus and 20% for total nitrogen within the GBMA. However, an important factor to be considered is the relative contribution of these additional loads from both flow and concentration. With respect to the AWRC releases, the increases in load to the river are predominantly driven by the additional flows, and not increases in concentration, as the AWRC releases are typically lower in nutrient content than that found in existing ambient conditions. Therefore, despite the increases in loads, the concentrations of most nitrogen and phosphorus indicators within the GBMA are predicted to reduce as presented in the Submissions Report. This is discussed further below. Additional detail about overall nutrient load impacts to the Hawkesbury Nepean catchment was provided in section 6.1.2.2 of the Hydrodynamic and Water Quality Impact Assessment (Appendix F of the EIS). Nutrient loads are consistent with the Hawkesbury Nepean Nutrient Framework (NSW EPA 2019), a document developed by the EPA with the purpose of protecting river health in light of proposed development in Western Sydney. **Nutrient concentrations** In addition to nutrient loads and flow rates, impacts to nutrient concentrations must be considered to understand potential impacts to waterway health. Water quality modelling predicts that the AWRC releases to Nepean River will result in: • improvements for several indicators within the GBMA when compared to the background scenario as a result of dilution from the high

Issue	Response
	quality AWRC releases. This includes total nitrogen, total phosphorus, filterable reactive phosphorus, chlorophyll a, dissolved oxygen, salinity and total suspended solids • no discernible change to the risk of cyanobacteria • marginal increases to oxidised nitrogen and ammonia concentrations. • short term increases in nutrients predicted in wet weather when tertiary treated water is released. These short term increases (spikes) in concentration generally occur during severe wet weather, when the majority of the release is tertiary treated. For example, the modelling predicts that spikes in total nitrogen will occur about four times in a wet year. No spikes are predicted in a dry year. As summarised in section 8.7.4 of the EIS, while some minor impacts are expected, on balance the project is predicted to protect and maintain the ecological condition of aquatic systems and their riparian zones within Nepean River. Sydney Water considers that the conclusion of the World heritage assessment (Appendix Q of the EIS) that this represents a negligible positive benefit on water quality values in the GBMA is appropriate.
World and National heritage – visual impacts on the GBMA In the RtS report, the applicant assesses that the 'project would not visually alter the GBMA [and] there would be no impact on natural beauty.' However, natural beauty is subjective and not just appreciated from lookouts, and parts of the Nepean River within the GBMA will be visibly altered by raised water levels and impacts on riparian vegetation. For instance, Table 5-10 assesses that 'the additional flow will likely raise water levels…increase in wetted perimeter…more frequent inundation of the vegetated bar at the mouth of Glenbrook Creek'. Intermittent recession of water levels could also result in algae/scum and dead vegetation along the wetted perimeter, and so the assessment that there would be no impacts to natural beauty of the GBMA needs reconsideration.	As noted above, changes in water surface elevation are predicted to be minor, with an average increase of about three centimetres predicted for the section within the GBMA. This area of the river is hydraulically controlled by the Penrith Weir. Changes of this scale are within natural river level fluctuations and unlikely to be perceptible to the human eye from lookouts or on the water. Similarly, the changes in wetted perimeter are generally minor (less than one metre) with changes limited to the areas along the main river channel that are already subject to periodic inundation. The risk of algal blooms was assessed in the Hydrodynamic and Water Quality Impact Assessment (Appendix F of the EIS) via the cyanobacteria risk index. The cyanobacteria risk index is derived from analysis of the primary factors that are considered conducive to cyanobacteria growth including temperature, salinity, oxidised

Issue	Response
	nitrogen, ammonia, filterable reactive phosphorus, depth and velocity. The results predicted no discernible change in chlorophyll *a* and the risk of cyanobacteria. Therefore, an increase in algal scum as a result of AWRC releases in the Nepean River is not expected and is therefore unlikely to affect the natural beauty of the GBMA. Extensive dieback of vegetation in areas subject to increased inundation is unlikely. The river is a dynamic environment, subject to seasonal fluctuations, flood events, dam releases and droughts. The scale of changes to riparian vegetation as a result of the AWRC releases would be minor, especially in comparison to vegetation impacts that occur during flood events (as shown in Figure 5-19 of the Submissions Report). It is therefore unlikely that there will be additional dead vegetation along the river banks or on vegetated bars within the river during periods of intermittent recession and impacts to the natural beauty of the GBMA are unlikely.
Flooding EHG notes that previous comments on the AWRC flood model are still relevant and have not been addressed in the Submissions Report. EHG's key concerns are that the Upper South Creek Advanced Water Recycling Centre (USC AWRC) existing case flood model is not consistent with Penrith City Council's (PCC) 2015 adopted flood model. • EHG considers calibration of the USC AWRC XP RAFTS ARR2019 hydrological model is the 'least preferred' approach within the *'incorporating ARR2016 into flood studies'* guideline and they indicate this has led to the underestimation of flows used in the USC AWRC flood impact assessment. • EHG considers the approach to validation is misleading because it compares flood levels from the USC AWRC TUFLOW hydraulic model against PCC's 2015 adopted flood model using ARR1987 hydrology. EHG consider validation against PCC's 2015 adopted flood model should compare flood levels with the modelled ARR2019 hydrology used to assess	**Penrith Council adopted flood model** Sydney Water reiterates that all the AWRC operational infrastructure is above PCC's 1% AEP flood planning level, and the USC AWRC flood impact assessment has regard for PCC's floodplain development planning controls. The EIS and Submissions Report provide evidence that the USC AWRC existing case hydraulic model is consistent with INSW 2020 flood model. It is also acknowledged that PCC's 2015 adopted flood model is now outdated as it does not reflect latest topography of the existing floodplain. **Calibration** Table 5-2 in section 5.4.1 of the Submissions Report clarifies the approach to calibration. The USC AWRC XP RAFTS ARR2019 hydrology has been calibrated to the 1988 and 1986 historical events. Reasonable calibration was achieved to 1986 peak flow and hydrograph shape at Elizabeth Drive gauge and the Great Western Highway. Loss parameters used in the USC AWRC flood impact assessment yielded a good fit with those events. Sydney Water notes the calibration approach is appropriate because whilst it uses data hub, the calibration parameters used are from an 'actual' flood study (1990 South Creek flood

Issue	Response
impacts in the USC AWRC flood impact assessment. • EHG recommends any alternative models must be calibrated and validated to historical data to ensure the hydrographs match those within the INSW 2020 flood model or PCC's adopted 2015 flood model • EHG recommends the USC AWRC TUFLOW model should be extended downstream to the Great Western Highway. EHG notes that it does not accept the use of INSW flow inputs in the USC AWRC TUFLOW hydraulic model as validation. In order to validate the USC AWRC TUFLOW model EHG recommends this is done by using the same ARR2019 hydrographs modelled in the AWRC flood impact assessment. EHG notes concerns with the low flows presented in the AWRC flood impact assessment and refers to previous comments on calibration.	study) and calibrated to historic events. EHG's position on the USC AWRC XP RAFTS ARR2019 hydrological flows is acknowledged. These flows are lower than PCC and INSW flows (both ARR1987) because they are derived using different modelling methodologies. This does not necessarily mean they are underestimated. However, consistent with advice from EHG provided during consultation, the EIS and Submission Report also adopt 1% AEP and PMF flows that are consistent with PCC's 2015 adopted flood model. This includes a flow of 540m^3/s at the AWRC (also detailed in Table 5-2). This flow closely matches PCC's adopted 1% AEP flow at the AWRC. **Validation** Sydney Water has validated the hydraulic model against PCC's 2015 adopted flood model and the INSW 2020 flood model using INSW's flows because these are flows that EHG and PCC both endorse and requested that we use. Validation of the USC AWRC hydraulic model against PCC's 2015 adopted flood model, described in section 4.4.7 of the USC AWRC flood impact assessment has been undertaken using ARR1987 hydrology. This has been done to enable a direct flood level comparison between the AWRC TUFLOW hydraulic model and PCC's 2015 hydraulic model. This comparison has shown a reasonable fit and demonstrates that the AWRC TUFLOW hydraulic model produces results consistent with PCC's 2015 adopted flood study when used with similar flow inputs. This is a standard method of validation and demonstrates the model is fit for the purpose of assessing impacts. The AWRC TUFLOW hydraulic model has been used in the USC AWRC flood impact assessment with a range of flow inputs including the lower ARR2019 flows. These lower flows have shown to yield lower flood levels than the PCC 2015 adopted flood study so are not similar enough to use to validate the USC AWRC TUFLOW hydraulic model in the EIS or the Submissions Report. Because of this, Appendix C and Table 5-2 in the Submissions Report demonstrate appropriate calibration and validation by using the INSW flow inputs (ARR1987) in the USC AWRC TUFLOW hydraulic model. A comparison of

Issue	Response
	the modelled outputs in Appendix C shows a good fit with the INSW 1%AEP flood extents which means the USC AWRC TUFLOW hydraulic model is now also consistent with the INSW 2020 flood study and is calibrated and validated with hydrographs that match those in the INSW 2020 flood model. On this basis it can be used with a range of flow inputs, including calibrated INSW flow inputs, to assess flood impacts. The USC AWRC flood impact assessment and the Submissions Report assess impacts of the project's reference design with a range of modelled flows between 151m^3/s - 1650m^3/s which includes the 1% AEP flow from INSW up to the PMF. Sydney Water's assessment has demonstrated flood impacts are acceptable for a range of hydrological flows applied, including: • USC AWRC XP RAFTS ARR2019 flows • USC AWRC XP RAFTS PMF flows • INSW 2020 1% AEP flows **Sydney Water's approach to flood modelling** In developing the methodology for flood modelling Sydney Water engaged extensively with stakeholders including PCC, DPE EHG and INSW. This included in a Waterways Workshop held in December 2020 and several one on one consultation meetings. Sydney Water considers that it has listened to feedback provided and accommodated suggested alternatives for calibration and validation. Sydney Water does not believe it has been misleading, but that it has progressed with these studies with the spirit of collaboration and effectively incorporated suggestions, which has benefited the impact assessment. **Extension of model downstream** Given the flood assessment demonstrates the project does not change flood behaviour beyond the AWRC site boundary up to the PMF, it follows there would be no impact further downstream. On this basis, Sydney Water considers there is no benefit in extending the hydraulic model boundaries beyond the existing hydraulic controls.

Table 3 Department of Primary Industries - Fisheries

Issue	Response
DPI Fisheries notes project changes and that issues raised are addressed in the Submissions Report. DPI Fisheries requests consultation on relevant sections of CEMP, including the Biodiversity Management Plan, Soil & Water Management Plan and the Site-Specific Riparian Zone Vegetation Plans.	Sydney Water committed to management measure G12 in Appendix B of the Submissions Report: • Consult with DPI Fisheries during development of the CEMP, including the Biodiversity Management Plan, Soil and Water Management Plan and management measures at the Hinchinbrook Creek crossing As noted in section 5.7.1 of the Submissions Report, Site-Specific Riparian Zone Vegetation Plans are not proposed, however the management of riparian vegetation will be considered in the Urban Design and Landscaping Plan, Biodiversity Management Plan and Rehabilitation Management Plan.

Table 4 Greater Sydney Parklands Authority

Issue	Response
Greater Sydney Parklands supports the revised alignment and ongoing collaboration with Sydney Water during detailed design.	Sydney Water considers no further response is required.

Table 5 Heritage NSW

Issue	Response
Noise and vibration Monitoring of noise and vibration considered satisfactory for managing risk of vibration impacts.	Sydney Water considers no further response is required.
Archaeological investigations Regarding archaeological investigations prior to impact, Heritage NSW considers its comments are not addressed and continue to apply because: • AHIPs are not required after the issue of SEARs so this is not a justification for not completing testing now • The reasoning of most effectively and efficiently completing testing as part of detailed design is considered a project	Sydney Water considers that further archaeological test excavations for Aboriginal heritage are not required, which means the next step for Aboriginal heritage excavations is salvage. The SEARs require Sydney Water to comply with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010). Requirement 16 of this code notes that it does not authorise salvage excavation. Sydney Water's interpretation is therefore that Aboriginal heritage salvage cannot progress until either the project is

Issue	Response
management issue and not a strong justification.	approved or an AHIP is obtained. In addition to effective management of environment and heritage, Sydney Water also needs to make prudent decisions about spending money. Sydney Water maintains that further archaeological investigations are most effectively and efficiently done after project approval, and the activity and associated salvage is planned as early works following project approval. Sydney Water has started procurement of consultants to complete Aboriginal heritage salvage and non-Aboriginal heritage archaeological investigations.

Table 6 Transport for NSW

Issue	Response
Concurrence TfNSW notes that concurrence of TfNSW must be obtained for any construction works within classified road corridors under Section 138 of *Roads Act 1993*. As such, prior to the issue of a Construction Certificate to any specific construction works (including early geotechnical investigation) within classified road corridors, civil design plans should be submitted to TfNSW for consideration and concurrence under Section 138 of Roads Act, 1993. The developer is required to enter into a Works Authorisation Deed (WAD) for the abovementioned works. TfNSW fees for administration, plan checking, civil works inspections and project management shall be paid by the developer prior to the commencement of works.	Table 5-12 of the EIS outlines the legislative approvals required for the project. This includes concurrence under section 138 of *Roads Act 1993* which would be issued consistent with the Minister for Planning's approval of the project. Sydney Water acknowledges the need to submit appropriate design information to inform this concurrence. Where required, Sydney Water will enter into a WAD for works that are located within classified road corridors. Management measure TT01 in Table 15-3 of the EIS commits to preparing Site Specific Construction Traffic Management Plans (SSCTMP) in consultation with TfNSW. These plans would outline any required WADs for the project.
Referrals of work outside SSI scope TfNSW notes that it understands the proposed upgrade of Elizabeth Drive and Clifton Avenue intersection, and the access road to the AWRC off Clifton Avenue, are outside the scope of SSI-8609189 and will be delivered under a separate planning approval. Upon receipt of the referral of this application for the proposed upgrade of Elizabeth Drive and Clifton Avenue intersection	Sydney Water confirms this is correct and will continue to consult with TfNSW as the access road project and any intersection changes progress. Sydney Water notes that the Elizabeth Drive/Clifton Avenue intersection changes mentioned in section 4.14.1 of the EIS relate to ensuring adequate shoulders for safe turning of semi-trailers and truck-and-dog vehicles between Elizabeth Drive and Clifton Avenue. Sydney Water will further consider whether

Issue	Response
under Section 138 of *Roads Act 1993*, TfNSW will undertake further review and provides a separate response accordingly.	this is required during detailed design of the project.
Consultation including M12 Motorway TfNSW notes that the project is close to or intersects with existing and future TfNSW assets, and encourages on-going collaboration during detailed design and construction. TfNSW makes specific comments on this topic: 1. Sydney Water is to consult with the TfNSW M12 team about construction staging of the AWRC and the treated water main. 2. It is understood that Sydney Water will deliver sections of the project under differing planning pathways. Any works delivered under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) will be required to comply with division 5.31 of the EP&A Act with respect to concurrence and notification requirements in infrastructure corridors.	Sydney Water is committed to ongoing consultation as the project progresses through detailed design and construction. Management measure TT01 in Appendix B of the Submissions Report specifies that Site Specific Construction Traffic Management Plans (SSCTMP) will be prepared in consultation with TfNSW and will include measures to outline construction interface management with the M12 Motorway project. Sydney Water also has an interface agreement with TfNSW to support coordination and collaboration between the project and the M12 Motorway project. Sydney Water confirms that any concurrence and approvals required for projects delivered under Division 5.1 of the EP&A Act will be obtained prior to construction for any relevant . any relevant works outside the scope of the EIS.
Consultation – M7 Motorway The following requirements are specified for any construction works (including underboring) within Westlink M7 Motorway land: • Westlink M7 requires an internal peer review of the proposed design within M7 corridor • Underbored pipe is to be maintenance-free within M7 corridor • Temporary works pits and permanent access pits to be constructed outside M7 corridor • Internal Westlink M7 peer review to review proposed design, any planned temporary works impacting on the boundary of the M7, proposed monitoring methodology and reviewing data taken from monitoring works (costs to be reimbursed by Client) • Commercial Agreement to be entered into with contractor undertaking works, including the supply of Bank Guarantee • Contractor responsible for undertaking a	Sydney Water will continue consulting with utility providers as outlined in management measure G10 in Appendix B of the Submissions Report. This includes providing Westlink M7 the opportunity to review the design, any planned temporary works impacting the boundary of the M7, proposed monitoring methodology and monitoring data. Any associated fees with this process will be reimbursed by Sydney Water or Sydney Water's construction contractor. Sydney Water also confirms: • the underbored pipeline beneath the M7 will be maintenance free as specified in section 13.2.3 of the EIS • temporary works pits and permanent access pits will be constructed outside of the M7 corridor • pre and post dilapidation reports will be prepared, as committed to in management measure U02 in Appendix B of the Submissions Report • induction and access processes will be followed to gain access to the M7 corridor • the construction contractor will be responsible for

Issue	Response
pre and post dilapidation report • Bank Guarantee to be released upon completion of works, satisfactory reinstatement of any M7 assets impacted during works (eg. removal of corridor fencing), submission of as-built drawings to Westlink M7 for peer review acceptance of monitoring data • All personnel coming onto M7 Land (eg monitoring surveyor and traffic control co.) to be M7 inducted and undergo the appropriate process to gain access to the M7 corridor (Work Authority Permit)	entering into any necessary commercial agreements.

Table 7 WaterNSW

Issue	Response
WaterNSW supports the proposal and considers its comments on the project are sufficiently addressed. WaterNSW notes the removal of reference to the 'Blue Book' (Landcom, 2004) and recommends that the requirement to comply with the 'Blue Book' be included as condition of consent.	Management measure SW05 (Appendix B of the Submissions Report) was amended in response to a submission from DPE EHG (formerly DPE Biodiversity and Conservation). The management measure was changed to refer to construction phase targets (PO1-PO5) in the draft Western Sydney Aerotropolis DCP – Phase 2 (October 2021). Target PO5 in section 9.6.2 of the Phase 2 DCP requires that sediment and erosion control measures be installed in accordance with the 'Blue Book'.

Table 8 Western Sydney Airport

Issue	Response
Overlapping timeframes WSA notes that this Application needs to assess construction impacts on the operations of the airport, in the instance that there is an overlay in timeframes (e.g. construction of the Sydney Water facility is delayed). To mitigate this risk, there would need to be conditions that address if construction of the facility extends into the testing, commissioning and operational phases of the airport. As raised in the original WSA submission, testing and commissioning is likely	Table 1 includes a high level construction program. More detailed construction programs will be developed once construction contracts are awarded and will likely be refined over the three year construction period. No further information is currently available about the specific construction activities that could be underway towards the end of the construction period when there is a risk of overlap with airport testing and commissioning. As noted in section 5.17.2 of the Submissions Report, the main potential for interaction with airport operations

Issue	Response
to occur in this period, which could necessitate 'operational' conditions in the area surrounding WSI. Additional approvals may be required under the Airports (Building Control) Regulations 1996 and mitigation measures will need to address all potential operational impacts from WSI including in relation to all impacts which are likely to change in the context of an operating airport. This contingency would also need to be protected for the pipeline works, which have not been addressed for operational impacts to WSI.	in this scenario is cranes for the construction of AWRC structures. The EIS notes these are likely to be about 50 metres high which is below the maximum Obstacle Limitation Surface (OLS) height of 75 metres. Sydney Water is committed to ongoing engagement with Western Sydney Airport as the project progresses to identify and manage any risks in the event construction activities overlap with airport testing and commissioning.
Legislation and regulation WSA notes that finalised versions of the Aerotropolis Planning Package have now been released, and a consistency check of this application will need to be undertaken to confirm alignment of the project.	Section 5.17.7 of the Submissions Report addressed consistency with the finalised Aerotropolis Planning Package and Sydney Water has no further information to provide.
Protected airspace For the assurance of any future airspace activities being appropriately addressed, WSA recommends inclusion of a specific condition.	The EIS assessed the impacts of the project's reference design on protected airspace and concluded no approvals would be required. This will be revisited in detailed design (management measure AO03 in Appendix B of the Submissions Report) and Sydney Water would obtain any approvals required.
Wildlife risk In addition to the mitigation measures being likely to reduce the very high risk rating, there remains a degree of uncertainty in relation to the finalised location and make-up of the facilities at the site, as well as the detailed design of the various components of the development. Therefore, there is some ambiguity in relation to the final wildlife risk rating of the development until such a point as the detailed design has been completed, which could have either a positive or negative impact on wildlife attraction risk to WSI. The mitigation measures outlined at management measure AO01 in Appendix B are acknowledged in relation to this issue of design certainty, with the following additional measures potentially included to supplement these: • No new planting at the site which produces fruit or flowers or is likely to attract birds and wildlife.	Sydney Water considers the principles of effectively managing wildlife risk are already incorporated into management measures in Appendix B of the Submissions Report as outlined in the dot points below. These would be guided by the measures recommended in the Wildlife Risk Assessment in Appendix AA of the EIS which addresses all three specific points raised by Western Sydney Airport. • UD01 Urban Design and Landscaping Plan, which will address airport safeguarding constraints, requires input from ecologists and wildlife hazard experts and requires consideration of Aerotropolis tree planting provisions in the finalised Development Control Plan. • G05 Rehabilitation Plan for pipelines, which also refers to consideration of Aerotropolis tree planting provisions. • AO01-AO04 – relating to design measures, wildlife risk assessment and wildlife

Issue	Response
• Design of basins to drain within 48 hours of a rainfall event. • Design of development to minimise areas for wildlife use such as nesting or roosting.	management plan. In relation to new planting, Sydney Water is committed to landscaping in a way that manages wildlife risk and aligns with planting guidelines in the finalised Aerotropolis DCP. Although Sydney Water can avoid using species significantly attractive to wildlife, a blanket requirement for no plants that fruit or flower is not practical and does not align with NSW government expectations for enhancing biodiversity along South Creek.
Wildlife risk – cumulative impacts Further information is required in relation to cumulative impact of wildlife attraction. It needs to be demonstrated how Sydney Water could potentially contribute to cumulative impact noting the cumulative nature of wildlife attraction as a risk, and the proximity of the site to other high risk / wildlife attracting uses. Further assessment demonstrating the potential for the proposal to contribute to existing wildlife movements surrounding the facility is required, as this is a key generator of risk to WSA. Specifies content of a cumulative wildlife impacts assessment and notes a precautionary approach to wildlife impact assessment would include a review of existing wildlife generating uses and how this development proposal could contribute to or elevate this risk.	The Wildlife Risk Assessment by Avisure in Appendix AA of the EIS acknowledges the interactions between the surrounding landscape and the AWRC site in contributing to wildlife risk. The risk assessment methodology is described in Appendix B of Appendix AA and incorporates off-site factors. The risk assessment has identified a very high risk for the site (the highest rating) and that an appropriate response is to mitigate impacts. As a result, Sydney Water has included a comprehensive range of measures to effectively manage its contribution to the cumulative risk of wildlife strike.
Wildlife risk – SEPP provisions These works need to ensure that the development satisfies Provision 4.19 of State Environmental Planning Policy (Precincts – Western Parklands City) 2021, including provision 4.19(2)(b), to ensure that WSA is satisfied under 4.19(2)(c), which includes assessment of: • Species, size, quantity, flock behaviour and the particular times of year when the wildlife is likely to be present; and • Whether any of the wildlife is a threatened species, and • A description of how the assessment was carried out.	Sydney Water notes that State Environmental Planning Policies (including the development consent provisions referenced) do not apply to State significant infrastructure. However, Sydney Water has provided a wildlife risk assessment in Appendix AA of the EIS that it considers meets the intent of these provisions.

Issue	Response
Wildlife risk - landscaping Notes that as landscaping can directly influence to the wildlife attraction of the development, there will need to be assessment of the landscape design which specifically demonstrates the risk as acceptable. In particular, the use of open water bodies and 'wetlands' continue to be of concern to WSA, and will continue to be concerning until sufficient design certainty and design specific assessment is required to demonstrate that the location of such uses will not pose an unacceptable wildlife attraction risk to WSA. It is recommended that Condition AO01 be amended to remove the term 'feasible' – this exercise should be undertaken on the basis of risk.	As noted in the response above, Sydney Water has committed to a range of measures to manage the risk of attracting wildlife. Sydney Water expects there will be a large suite of specific measures to manage risk. However, Sydney Water needs to ensure that wildlife management measures do not compromise the safe and effective operation of the AWRC. As a result, Sydney Water considers it is appropriate to retain the word 'feasible' in management measure AO01.
Traffic Sydney Water has noted that Traffic Management Plans would be developed to potentially review the impact of operations on Clifton Ave intersection. Given the already highly congested nature of Elizabeth Drive, it is recommended that extension of the right turn bay be identified as a required upgrade as part of this development, rather than considered as just one potential solution. Management of this issue through soft measures, such as scheduling of movements, is unlikely to result in an acceptable outcome for an intersection already experiencing traffic congestion issues.	Sydney Water's response in section 5.14.1 of the Submissions Report refers to a range of measures that will be considered to reduce construction traffic impacts as detailed design progresses. Sydney Water considers it is reasonable to consider this further as part of detailed design so it can be informed by more detailed planning. For example, early information from the construction procurement process suggests there may be opportunities to reduce and/or stage construction vehicle movements associated with bulk earthworks at the AWRC site.
Consultation Requests that the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications be identified as a relevant consultation body.	Sydney Water considers this is addressed by management measure G08 (Community and Stakeholder Engagement Plan) in Appendix B of the Submissions Report.

Table 9 Penrith City Council

Issue	Response
Project staging Staging and extent of works - full extent of works	Page 15 of the Submissions Report differentiates between the size of the AWRC in Stage 1 vs future

Issue	Response
in Stage 1 is unclear and particularly notes that the green space area should be included in Stage 1. The letter references descriptions of Stage 1 in the Executive Summary of the Submissions Report (page 15) and description of the green space area in section 6.4.3 (page 315).	stages, because the expansion of the AWRC itself is the only element of the project that will be delivered in future stages. Section 6.4.3 of the Submissions Report is correct and Sydney Water is seeking approval for the green space area (including recreational access) as part of Stage 1 of the project. Table 1 includes more detail about works in the green space area.
Noise and vibration Sizing of air release valves along project pipelines, and a requirement to update the Noise and Vibration Impact Assessment if changes to adverse impacts to surrounding sensitive receivers are anticipated.	As outlined in Table 6-13 of the Submissions Report, the sizing of air release valves will be determined during detailed design of the project. The valves will be sized according to the diameter of the pipeline to ensure they operate efficiently. Sydney Water does not expect update of the Noise and Vibration Impact Assessment will be required as the design changes will be minor and unlikely to change assessed impacts.
Renewable energy generation It is unclear if the project includes renewable energy generation from cogeneration and solar panels given page 15 of the Submissions Report does not refer to them. Recommends DPE require installation of sustainability features including solar panels.	Page 15 of the Submissions Report Executive Summary provides a brief project summary in dot point form that has not changed from the EIS. This includes reference to renewable energy generation in the first dot point. Sydney Water has confirmed the inclusion of renewable energy generation in: • section 6.4.4 of the Submissions Report in response to Penrith City Council's submission • the EIS (particularly Table 4-3 of the project description). This project description still applies (subject to the updates in the Amendment Report) but is not required to be repeated in the Submissions Report.
Landscaped areas Landscaped areas should be restored, regenerated and protected by conditions of consent for maintenance and reporting. Offset areas should be protected in perpetuity. Fencing surrounding riparian or landscaped areas should not prevent terrestrial movement and connectivity between corridors. Fencing without integrated opportunities for crossings (regular spaces gaps under or at the base of fences etc) can affect the dispersal and survival of terrestrial wildlife, and prevents free movement in times of migration, drought, flood and fire. Entrapment in	Sydney Water considers that management measures UD01 (Urban Design and Landscaping Plan) and G05 (Rehabilitation Management Plan) in Appendix B of the Submissions Report would address this matter, including in relation to restoration and ongoing maintenance of landscaped areas. Appropriate fencing would be addressed in UD01 through input from an ecologist in the design. Management measure TB10 commits to a Biodiversity Offset Strategy and it is standard practice for offset areas to be protected in perpetuity.

Issue	Response
the fencing affects marsupials, birds, bats and reptiles, and fence hanging is a common threat.	
Visual impacts Impacts on landscape character, cultural heritage and views will not be insignificant noting the scale and height of structures proposed and that the assessment of the impacts of such structures be appropriately informed. Refers to Council's request for details designs, architectural and landscape plans, and visual impact analysis of proposed structures on AWRC site, with regard to reflectivity of materials.	Section 6.4.11 of the Submissions Report notes that a visual impact assessment has been undertaken and is included in section 11.3 and Appendix T of the EIS. The visual impact assessment uses photomontages to analyse and assess the visual impact of the AWRC in the landscape. Although the assessment is indicative, it is based on the functional requirements of the project's reference design, including scale and height of structures. On this basis, Sydney Water considers that the visual impact assessment has been appropriately informed. Sydney Water has not yet developed detailed designs, architectural or landscape plans because procurement of contractors who will do this work is currently underway.
Impact on Wallacia Village and public places Council requests that the Department ensure pipeline locations are to avoid bisecting Council reserves and parks. Pipeline locations and the construction methodologies are to be amended such that the visual and biodiversity impacts, impacts on Aboriginal cultural landscapes and on Council reserves, parks and public places are minimised.	Chapter 3 of the EIS describes how the project has been designed to minimise environment and heritage impacts and to follow existing road alignments where possible. It also describes the options assessed for all project components. Sydney Water has included a range of management measures in Appendix B of the Submissions Report to identify further opportunities to minimise impacts as detailed design and construction planning progress. In terms of council reserves and parks in the Penrith local government area, there are two relevant reserves: • Crossman Reserve on Park Road in Wallacia. The treated water pipeline will skirt around the edge of this reserve. • Fowler Reserve adjacent to Nepean River at Wallacia. The treated water pipeline will run through this reserve, with the alignment chosen to avoid impacts on the main thoroughfare (Silverdale) and future upgrade plans for Silverdale Road and Wallacia Bridge. Temporary construction impacts on Fowler Reserve are assessed in the EIS. The pipeline will be below ground, so once it is operational will not affect public use of the reserve.
Traffic	Management measure TT01 in Appendix B of the

Issue	Response
Raises concerns about premature road failure of Clifton Avenue and does not support a patch and go approach to upgrades. Requests several items in SSCTMP relating to geotechnical investigations, pavement upgrades and dilapidation report for Clifton Avenue. Council will continue to advocate road upgrades are done by DPE.	Submissions Report outlines what will be included in project SSCTMPs. These documents will not outline any required upgrade, testing or dilapidation assessments of roads and utilities. Management measure U02 in Appendix B of the Submissions Report commits to completing dilapidation surveys of utilities, including Clifton Avenue, prior to the commencement of construction. Sydney Water will complete a condition assessment of Clifton Avenue, and will restore the road to pre-existing conditions at the completion of construction. Sydney Water does not plan to upgrade any sections of Clifton Avenue as it considers this is not needed to cater for construction or operational traffic volumes. However, given the extended construction timeframe, and the shared use of the road by Sydney Water and TfNSW's M12 Motorway project, Sydney Water will work closely with TfNSW throughout construction to ensure Clifton Avenue is maintained to a safe condition.
Engineering and flooding Council reiterates comments provided in its 14 December 2021 submission (specifically section 12) in relation to engineering and flooding. Penrith City Council (PCC) raised concerns about the lower flow rates and corresponding lower flood levels that do not align with PCC's 2015 adopted flood model. PCC also noted that the comparison of flood levels presented in AWRC flood impact assessment (validation results in Table 4-7) do not correlate with the results of the study. PCC requested that the flow rates modelled in the 2015 adopted flood study must be used in the AWRC TUFLOW model together with the ARR1987 guidelines to define the existing case flood.	Sections 6.4.13 – 6.4.18 and Appendix C in the Submissions Report address the engineering and flooding comments from Penrith City Council's 14 December 2021 submission. Further clarification on hydraulic model validation, model comparison and the use of lower ARR2019 flows in the AWRC TUFLOW model is also provided in Table 2 above. Sydney Water notes that INSW flows (ARR1987) are used in the AWRC TUFLOW model as described in Table 2 above and Appendix C of the Submissions Report and they closely match flows in PCC's 2015 adopted flood model. This means the AWRC TUFLOW model can produce consistent results with PCC's 2015 adopted flood model and it can adequately define the existing case flood.
Hazardous development No objections are raised with confirming antiscalant at detailed design, provided that this is confirmed, and appropriate measures put in place prior to determination by the relevant authority.	The antiscalant product used during operation of the AWRC will be determined during detailed design of the project. Appropriate design measures will be included at the AWRC site such as: • compatibility of storage near other chemicals to ensure no adverse chemical reactions occur

Issue	Response
	• storage away from key operational areas of the AWRC (such as bioreactors and the advanced water treatment plant) where flammability hazards are increased.
Stormwater design The Department would need to be satisfied with stormwater design being confirmed in detailed design (in relation to firewater). Council raises no objection, provided that appropriate mitigation measures are implemented should there be insufficient space for fire water, which should be assessed by the relevant authority prior to determination.	The stormwater system for the AWRC site will be finalised as part of detailed design. Following a fire event that requires extinguishing, firewater would typically be captured in the stormwater system. This includes the first flush system that typically captures the first 10 mm of rain which is sent to the head of works for treatment through the wastewater treatment process. Excess firewater would be captured in the onsite stormwater detention basins where it would be tested prior to offsite disposal or release. The sizing of the stormwater detention basins will be determined during detailed design.
Contaminated land Penrith City Council notes that responses provided to concerns with contaminated land are considered satisfactory.	Sydney Water considers no further response is required.
Waterway management and WSUD It is noted in the supporting updated information that a more detailed assessment of risks and mitigation measures would be considered and developed during the detailed design and construction planning. Penrith City Council raises no objections, provided that the outstanding information can be reviewed by the Department of Planning and Environment (DPE) prior to approval of the scheme and commencement of works and prior to the operation of the scheme. The updated information appended to the Response to Submissions document includes a range of management measures and commitments to ensure that the detailed design of waterway crossings further considers geomorphology, aquatic ecology and groundwater. In addition, disturbed areas will need to be stabilised and revegetated in accordance with proposed management measures.	Sydney Water will progress detailed design as part of its construction contracts, for which procurement is currently underway. Sydney Water will apply management measures in Appendix B of the Submissions Report in detailed design where applicable and does not intend updating these further. Risk assessments are active documents and will be reviewed and updated as detailed design and construction progress. Detailed waterway impact assessments were completed as part of the EIS and Sydney Water has committed to the range of waterway management measures described in Appendix B of the Submissions Report to manage waterway crossing impacts. During operation, at the release locations, impacts associated with erosion and sedimentation will be effectively managed by measures that include condition monitoring and completion of a risk assessment should erosion or sedimentation issues be identified. For the construction phase, these measures will be included in a Soil and Water Management Plan as part of the CEMP.

Issue	Response
Recommends implementation of management measures and conditions to be adopted by DPE, should consent be granted.	Sydney Water has also committed to an Urban Design and Landscaping Plan for the site (management measure UD01 in Appendix B of the Submissions Report) and a Rehabilitation Management Plan (measure G05) for pipelines to address stabilisation and revegetation.
Wianamatta South Creek Penrith City Council notes that the updated information provided in the Submissions Report has also indicated how the project will meet updated pollution reduction and flow management targets of the new DPE EES targets for Wianamatta South Creek. Penrith City Council notes that additional details will need to be provided during the detailed design stage, and this will need to be assessed / approved to the satisfaction of DPE. Penrith City Council also notes that during construction, impacts to waterways are proposed to be managed by measures in a Soil and Water Management Plan as part of the CEMP. The CEMP will need to be in place prior to construction and all commitments must be implemented for the duration of construction. This will need to be reviewed and approved by the relevant authority.	In addition to Appendix F of the Submissions Report that considers the updated pollution and flow management targets for the Aerotropolis, Sydney Water updated management measure SW02 in Appendix B of the Submissions Report. This will ensure detailed design also meets these updated targets. Management measure G01 in Appendix B of the Submissions Report commits to preparing and implementing a CEMP. This will be prepared prior to construction and implemented during construction.
Treated water releases Penrith City Council notes that during operation of the scheme, the main potential risks result from the treated water releases to South Creek and Nepean and Warragamba rivers. These reports note that releases have the potential to impact on water quality, geomorphology, aquatic ecology and as a result of altered flow regimes. Penrith City Council notes that a review of the information and proposed safeguards indicates that the general impacts of the project are not extensive. The supporting studies included in the EIS and Submissions Report - Appendix B Updated Management Measures, included numerous mitigation measures and safeguards to manage the risks, and a detailed monitoring and reporting program.	Sydney Water notes Penrith City Council's summary of the potential operational impacts and confirms that a detailed monitoring and reporting program will be implemented in accordance with management measures WW22 to WW34 included in Appendix B of the Submissions report WW22 to WW34.

Issue	Response
Impacts to receiving waterways Penrith City Council notes that the monitoring program will need to have water quality, aquatic ecology, and geomorphic components. It also notes that monitoring should be sufficient to demonstrate that there are no adverse impacts to the health of the river, including ability for community use for recreation and other purposes. DPE should require the monitoring is sufficient to ensure that impacts and issues are identified at an early stage so that rectification actions can be implemented. In finalising the detailed design of the project and operational plans, consultation with relevant stakeholders including Council should be undertaken. Important that adequate consideration is undertaken to ensure the design and operation of the AWRC continues to meet water quality objectives, and that any impacts as a result of the project with respect to water quality management, impacts to creek geomorphology and aquatic species are identified and managed.	Sydney Water confirms that a baseline and post commissioning monitoring program will be implemented. Baseline monitoring commenced in March 2020 and will continue through the construction period. Post-commissioning monitoring will commence after project commissioning. The monitoring program will include the measures outlined in Appendix B of the Submissions Report (measures WW22 to WW34). The measures have water quality, aquatic ecology and geomorphic components. The monitoring program will allow Sydney Water to detect impacts to waterway health during operation, by comparing results to the baseline data currently being collected. Indicators such as faecal coliforms and *Enterococci* are included in the program which will allow impacts on water use for recreational purposes to be analysed. During detailed design and construction, Sydney Water will continue to consult with landowners, stakeholders, local councils, businesses and other government agencies, as outlined in management measure G08 (Appendix B of the Submissions Report). As part of detailed design, Sydney Water will confirm that the design and operation of the AWRC is consistent with the treatment levels, concentrations and load limits outlined in section 5.2.6 of the EIS.

Table 10 Canterbury-Bankstown City Council

Issue	Response
Requests several conditions of consent be added, related to previous comments made.	Sydney Water considers this letter is largely a matter for DPE's consideration in developing any conditions of approval for the project. However, section 6.1 of the Submissions Report responds to the issues, as they were also raised in City of Canterbury-Bankstown Council's submission on the EIS. In addition, works in Lansdowne Reserve will be covered by the project's Rehabilitation Management Plan under management measure G05

Issue	Response
	in Appendix B of the Submissions Report.

Table 11 Fairfield City Council

Issue	Response
Fairfield City Council welcomes the realignment of brine pipeline out of Cabravale Park but concerns remain about realignment through Cabravale Leisure Centre carpark. Council has met with Sydney Water to discuss an alternative alignment (involving a temporary road closure) to minimise disruption to Cabravale Leisure Centre and surrounding properties. Council notes the need for further discussions with TfNSW and note that further consideration of route realignment is required prior to project determination.	Sydney Water met with Fairfield City Council on 5 May 2022 to discuss the brine pipeline alignment in Cabramatta. Council raised concerns about disruption to Cabravale Leisure Centre car park and proposed an alternative alignment. Given this suggestion has arisen late in the planning approval process, Sydney Water proposes to investigate feasibility of this alignment during detailed design, particularly: • constructability of the alternative alignment (for example if there is enough space in the road reserve, consideration of potential impacts given residences would be much closer to the tunnelling compound) • further consultation with TfNSW, given the angle of the rail crossing is outside the parameters of what would typically be acceptable. If Sydney Water proposes any changes to the brine pipeline alignment in this area as a result of these investigations, it would seek a modification to the project approval. Sydney Water will continue to consult with Fairfield City Council as detailed design progresses.
The mitigation measures in Volume 4 of the EIS must be applied and monitored during all stages of the project in collaboration with affected stakeholders.	Management measures described in Table 15-3 of the EIS were updated in Appendix B of the Submissions Report. Appendix B details which project stage is relevant for each management measure. As outlined in Chapter 14 of the EIS: • for construction, the Construction Environmental Management Plan (CEMP) will include management measures, monitoring and auditing approaches • for operation, Sydney Water will incorporate operational management measures into its existing management systems.

Issue	Response
	Section 6.5 of the EIS describes Sydney Water's approach to stakeholder consultation during all project phases.
Amend wording to management measure GW11 to ensure geotechnical investigations include 'all waterways'	Management measure GW11 in Appendix B of the Submissions Report commits to managing impacts to surface water-groundwater connectivity where tunnelling under waterways will occur. No further changes are proposed.
Amend wording to management measure WW27 to include 'During construction and operation' to ensure regular monitoring of creek profiles for boring and trenching of creeks are monitored in both stages of project works.	Management measures WW01 – WW17 and WW21A in Appendix B of the Submissions Report will effectively manage impacts to waterway crossings during construction. Management measure WW27 commits to baseline and post construction monitoring and will effectively identify and manage any ongoing impacts to waterways at each crossing location. No further changes are proposed.
Amend flood management measures to include: 'Elevated sites must be outside 1% AEP were practical'	Management measure G06 in Appendix B of the Submissions Report commits to locating stockpiles and equipment away from drainage pathways, in elevated positions or at alternative sites. Sydney Water considers this is adequate to minimise the risk of flooding being exacerbated by temporary construction activities. No further changes are proposed.
Amend biodiversity management measures to include construction 'hold points': • Pre - clearance survey • Site induction with contractor outlining biodiversity management measures ensuring avoid minimise mitigate principals are implemented • Regular toolbox talks with construction teams/contractors reporting on all biodiversity management measures • Practical completion – All biodiversity management measures have been met • Carry out general biosecurity duty under the *Biosecurity Act 2015* to prevent, eliminate or minimise the biosecurity risk, this includes measures to eliminate the	Management measure TB01 in Appendix B of the Submissions Report commits to implementing a Biodiversity Management Plan which will include all the biodiversity management measures described in Appendix B. This includes monitoring and auditing requirements and measures required to manage biosecurity and prevent the spread of weeds and pathogens. The Biodiversity Management Plan will be included as part of the project's CEMP. The contractor will be responsible for ensuring the CEMP is implemented, including site inductions, to manage impacts to biodiversity during construction. No further changes are proposed.

Issue	Response
risk of spread of weed propagules brought in by machinery, tools and footwear • Implement an appropriate phytophthora management plan as per Saving our Species Guidelines	
Amend measure SW05 (Erosion and Sediment Control measures) to include (in addition to what has already been suggested): • Site works will not start until adequate erosion and sediment control works outlined are installed and functional • The entry to and departure of vehicles from the site will be confined to one stabilised point • Sediment or barrier fencing will be used to restrict all vehicular movements to that point	Management measure SW05 in Appendix B of the Submissions Report commits to implementing sediment and erosion control measures that consider the targets in the draft Western Sydney Aerotropolis DCP – Phase 2 (PO1 in section 4.3.2 and PO1-PO5 in section 9.6.2). Target PO1 in section 9.6.2 of the Phase 2 DCP details requirements for a single stabilised entry/exit point to work sites. Management measure SW05 will be included in a Soil and Water Management Plan as part of the project's CEMP. The CEMP will be in place prior to construction and implemented during construction. No further changes are proposed.

Table 12 Liverpool City Council

Issue	Response
Satisfied with Submissions Report responses. Reiterates previous comments about timely construction of the facility, providing heritage documents to Council library, and actioning of Council's initial contamination comments by the consent authority.	Sydney Water has responded to the following issues in the Submissions Report and has no further information to add: • Project timing – section 6.3.11. • Contamination – section 6.3.12. Given the sensitive nature of some heritage information, feasibility of providing future heritage documents for public access would need to be considered on a case by case basis.

Attachment A Indicative urban design report

JULY 2021

Upper South Creek Advanced Water Recycling Centre

URBAN DESIGN REPORT

Sydney WATER

aurecon ARUP

Job title	Upper South Creek Advanced Water Recycling Centre		Job Number 269002-00	
Document Title	AWRC Urban Design Report			
Document Reference				
Date	Filename	AWRC Urban Design Report		
26/05/2020	Description	Draft 1		
		Prepared by	Checked by	Approved by
	Name	Glenda Yiu	Lidia Lewis	Lidia Lewis
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	Name	Glenda Yiu	Lidia Lewis	Lidia Lewis
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	Description	Final		
		Prepared by	Checked by	Approved by
	Name	Glenda Yiu	Lidia Lewis	Lidia Lewis

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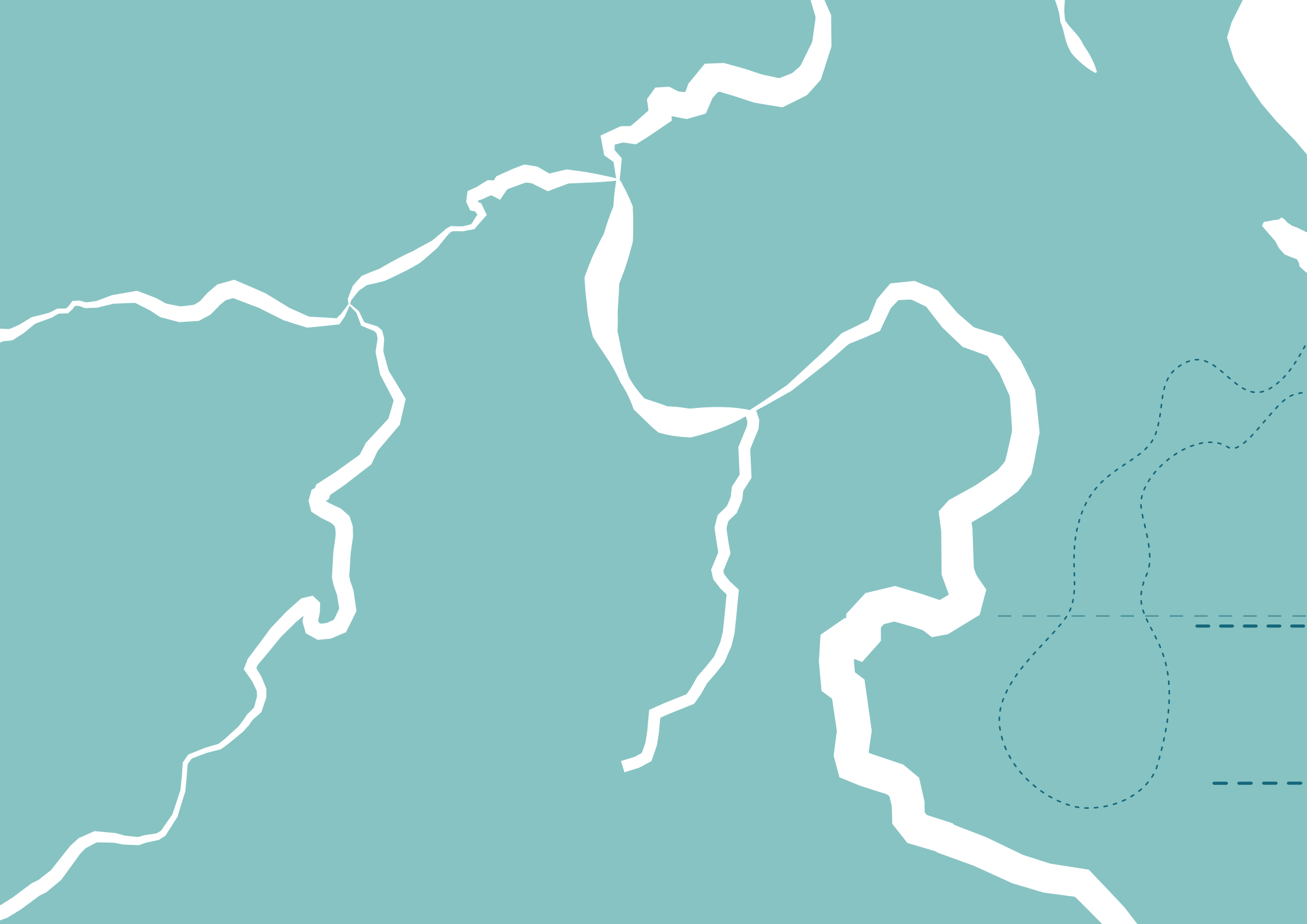


1. Introduction

1.1 Overview

Sydney Water is planning to build and operate new wastewater infrastructure to service the South West and Western Sydney Aerotropolis Growth Areas. The proposed development will include a wastewater treatment plant in Western Sydney, known as the Upper South Creek Advanced Water Recycling Centre (AWRC). Together, this Water Recycling Centre and the associated treated water and brine pipelines, will be known as the 'project'.

PROJECT OBJECTIVES

+ Sustainable solutions
+ Respond to growth
+ Provide cost effect service
+ Minimise disruption
+ Adaptable solution

An overview of the location of the proposed infrastructure is provided on the following page (Figure 1). Further details of each component of the project are provided below.

Advanced Water Recycling Centre

+ a wastewater treatment plant with the capacity to treat up to 50 ML of wastewater per day, with ultimate capacity of up to 100ML per day
+ the Advanced Water Recycling Centre will produce:
  - high-quality treated water suitable for a range of uses including recycling and environmental flows
  - renewable energy, including through the capturing of heat for cogeneration
  - biosolids suitable for beneficial reuse
  - brine, as a by-product of reverse osmosis treatment

Treated water pipelines

+ a pipeline about 17 km long from the Advanced Water Recycling Centre to the Nepean River at Wallacia Weir, for the release of treated water
+ infrastructure from the Advanced Water Recycling Centre to South Creek to release excess treated water and wet weather flows
+ a pipeline about five kilometres long from the main treated water pipeline at Wallacia to a location between the Warragamba Dam and Warragamba Weir, to release high-quality treated water to the Warragamba River as environmental flows.

Brine pipeline

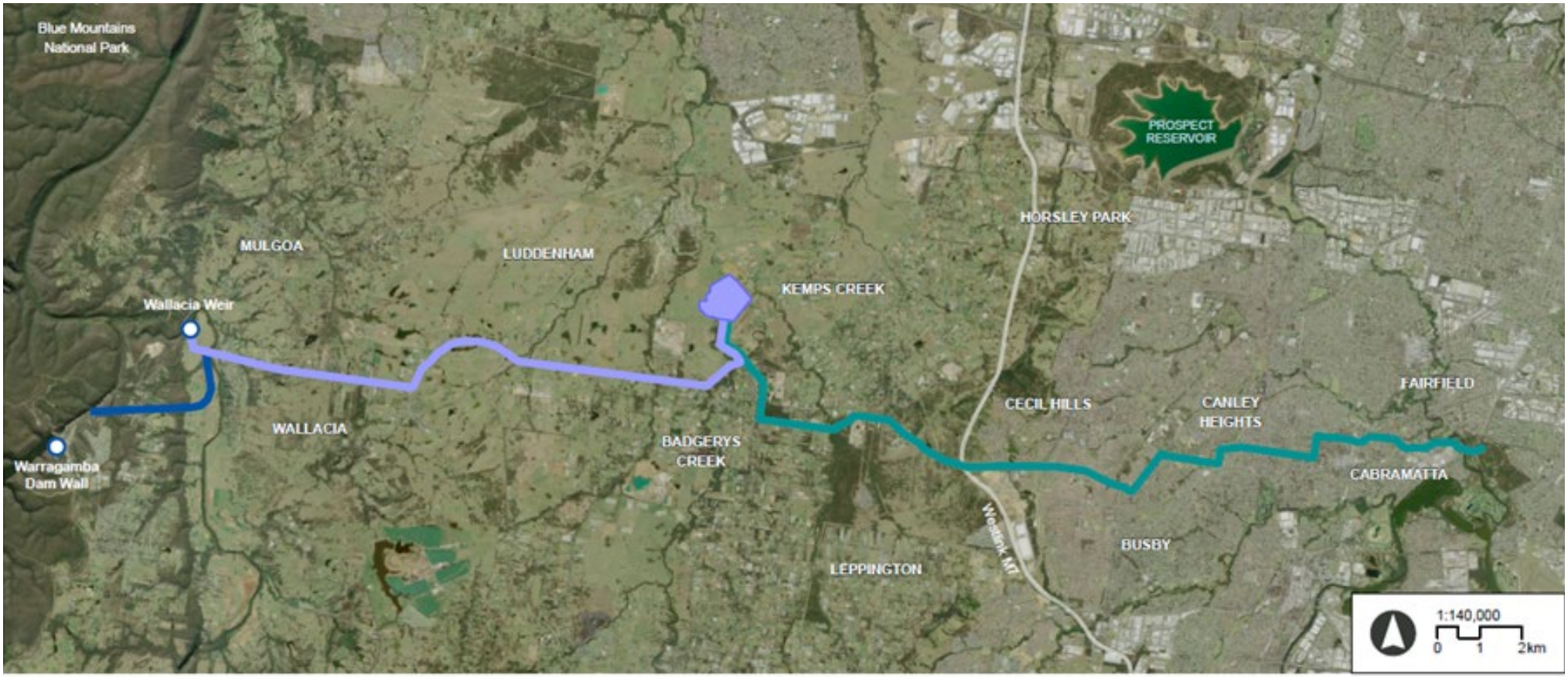
+ a pipeline about 24 km long that transfers brine from the Advanced Water Recycling Centre to Lansdowne, in south-west Sydney, where it connects to Sydney Water's existing Malabar wastewater network

Sydney Water is planning to deliver the project in stages, with Stage 1 comprising:

+ building and operating the Advanced Water Recycling Centre to treat an average dry weather flow of up to 50ML per day
+ building all pipelines to their ultimate capacity, but only operating them to transport and release volumes produced by the Stage 1 Advanced Water Recycling Centre

The timing and scale of future stages will be phased to respond to drivers including population growth rate and the most efficient way for Sydney Water to optimise its wastewater systems.

This concept landscape masterplan report relates to the Advanced Water Recycling Centre component of the project.



Projection: GDA 1994 MGA Zone 56
Project infrastructure locations are indicative and will be refined during design

Figure 1 Project Overview

Wianamatta-South Creek

1.2 Scope

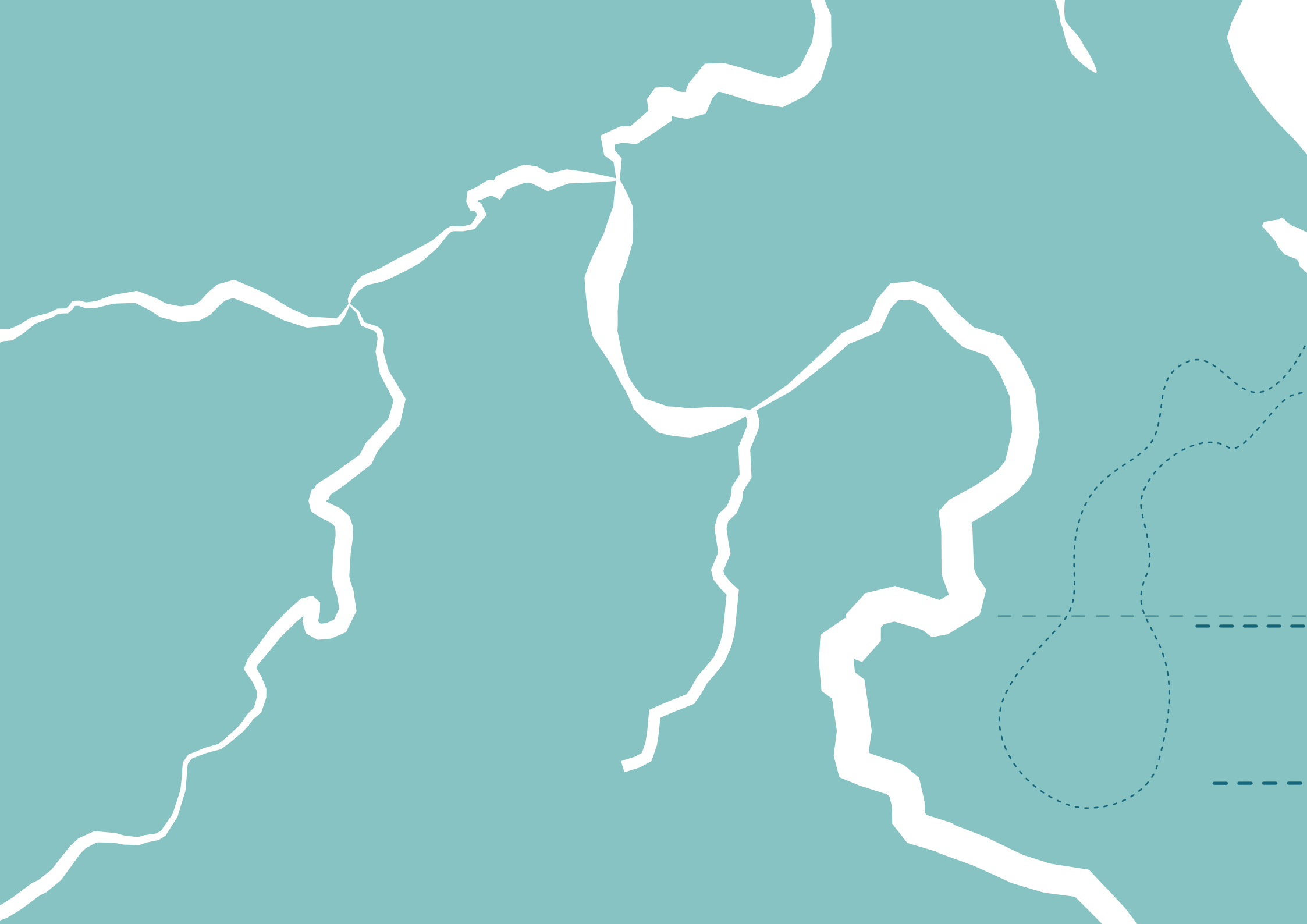
The purpose of the Urban Design Report is to develop a strategy for urban, landscape and architectural design at the AWRC and surrounding site. As part of this, a set of design objectives were established to guide the process in developing a landscape-led concept masterplan.

The concept masterplan informs the EIS process, support the objectives of Sydney Water and broadly align with the Western Sydney Parkland and Western Sydney Aerotropolis vision.

This report coordinates Urban Design, Landscape Architecture and Architecture with the technical infrastructure of AWRC to deliver a concept design as part of the EIS process, community engagement, and the future procurement, planning and delivery of the asset.

The report is structured into the following key sections:

+ Site analysis and appraisal of context at macro, meso and micro levels
+ Project Design Vision and Principles
+ Functional and Spatial Requirements related to the site
+ Concept Design Masterplan demonstrating a coordinated landscape-led approach to the whole site
+ Developed design and associated technical landscape, architectural and sustainability details



2.
Site Context

2.1 Strategic Context

2.1.1 Greater Sydney Commission

A Metropolis of Three Cities

In 2018 the NSW Greater Sydney Commission released *A Metropolis of Three Cities – The Greater Sydney Region Plan* to plan for the needs of a changing and growing city. The plan sets out a vision for a Greater Sydney with three productive, liveable and sustainable cities:

+ The Eastern Harbour City
+ The Central River City
+ The Western Parkland City

The plan advocates for 30minutes cities whereby all residents live within 30minutes of their jobs, education and health facilities, services and amenity. Each city has its unique character and landscapes with a focus on different industries and economies.

Western City District Plan

The AWRC is located within the Western Parkland City - a city in the landscape. *The Western District Plan*, is a 20 year integrated plan to guide and manage the growth of the Western Parkland City.

The catalyst for growth and the development of the Western Economic Corridor is the future Western Sydney Airport. This will see the construction of major transport infrastructure, such as the North South Rail LinE and the M12 Motorway, to support the transformation of predominantly peri-urban lands into a region that will be the home for over 1.5 million by 2056.

The Western Economic Corridor will attract globally significant commerce and trade, generating highly skilled, knowledge intensive jobs.

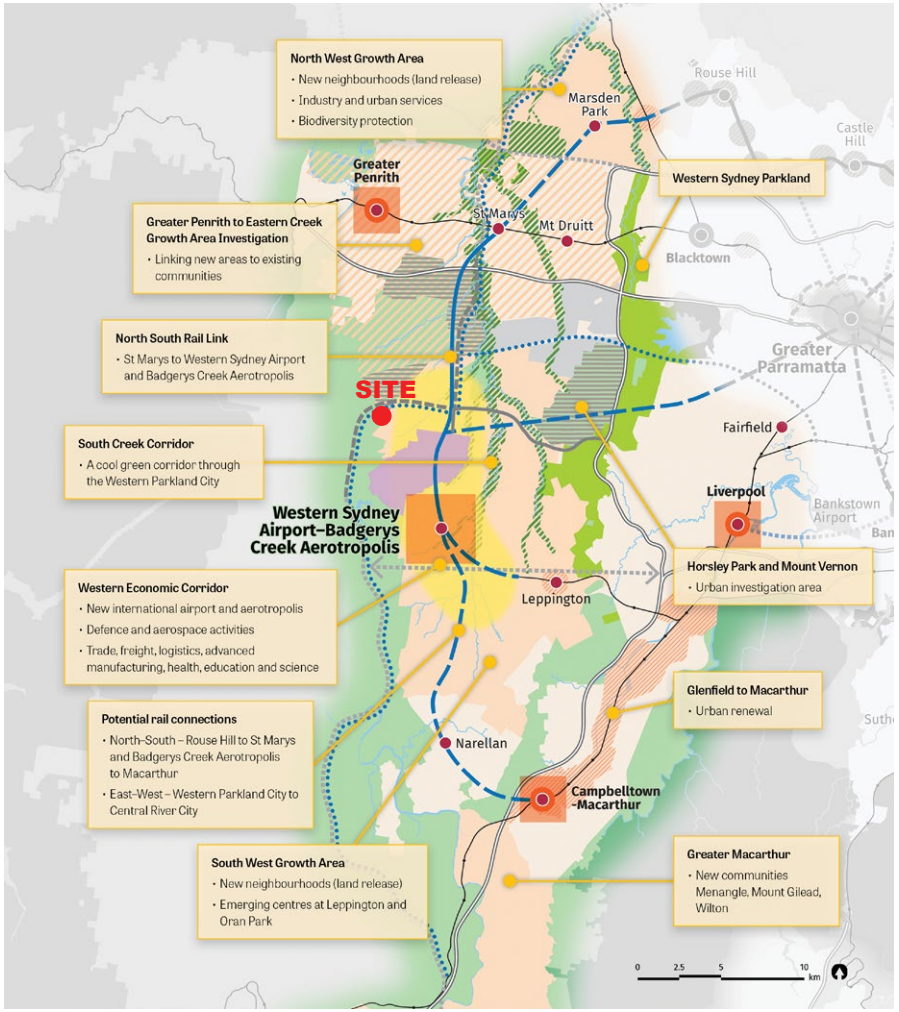


Figure 2 *A Metropolis of Three Cities:* Western Parkland City (Greater Sydney Commission)

Wianamatta- South Creek Corridor

Wianamatta-South Creek is the central urban element of the Western Parkland City. Bordering the western boundary of the site, it forms approximately 80% of the Western Parkland City's catchment, running through one of the flattest, driest and hottest parts of Greater Sydney.

Wianamatta-South Creek forms one of the thirty-eight objectives outlined in *A Metropolis of Three Cities* and *the Western City District Plan*; Objective 26/Planning Priority W13 - A cool and green parkland city in the Wianamatta-South Creek Corridor. The objective reflects the vision of the Corridor as forming the identity and acting as a defining spatial element at the heart of the parkland city.

Wianamatta-South Creek will create linking corridors of active and passive recreation and open spaces, parks, walking and cycling trails and community facilities to promote a connected, healthy, liveable and sustainable city.

An important tributary of Sydney's water catchment, the role of the Corridor in providing essential ecological services such as nutrient capture, urban cooling and habitat will be strengthened through innovative approaches to future development in the area.

Aspects around stormwater and wastewater management, flood mitigation, the introduction of wetlands to retain more water and increasing tree canopy to mitigate the urban heat island effect are a few of the strategies outlined under the objective.

In the Western City District Plan the urban design principles to guide the future development of the Wianamatta-South Creek Corridor are defined as:

Figure 3 Artistic Impression: Wianamatta-South Creek by Tyrell Studio

2.1 Strategic Context

2.1.2 Western Sydney Aerotropolis

The 11,200 hectare Western Sydney Aerotropolis (WSA) at Badgerys Creek is planned to be a 24 hour economy contributing to 200,000 new jobs for Western Sydney and forging strong local and international connections.

The WSA will enable the creation of high-value jobs and a sustainable low carbon precinct that embeds the circular economy principles. It is anchored by the Nancy Bird International Airport which is planned to start operation in 2026.

There are ten WSA precincts, six of which will be the focus of initial precinct planning. These include: Aerotropolis Core, Agribusiness Northern Gateway, Badgerys Creek, Mamre Road, Northern Gateway and Wianamatta-South Creek.

Western Sydney Aerotropolis Plan (WSAP) September 2020

The WSAP adopts an innovative landscape-led planning approach to development and growth, placing emphasis on the critical role of blue-green infrastructure in shaping the future of a more sustainable, cool, green and biodiverse city.

Recognising that accessible social and cultural infrastructure is key to creating sustainable and healthy communities, the WSAP embeds local cultural values and integrates environmental and open space strategies with the development of hard infrastructure required to service a 24 hour global economy. The plan, aligned with the Premier's key priorities outlines it's vision for a city with significant increase in tree canopy, increasing habitat and strengthening biodiversity, mitigating urban heat and improving resilience to climate change.

The four themes and eleven objectives that underpin the WSAP

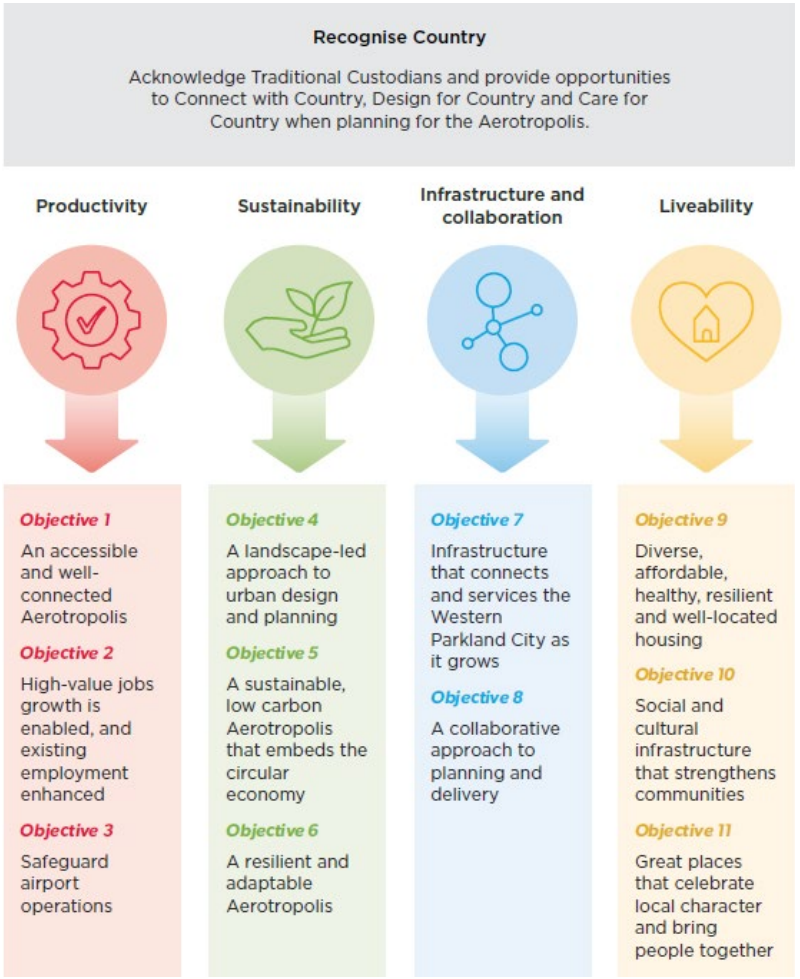


Figure 4 Western Sydney Aerotropolis Plan September 2020

2.1.3 Draft Cumberland Plain Conservation Plan 2020-2056

The Cumberland Plain Conservation Plan (The Plan) is one of the largest strategic conservation plans to be undertaken in Australia that aims to protect the regions important conservation values. Covering 200,000 hectares The Plan details 28 commitments under four categories building knowledge and capacity, to improve ecological resilience and support biodiversity and growth in the Western Parkland City. The four categories are:

+ Avoiding and minimising impacts;
+ Mitigating indirect and prescribed impacts;
+ Conserving flora, fauna and associated habitats;
+ Managing landscape threats;

The Plan has been prepared to meet requirements for strategic biodiversity certification under the *NSW Biodiversity Conservation Act 2016* and strategic assessment under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

Adopting a landscape-led approach to delivering the AWRC presents a major opportunity to minimise the environmental impacts of the centre and contribute to the ecological restoration of the waters and surrounding region.

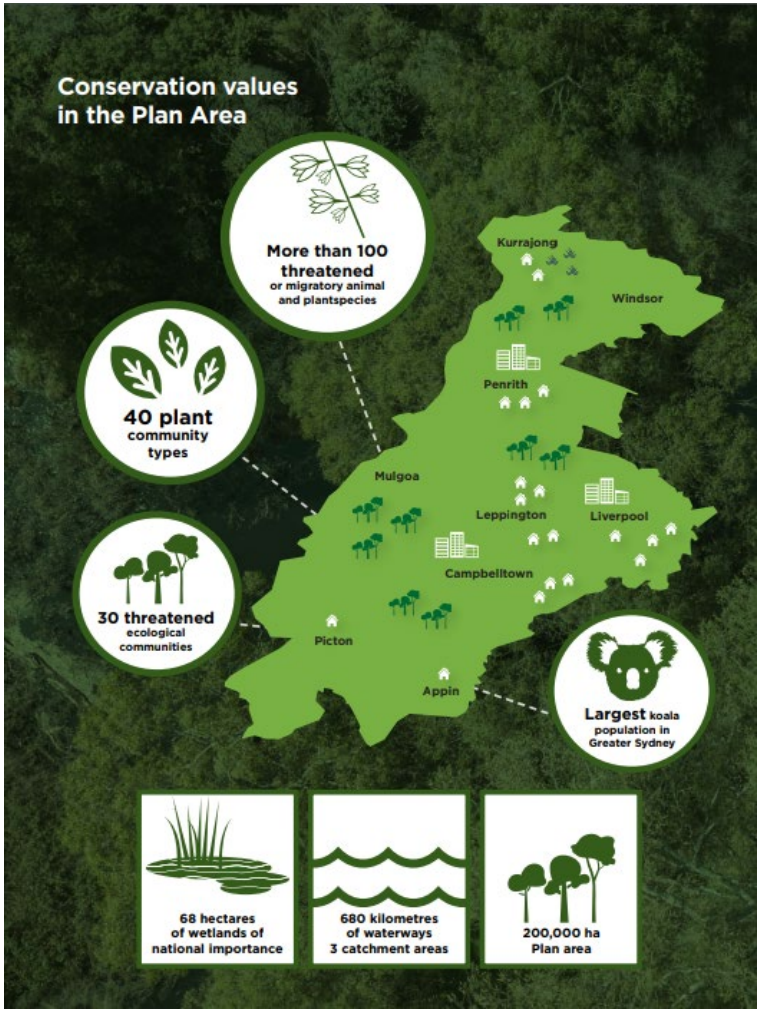


Figure 5 Draft Cumberland Plain Conservation Plan 2020-2056

2.1 Strategic Context

2.1.4 Government Architect of New South Wales

Sydney Green Grid + South West District Grid

Underpinning Objective 32 of *A Metropolis of Three Cities*, Sydney's *Green Grid* strategically looks at the inter-relationship between the city's network of green and grey infrastructure, district and local centres and residential neighbourhoods.

Green infrastructure being a system of agricultural, recreational, ecological and hydrological girds, Sydney's Green Grid begins to interrogate and map out Sydney's green spatial qualities and identifies opportunities and priorities for each of the Sydney's Districts.

Wianamatta-South Creek and Kemps Creek are located within the South West District. They have been identified to suffer from poor water quality and fragmented vegetation cover. However, through a balanced approach to access, biodiversity, development and recreation Wianamatta-South Creek poses a valuable asset to supporting the future growth of the district.

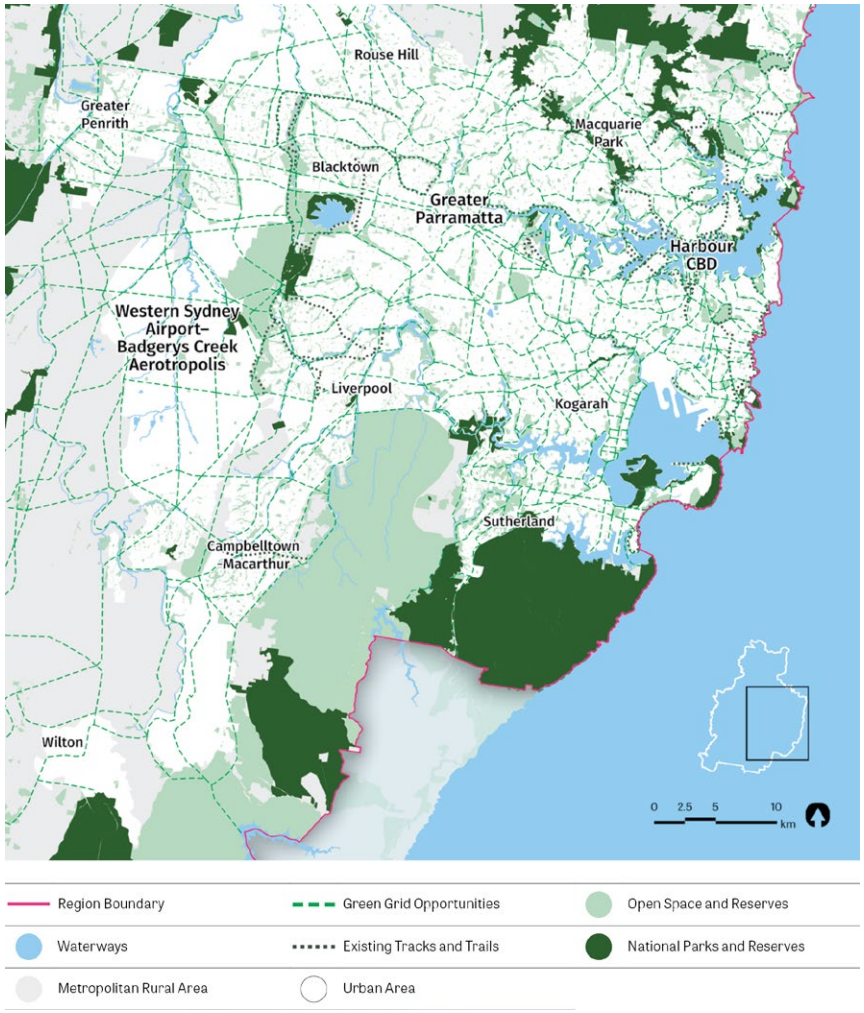


Figure 6 *A Metropolis of Three Cities:* Objective 32 - Green Grid vision and opportunities

Greener Places

Aligned with the Premier's Priorities: 'Greening Our City' and 'Greener Public Spaces,' Greener Places builds on the *Sydney Green Grid*, which forms part of the *Plan for Growing Sydney* and the *District Plans. Greener Places* is a state green infrastructure policy which aims to create healthier, more liveable and sustainable communities by improving the quality and access to natural and semi-natural systems such as parks and recreation, and waterways and bushland.

Greener Places highlights the social, environmental and economic benefits of green infrastructure and the need for well designed, planned and green infrastructure to support the ecological health of our environments, supporting biodiversity and habitat, and strengthening climate resilience.

The four principles for designing green infrastructure are:

1. Integration
   combine Green Infrastructure with urban development and grey infrastructure
2. Connectivity
   create an interconnected network of open space
3. Multi-functionality
   deliver multiple ecosystem services simultaneously
4. Participation
   involve stakeholders in development and implementation

Better Placed

The state's first design-led policy, *Better Placed* recognises the role our built environment has on shaping our lives and how the quality of design affects how places and spaces function and integration with the broader context.

The policy defines well designed architecture, public spaces and environments as being: Healthy, Responsive; Integrated; Equitable; and Resilient

The seven key objectives to help drive better design led outcomes that enhance all aspects of our environments are:

+ Better fit
  contextual, local and of its place
+ Better performance
  sustainable, adaptable and durable
+ Better community
  inclusive, connected and diverse
+ Better for people
  safe, comfortable and livable
+ Better working
  functional, efficient, and fit for purpose
+ Better value
  creative and adding value
+ Better look and feel
  engaging, inviting and attractive

2.1 Strategic Context

2.1.5 Sydney Water Strategy 2020-2030

Responding to key challeneges of today and the future, this strategy outlines the activities and ambitions of Sydney Water in achieving their vision creating a better life with world-class water services over the next decade.

The strategy identifies four strategic outcomes, detailing what success looks like, and what is required to accomplish this.

The four strategic outcomes include:

+ First choice of customers and partners
+ Successful and innovative business
+ High performance culture
+ Thriving, liveable and sustainable cities.

The AWRC masterplan aligns and contributes towards Sydney Water's 'thriving, liveable and sustainable cities' outcome. In doing so, this masterplan will need to deliver on the following objectives:

+ Our cities waterways are clean, healthy and safe for swimming and recreation
+ Our system is resilient to shocks and disruptions (e.g. we have achieved advanced system reliability and performance)
+ Our water and waterways are world class and support thriving liveable and sustainable cities
+ Our environmental performance is world class
+ We are a resource recovery business with an increasing portfolio of circular economy products and services
+ We have made substantial progress towards zero impact on the environment (focus on water, waste and carbon)

Figure 7 *Sydney Water's One strategy to deliver our vision*

2.2 Development Context

2.2.1 Policies and Guidelines

The strategic guidelines detailed on the previous pages together with local policy and legislation (Table 1) has informed the development of the masterplan.

Table 1: Legislation and policy context

LEGISLATION AND POLICY RELEVANT TO THE AWRC URBAN DESIGN REPORT		
Legislation/Policy reference in full	**Brief description legislation, salient parts and intent**	**How legislation/policy is relevant to the urban design**
Australian Standard AS1428.1 Design for access and mobility (Australian Standard, 2009)	Specifies the design requirements for new building work as required by the Building Code of Australia (BCA) and the Disability Standards to provide access for people with disabilities.	All areas including the administration office, facilities and publicly accessible outdoor areas will need to comply to AS1428.1.
State Environmental Planning Policy (Western Sydney Aerotropolis) 2020	The SEPP facilitates development in the WSA in accordance with the objectives and principles of the WSAP.	The AWRC must comply with this SEPP. It replaces conflicting policies identified under the Penrith Local Environmental Plan 2010
Technical guideline for Urban Green Cover in NSW (OEH, 2015)	Provides practical advice on best practices to increase community resilience to climate change.	Complementing the Western Parkland City vision. While not binding it's a good reference for best practice principles.
Department of Planning and Environment: A Liveability Framework for Sydney	The Framework identifies the most important considerations for achieving liveability improvements and suggests example ways to achieve these outcomes	Complementing the Western Parkland City and WSA visions, While not binding it's a good reference for best practice principles to achieving improved liveability within Greater Sydney.
Department of Planning and Environment: Everyone Can Play	Best practice guidelines to create world-class, safe and inclusive play spaces for all people of all ages.	Complementing the Western Parkland City and Wianamatta-South Creek Corridor vision. While not binding it's a good reference for best practice principles.
Premier's Priorities: 11 - Greener Public Spaces and 12 - Greening our City	The priorities represent the State Government's focus areas and commitment to delivering well connected communities with quality local environments.	The AWRC has the potential to assist the government in achieving state government's priority in greening public spaces, making open green spaces more accessible and contributing to the target of planting 1
Net Zero Plan 2030 and NSW Climate Change Policy Framework	Outlines the State Government's long-term objectives and plan to achieve net-zero emissions by 2050 increasing the State's resilience to a changing climate.	The AWRC has the potential to assist the government in achieving state government's climate and energy goals outlined in the above plans and frameworks

2.3 Local Context

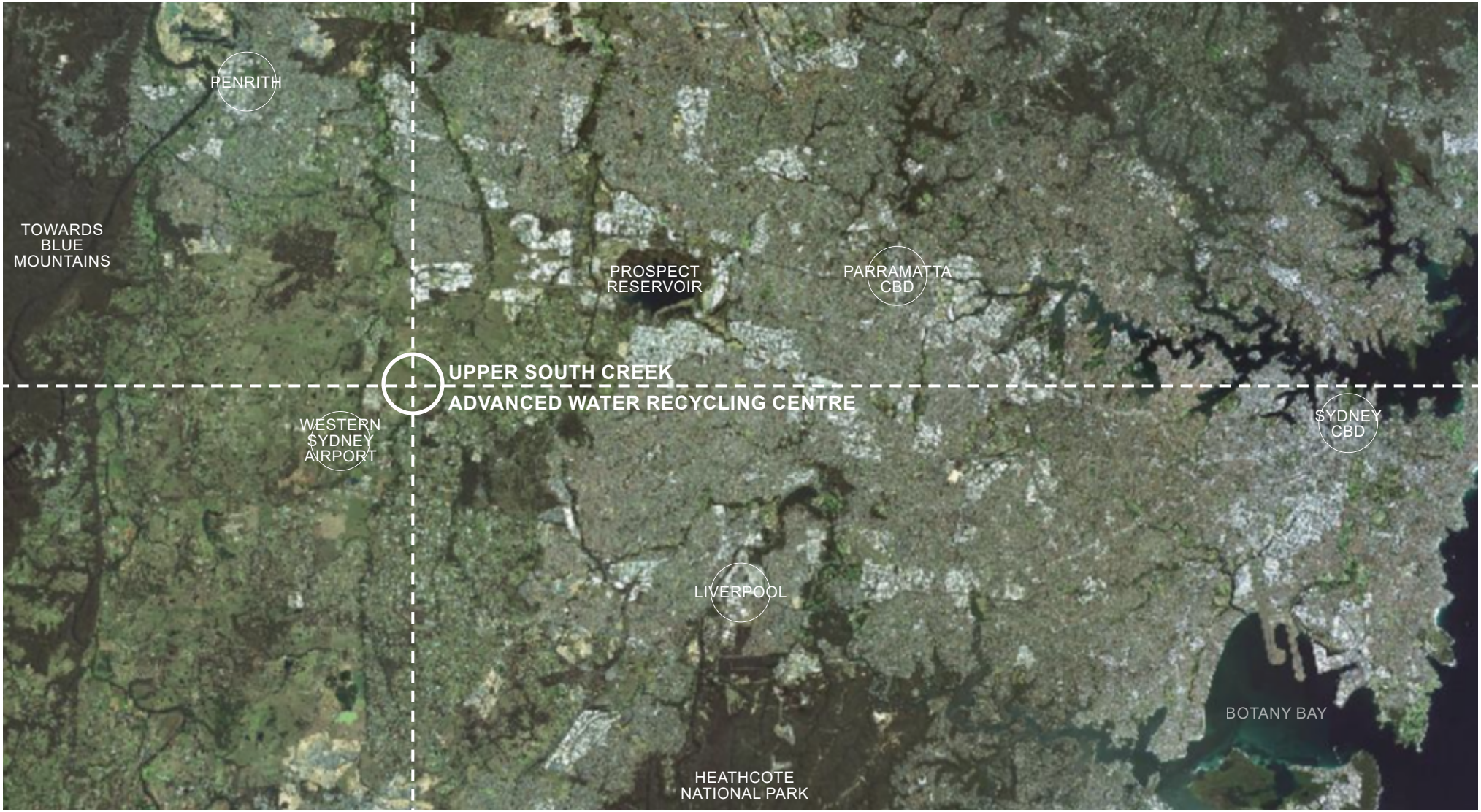


Figure 8 Context Map adapted from sixmaps.com.au

Location

The proposed site is located in Greater Sydney's peri-urban region between the Blue Mountains and the Sydney CBD, approximately 30 km south-west of Parramatta CBD within the future Western Parkland City.

Strategically positioned six kilometres north-east of the future Western Sydney Airport ,under the flight path, the proposed site forms part of the Western Sydney Aerotropolis - the future international gateway to Sydney in the west.

Sitting on the confluence of Wianamatta-South Creek and Kemps Creek, the proposed site forms a part of the Hawkesbury-Nepean catchment within the Cumberland Plain Bioregion.

Wianamatta-South Creek accounts for around 80% of the Western Parkland City's catchment, running through some of the flattest, driest and hottest parts of greater Sydney.

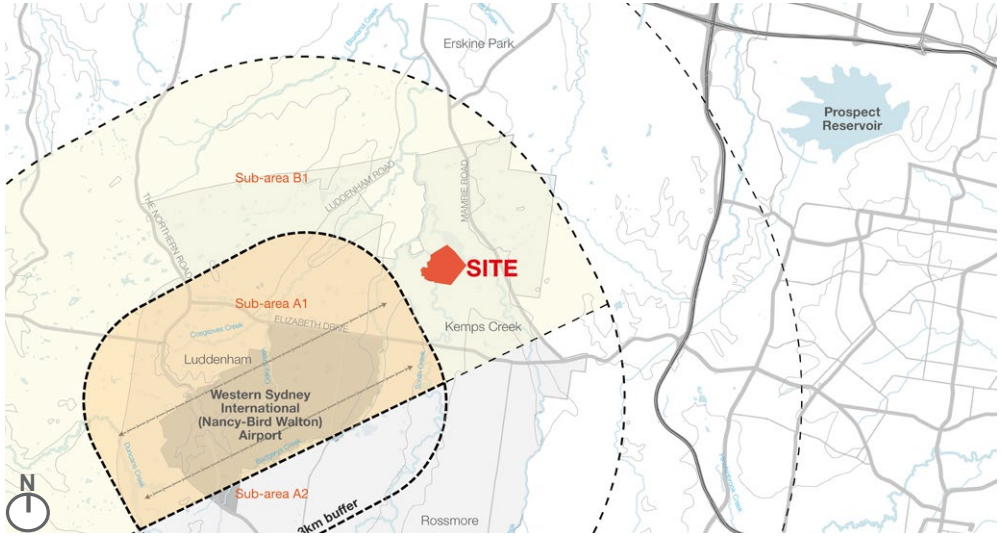


Figure 9 Context Plan

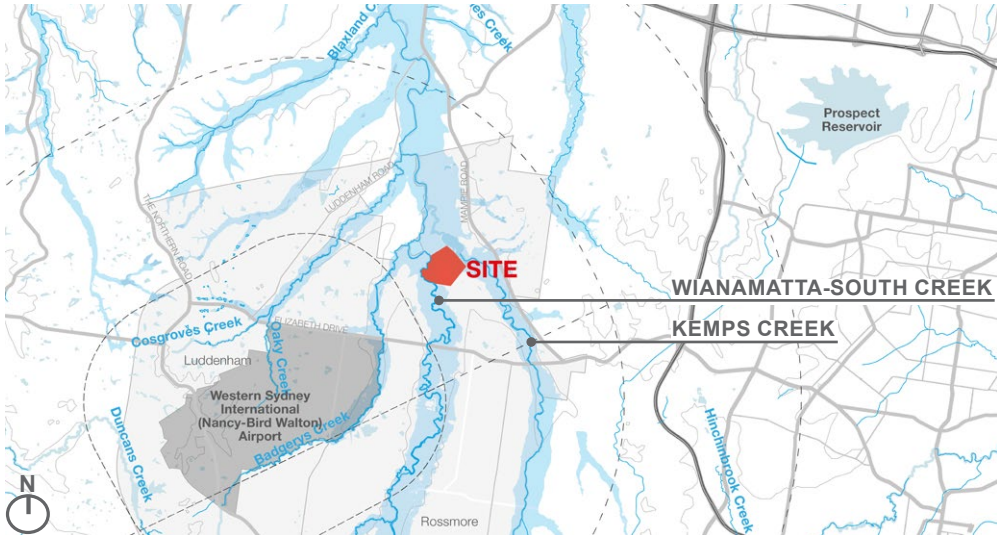


Figure 10 Hydrology Plan

2.3 Local Context

2.3.1 Land and Development Context

Vegetation Pattern

The Cumberland Plain is composed of relatively flat lying terrain. Changes in land use over time have resulted in extensive fragmentation of remnant grassy woodland communities.

Many of the Cumberland Plain native woodlands are classified as critically endangered. Conservation areas run along all riparian corridors including Wianamatta-South Creek and Kemps Creek.

Movement

The proposed M12 motorway, will connect the Western Sydney Airport into Sydney's wider road network. It is planned to run adjacent to the southern boundary of the site.

Vehicular access to the site is currently via an access track off Clifton Avenue east of the site. Clifton Avenue will be re-aligned as part of the new M12. The existing access track to AWRC will remain in the same location and upgraded to a paved road.

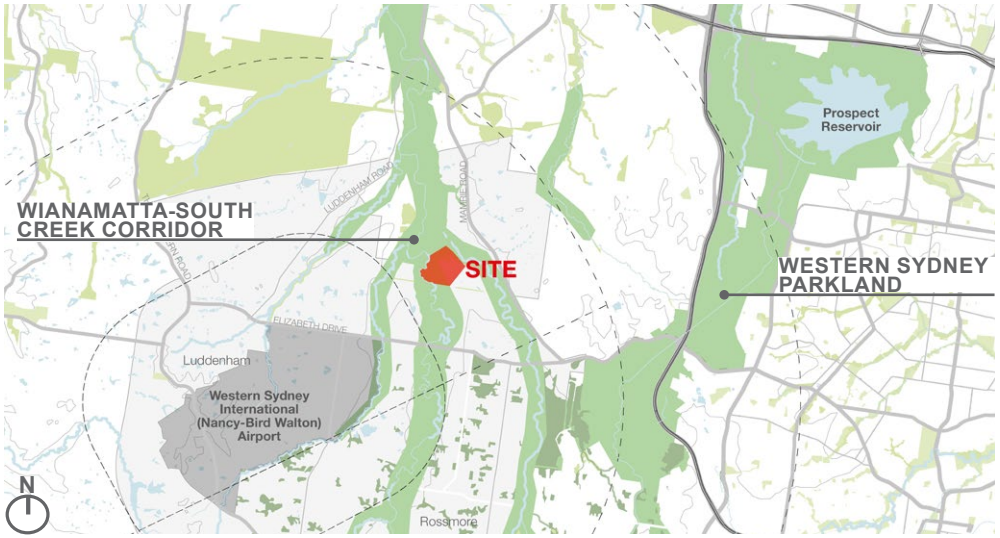


Figure 11 \Vegetation Pattern Plan

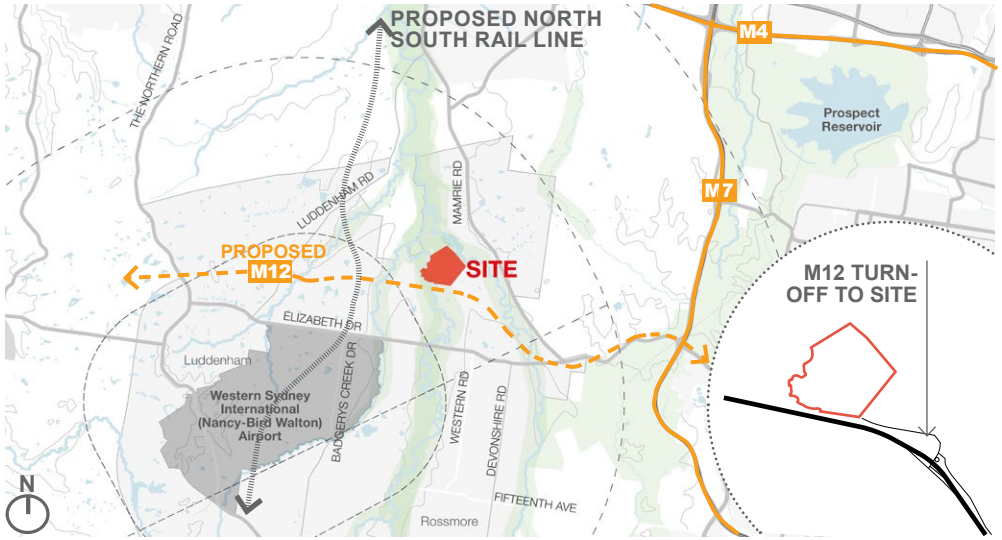


Figure 12 Movement Plan

Land Use and Development

There are currently a small proportion of residential and rural properties in proximity to the site.

Adjacent the proposed site are several planned Aerotropolis precincts:

+ Mamre Road - light industrial and logistics,
+ Kemps Creek - to be planned,
+ Badgerys Creek - technology and advanced manufacturing and industry and,
+ Northern Gateway - employment

View Corridors

The site is located at a low elevation consistent with the natural depression of the creek alignments, making it visible; to adjacent residential sites; along the riparian and future recreation corridor along Wianamatta-South Creek and; the future M12 Motorway.

The site is located directly under the flight path with key aerial views to/ from the future Western Sydney Airport.

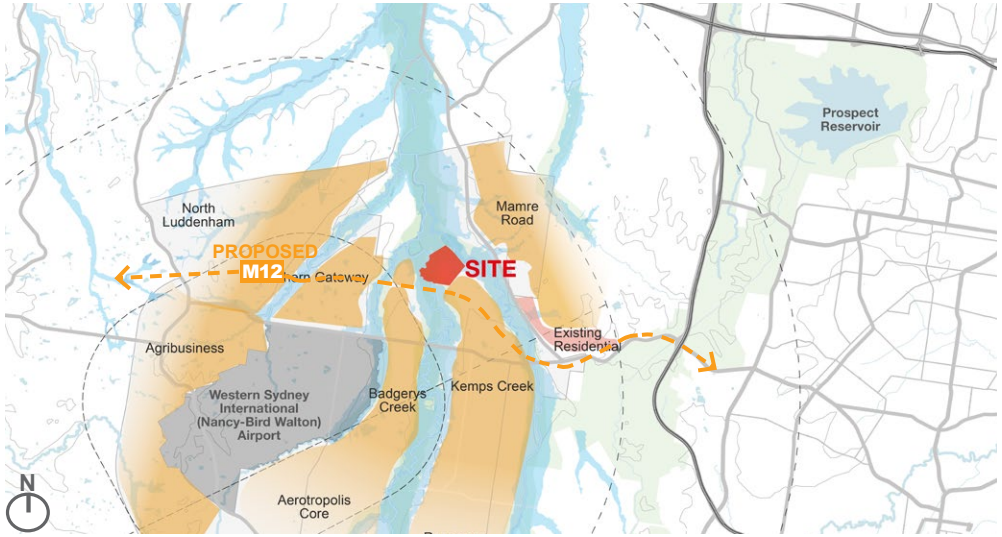


Figure 13 Land Use and Development Plan

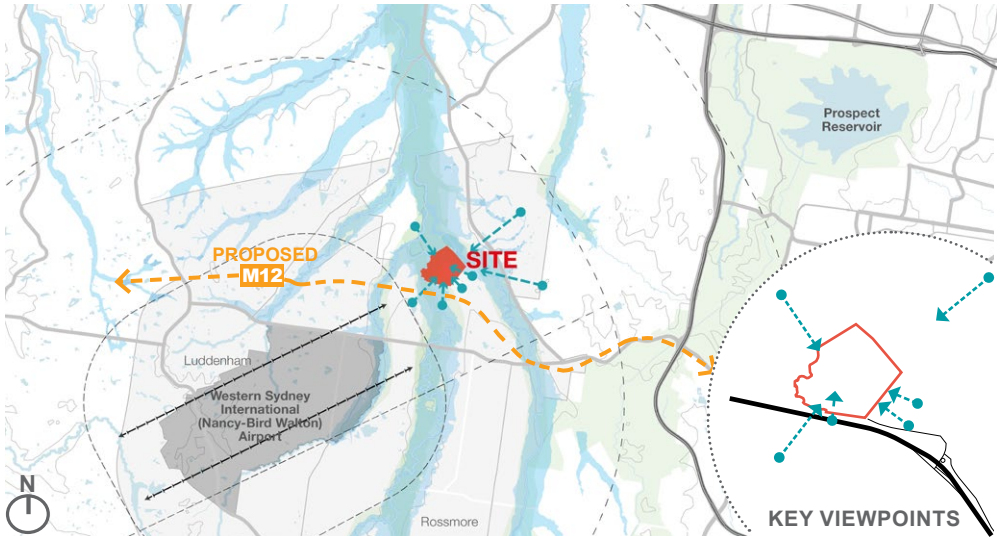


Figure 14 View Corridors Plan

2.3 Local Context

2.3.2 Historical Context

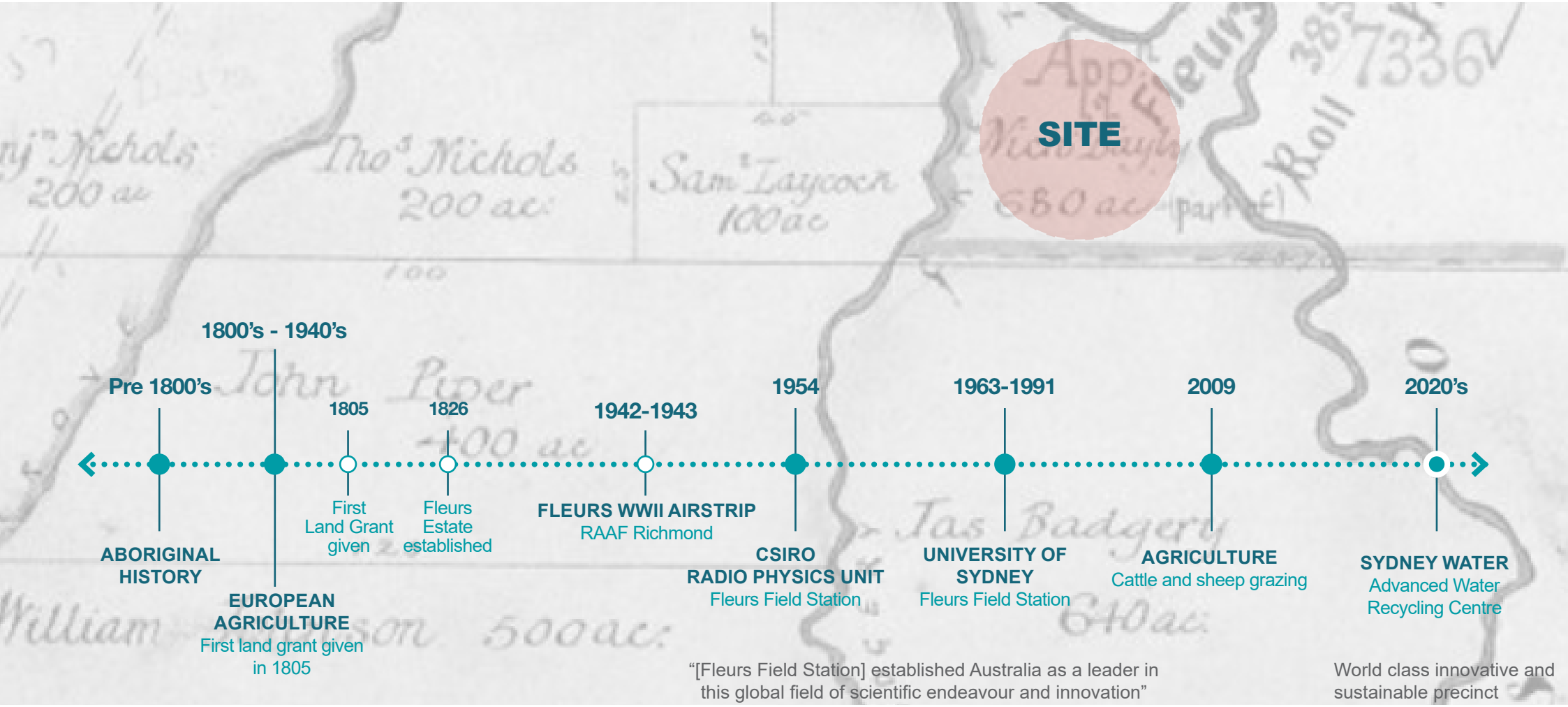


Figure 15 Historical Time Line - Land Use of Site and Adjacent Lands (Image Adapted from: LPI Historical Lands Viewer 140700)

Aboriginal Heritage

Wianamatta-South Creek, known as Wianamatta or 'the Mother Place' to the Aboriginal Peoples of the local Dharug language, holds special significance in a wider rich cultural landscape that extends from the Blue Mountains through Emu Plains and eastward to the coastline.

Generally, water resources have always held important cultural, spiritual and practical values for Aboriginal Peoples. Waterways are used for cultural practices including knowledge transfers and have always been a vital source of water and food.

As part of the wider project, Sydney Water undertook an initial consultation process with the local Aboriginal community where the area was identified as holding significant cultural heritage value to the local Darug community due to evidence of continued occupation with a complex of significant sites within close proximity to the project area.

Some of the Aboriginal cultural heritage values expressed by stakeholders include:

+ strong association with the land
+ responsibility to look after the land, including the heritage sites, plants and animals, rivers, creeks and the land itself
+ scarred trees
+ artefact sites and landscape features
+ waterways, particularly the Nepean River, Georges River, Wianamatta-South Creek and tributaries
+ indigenous plants and animals
+ general concern for burials, as their locations are not always known and they can be found anywhere.

However, no specific location within or around the AWRC site has been identified as holding significant historic, social or aesthetic values.

The AWRC site (Fleurs Radio Telescope site) has moderate scientific value offering the potential to yield information that will contribute to the growing holistic understanding of the Aboriginal cultural landscape of the south western Cumberland Plain.

An archaeological test excavation was undertaken in 2018 at the site within an assessment corridor for the proposed M12 Motorway. A total of 333 artefacts were recovered with the subsurface deposit characterised by a general low to moderate artefact density with a localised moderate density in the east and a localised moderate to high density in the west.

There is potential for the discovery of more indigenous artefacts during construction of the centre. In consultation with the Aboriginal community ways to integrate and celebrate these discoveries should be considered.

'these plains are watered by chains of small ponds, generally not more than half a mile apart... There are several kinds of grass, the principal of which is a species of wild oat, which grows in great luxuriance, and in fields of several acres in extent. Kangaroos, Emus, and Wild Ducks, are in great abundance, and in all respects'

(Sydney Gazette 1803 cited in Currey 1966: 100)

2.3 Local Context

2.3.2 Historical Context

European Heritage

The Kemps Creek region was first inhabited by Europeans in the early years of the 19th Century. The first grant for land in the area (which included the AWRC site) was awarded to Nicholas Bayly in 1805. Bayly played a key role in the coup against Governor Bligh and was banned by Governor Macquarie from the public office. Bayly's 1814 home still exists (greatly modified) at 919 Mamre Road.

In 1826 Bayly's estate was sold to Richard Jones who gave the name to Fleurs Estate, a legacy still carried till today. Over the next 100 years the estate was sub-divided and sold many times over. Uses included workshops, barns, huts, sheds, housing for labourers and gardeners as well as dairy and cattle farming.

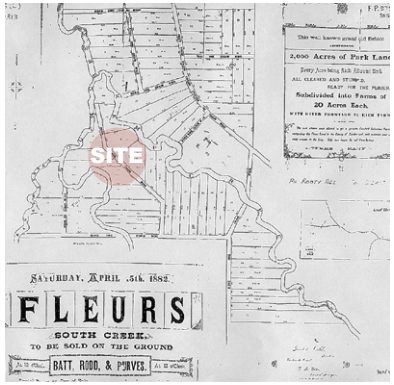


Figure 16 1882 Subdivision plan of Fleurs. (Source: LPI Plan 350)

Figure 17 1895 Sales poster for Fleurs Estate subdivision (Source: NLA MAP LFSP 2502, Folder 154))

CSIRO + University of Sydney Radio-Astronomy Field Station

In 1954 Fleurs Field Station (AWRC site) was established by the CSIRO (Council for Scientific and Industrial Research) Radiophysics Unit. Here three telescope arrays in cross configurations were invented:

- Mills Cross (Bernard Mills 1949);
- Shain Cross (Alex Shain 1958)
- Chris Cross (William Christiansen 1963)

The Mills Cross, Shain Cross and Chris Cross were the most powerful telescopes at the time. These inventions enabled data collection and exploration of the galaxy and beyond. The Chris Cross was composed of 64 parabolic dish antennae and at the time when it was built, it was the only telescope that could see close details of celestial objects and was used to map the sun.

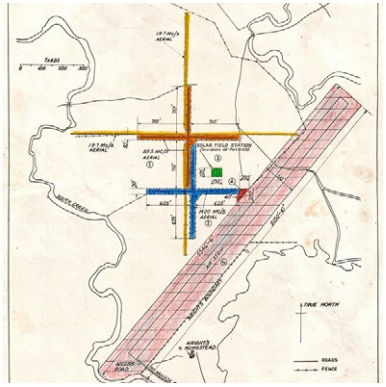


Figure 18 (Source: Journal of Astronomical History and Heritage Figure No 10)

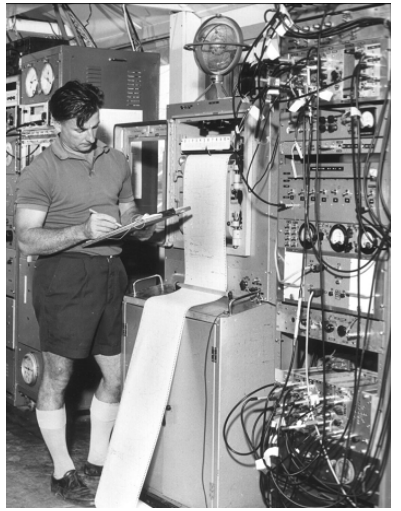


Figure 19 View inside the central receiver hut (Source: Journal of Astronomical History and Heritage Figure 18)

During World War II a small air field (now referred to as Fleurs aerodrome) was constructed south-east of the site. Designed for three runways, only two were constructed and used by the RAAF at Richmond.

In 1963 the University of Sydney bought Fleurs Field Station and continued with radio astronomy research on the site.

The telescope array configuration can still be seen today in aerial imagery. Remnant infrastructure of the field station, including two parabolic antennas and several huts and buildings are scattered across the site. This presents a great opportunity to celebrate the historic inventions created on site. Heritage interpretation could be achieved through design, programming and the retention and re-use of materials where feasible. Photographic archival recording of the site prior to construction works should be undertaken to ensure a final detailed recording of the site.

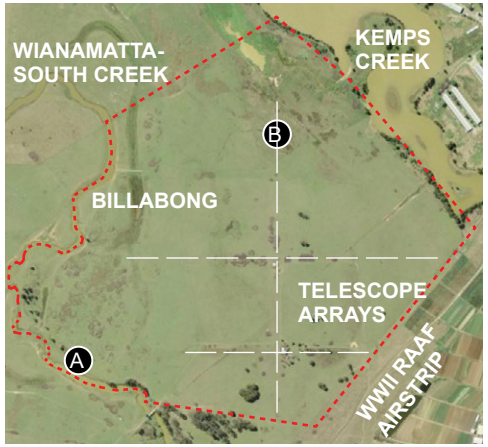


Figure 20 Map of redio-astronomy infrastructure remnants on site (Source: sixmaps.com.au)

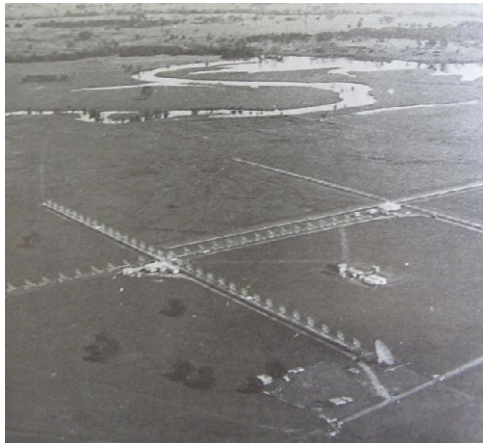


Figure 21 View of the arrays and South Creek (Source: 43046 G3/13 Uni. of Sydney Archives)

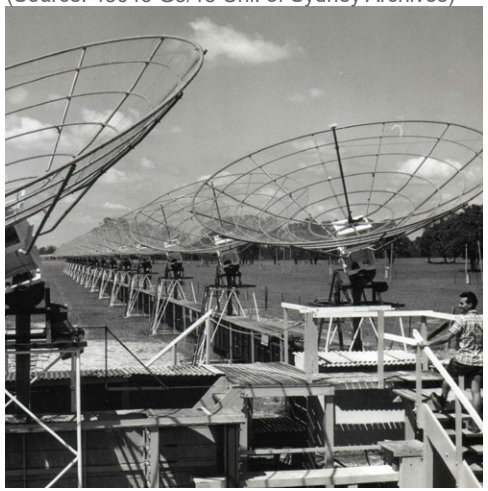
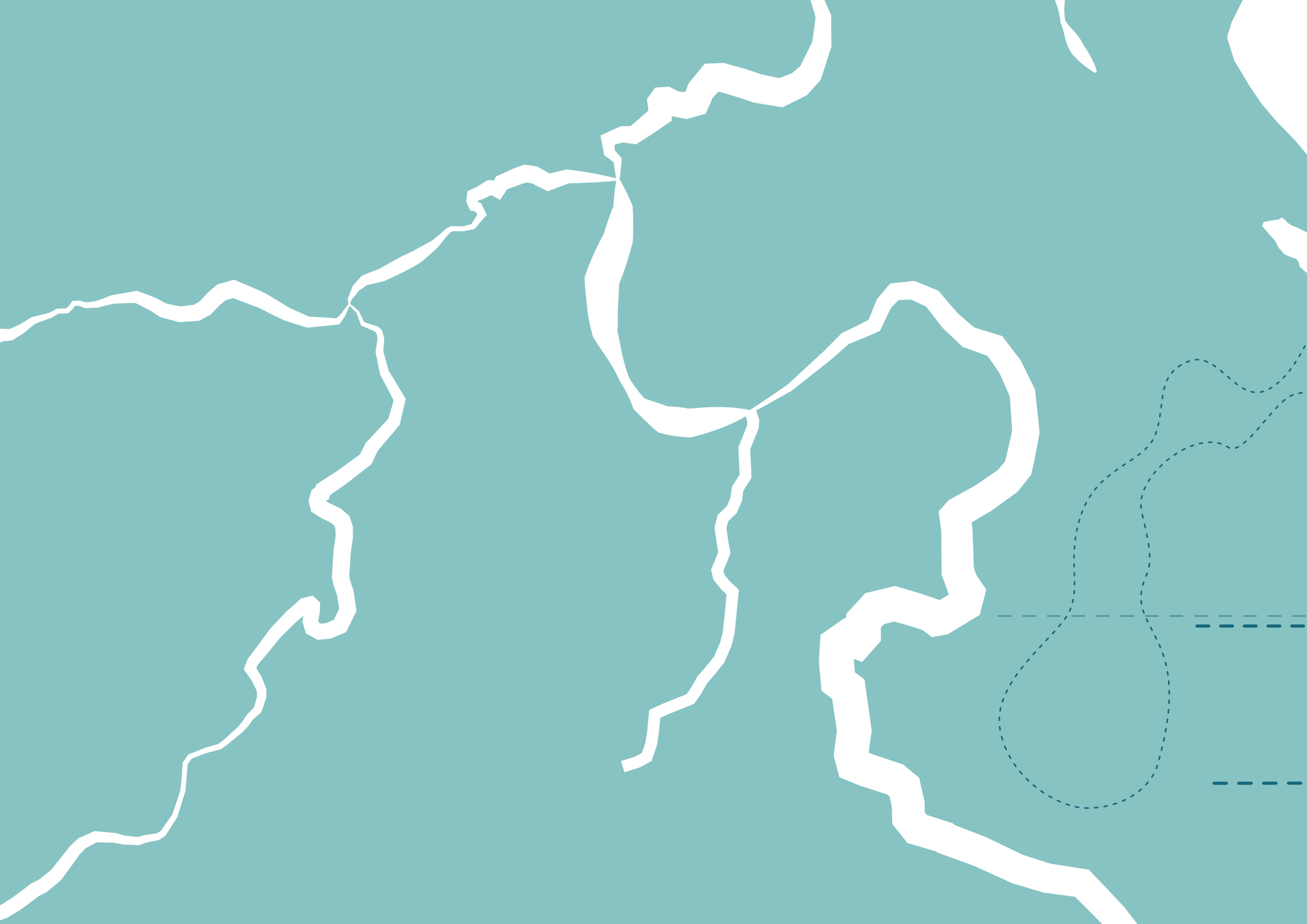


Figure 22 Southern part of the Chris Cross N-S arm (Source: ATNF Historic Photographic Archive: 9097-12 cited on CSIRO.com.au)

The Fleurs Field Station established Australia as a global leader in the field. The research and innovative technology developed during this period was adopted across the world.



3. Vision and Objectives

Figure 23 Existing view looking north-east towards the proposed facility (Aurecon Arup)

3.1 Urban Design Principles

The following five urban design principles have been created to underpin this landscape led masterplan and to ensure that it meets the needs and ambition of the wider project vision.

Safe and sustainable water treatment that addresses the ever increasing issue of water security and drive awareness and education in water management.

+ Future proof expansion and ensure adaptability in design for alternative futures, a range of demand scenarios and meeting the changing needs of the future

Generation of clean water and the potential to deliver fertilizer and energy through solar and heat capture (fuel from biosolids).

+ Maximise opportunities in implementing circular economy approaches.
+ Maximise recovery of nutrients from wastewater.
+ Maximise ecosystem services opportunities
+ Minimise waste and maximise reuse.
+ Minimise energy use and maximise energy recovery.
+ Maximise opportunities for stormwater harvesting stormwater run off.

Showcase innovation and leadership in sustainable water management, energy capture, waste reduction and environmental management.

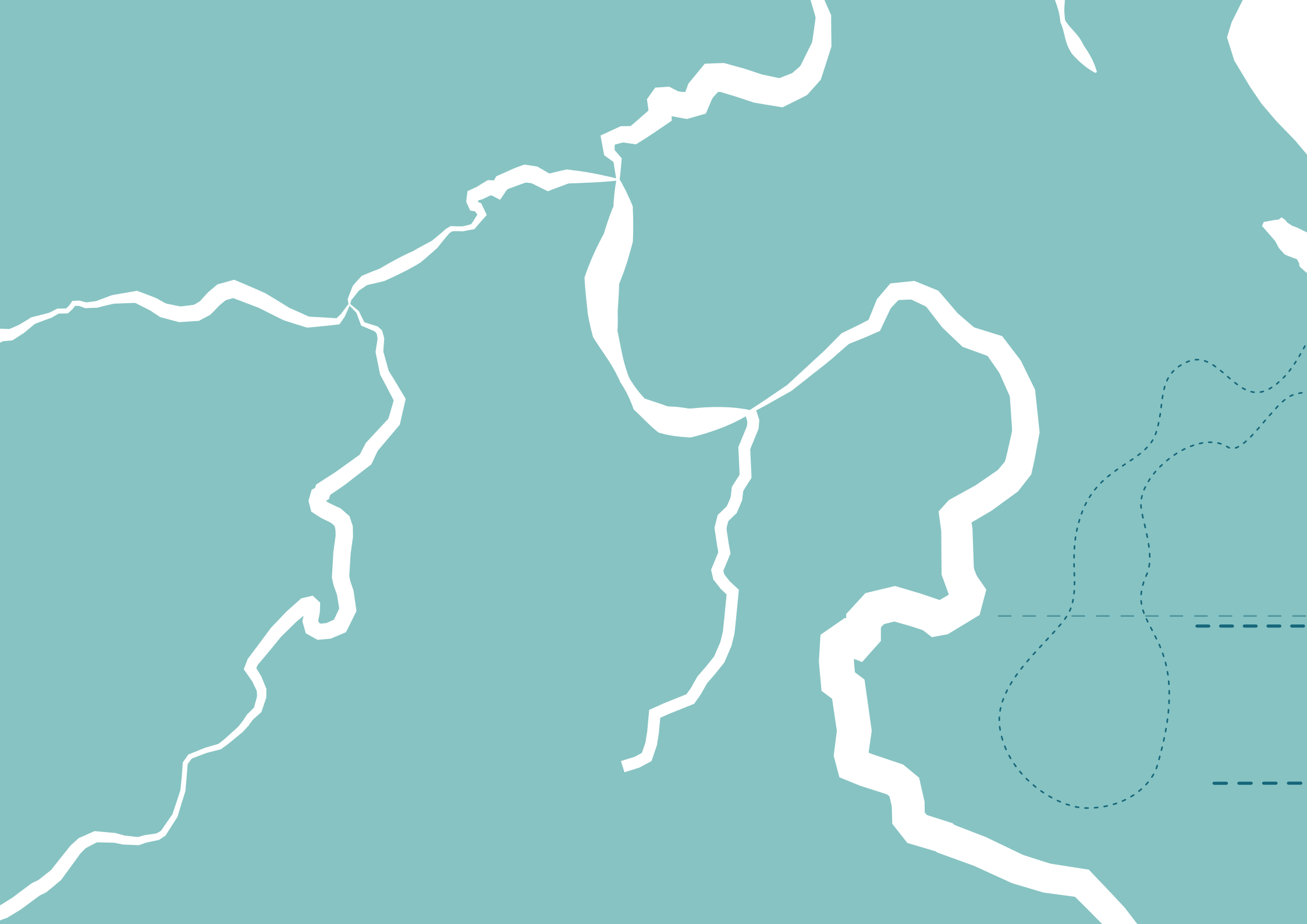
+ Minimise off-site impacts of effluent discharge.
+ Restore and protect waterway health and amenity values; the natural landscape; and biodiversity.
+ Minimise impact of built form and hard surfaces.
+ Demonstrate an integrated functional and landscape-led design across the site, aligning to the WSAP and Western Parkland vision.
+ Maximise integration of water in the landscape to mitigate urban heating in Western Sydney.

Continue to contribute to the rich cultural and environmental context of the site; playing an important role in providing for a thriving and liveable future of Western Sydney.

+ Maximise opportunities for partnership with local community and businesses, including indigenous communities.
+ Provide quality amenity that contribute to creating green and vibrant places for workers, visitors and the wider community.

A unique opportunity to positively integrate with the natural environment and urban fabric of the Western Parkland City.

+ Built form responds to the contextual landscape and future urban character.
+ Design accommodates the functional properties of the water recycling centre.
+ Address aerial views experienced by passengers departing and arriving at the new airport.
+ Minimise negative environmental impacts.
+ Embody the urban design principles of all surrounding district and precinct plans.



4.
Functional + Spatial Requirements

4.1 Functional Design

Introduction

The spatial and functional design summarised in this chapter provides the context to the development of the concept landscape masterplan. It establishes the parameters and considerations required in the design response. This section of the report should be read in conjunction with the detailed consultant reports developed for the project.

Context

The development of AWRC is driven by the need to provide advanced treatment of wastewater to support the growing population in the WSAGA and SWGA. Significant residential and economic growth is expected in this area over the next 35 years, driven by:

+ opening of the Western Sydney Airport by 2025
+ government and private sector investment in the WSAGA
+ state, commonwealth and local government investment in infrastructure, including major new road and rail assets, social infrastructure and utilities
+ release of new land areas, particularly for additional housing
+ support for the establishment of industrial, manufacturing, agribusiness, commercial and other businesses that will create a large number of high value jobs.

Sydney Water has used DPIE's population growth projections for the WSAGA and SWGA to estimate wastewater generated in the Upper South Creek servicing area and the proposed size and staging of the project. DPIE population growth projections consider the range of factors that affect population growth, including travel zone analysis.

Engineering Masterplan

The AWRC Engineering Masterplan comprises two separate stages of works; 'AWRC Masterplan' (50ML/d to 2034), and 'Future Stage' (100ML/d to 2056).

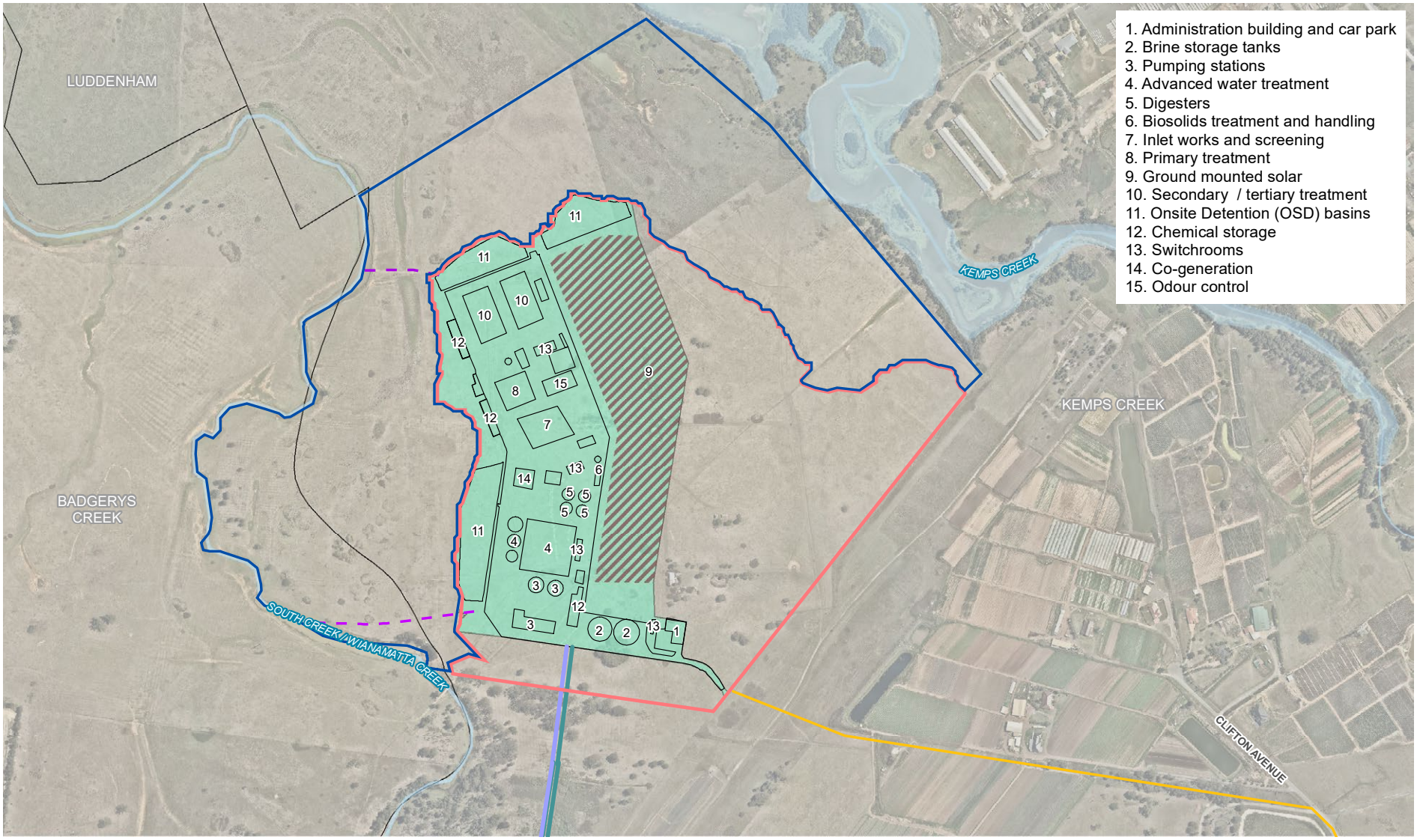
Development of the concept masterplan and associated technical studies has only been undertaken for the first stage - AWRC Masterplan.

Information presented for the Future Stage works (site layout, expected electrical demand, etc.) is notionally a duplication of the masterplan facilities, to ensure that the land and infrastructure can accommodate future expansion requirements.

The engineering masterplan is an indicative plan that demonstrates an efficient layout that includes the following key elements:

1. Advanced Water Recycling Centre – for treatment of the wastewater prior to reuse applications or discharge, which includes liquids treatment, advanced water treatment, solids treatment, odour treatment, and residuals management
2. Effluent Management – for delivery of the produced treated effluent, either to reuse customers, or for creek discharge, which includes transfer mains and discharge connections to Nepean/ Warragamba Rivers
3. Brine Management – for the transfer of reverse osmosis (RO) by-product to the Malabar wastewater system
4. Wet weather discharge to South Creek.

Please refer to the *AWRC Masterplan Design Report* for details.



Source: Aurecon, Sydney Water, LPI, Nearmap, ESRI
Projection: GDA2020 MGA Zone 56

Figure 24 Upper South Creek AWRC Engineering Masterplan - Indicative Layout Stage 1

4.1 Functional Design

Bushfire Protection Measures

The AWRC site is located within bushfire prone land on the *Penrith City Council's Bushfire Prone Land Map,* containing Category Two Vegetation. Proposed development should therefore comply with the aims and objectives of the NSW Rural Fire Service's *Planning for Bush Fire Protection 2019 (PBP) and Australian Standard 3959.*

In accordance with the PBP a ten metre minimum Asset Protection Zone (APZ) is required around the perimeter of the centre footprint.

The APZ will include a grass surface and four metre wide service road/ access trail and an Inner Protection Zone with landscaping that can contain the following features:

- Trees are preferred to be of the smooth back type.
- Trees to have a maximum of five metre crown width.
- There can be no interconnecting tree crowns (a separation of two to five metres is required at maturity).
- Tree crowns cannot overhang any building.
- Low level shrubs can be provided in clumps only (two to three metres in area and separated by two to three metres).
- Low level hedges can be provided they are no more than 1.8 - 2.0m in height ant not located within six metres of any building. Access passages must be provided a six metre intervals.
- Grasses can be no higher than 100mm across any part of the APZ
- Four metre vertical clearance over internal roads and access trails.

Where there are deviations from the above recommendations a Bushfire Risk Management Plan should be produced to address alternate risk reduction strategies and mitigation plans to achieve the aims and objectives of the PBP.

Please refer to the *Bushfire Constraints and Opportunities Report* for details.

Air Quality and Odour

The potential air quality and odour impacts caused by the AWRC operating at 50ML/d have been assessed against the EPA odour assessment criteria.

The criterion of 2 OU at the 99th percentile is considered to be acceptable for the whole population. AWRC's 2 OU extent is predominantly contatined within the site boundary as demonstrated in Figure 25. Many of the key odour generating sources will be ducted to the proposed odour control facility, treated and exhausted via a stack.

While the site is not planned to be accessible to the public, spaces that could facilitate prolonged times of occupation should be located below the 2 OU contour extent.

Please refer to the *Air Quality Impact Assessment* for further details.

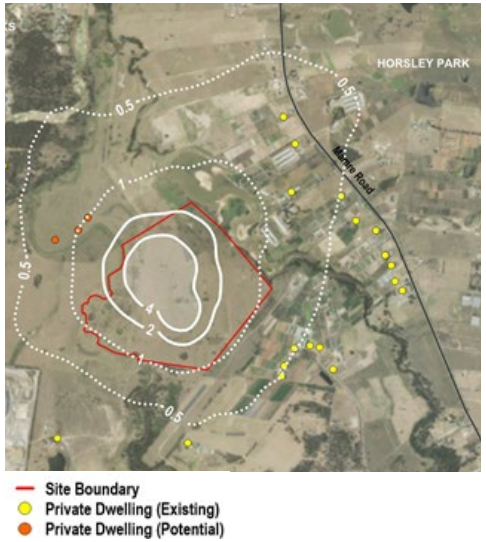


Figure 25 Predicted odour levels at the 99th percentile due to the AWRC 50ML/d (image taken from the Air Quality Impact Assessment Report)

Acoustics

The primary operational noise sources associated with the AWRC with the potential to impact on surrounding receivers are:

Plant and equipment:

- Blower building
- Outloading building
- Advanced water treatment plant (AWTP) building
- Transfer Pump Station
- Various pumps
- Co-gen and associated equipment
- Odour control fans

Noise mitigation measures to be considered through architectural treatment could include:

- installation of acoustic louvres with a higher performance rating on the transfer pump station exhaust fan outlet and/or installation of internal lining and/or attenuators along the exhaust fan ductwork
- upgrade to the construction of the building envelopes, including cladding and over-cladding

Further assessment of building envelope acoustic requirements to be conducted during detail design.

Please refer to the *Noise and Vibration Impact Assessment* for further details.

4.2 Wildlife Strike Mitigation Design Guidelines

The Western Sydney Planning Partnership has developed a set of landscape wildlife strike mitigation guidelines for development within a 13 km radius of the future WSA.

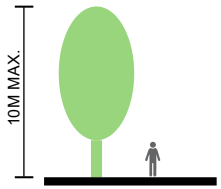
The main factors determining the consequences of a strike are the number and size of animals struck, the combined closing speed at which the strike occurred, the phase of flight when struck and the part of the aircraft hit. Generally, the larger the animal, the greater the damage.

These design and management initiatives aim to discourage the attraction of bird life to ensure the safety of aircraft and passengers whilst embodying the vision of a 'city in landscape.'

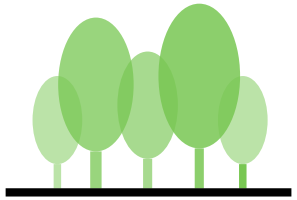
The proposed AWRC is within an eight kilometre radius of the airport and the following design guidelines are recommended in this zone.

Please refer to the *Wildlife Hazard Assessment* for details.

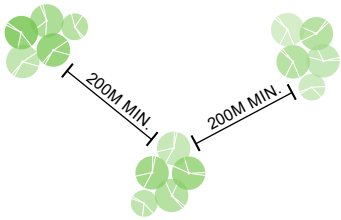
Planting Design Guidelines



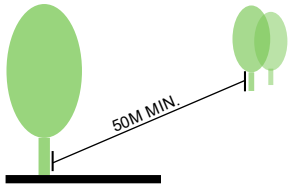
1. Mature tree height maximum 10m high



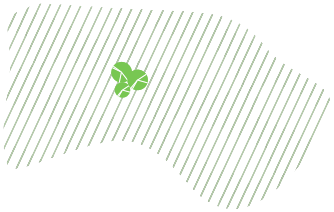
2. Maximum of five trees in one group



3. Minimum 100m interval between tree groups, average interval not less than 200m

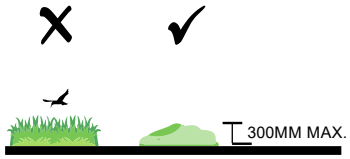


4. Single trees to be planted >50m to any other single tree or tree groups

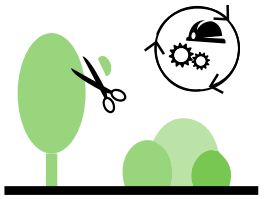


5. Maximum five percent (5%) tree planting within shrub planting areas

6. Mature shrub height maximum 5m high



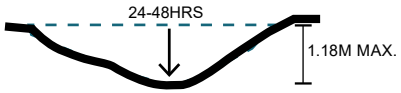
7. Low prostrate ground cover, maximum 300mm high, in place of grass



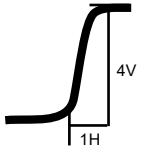
8. Regular maintenance of shrubs and trees

Water Storage and Drainage Guidelines

9. Water surface area of retention basins maximum 100m²



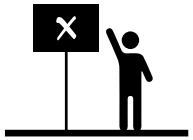
10. Retention basins should fully drain within 24-48 hours.



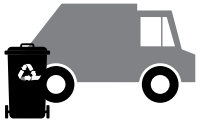
11. 4V:1H maximum retention basin bank slopes

12. Swale grass maintained between maximum 200-400m in height

Operations and Management Guidelines



13. Signage and penalties to discourage feeding wildlife



14. Waste collection at a suitable frequency

Planting Selection

The Western Sydney Wildlife Management Assessment Report provides guidelines for planting species to minimise the attraction of birds and flying foxes within the Aerotropolis.

Trees and shrubs planted in the area should not bear edible berries, fruits, seeds, nuts, nectar or bear flowers profusely. Such vegetations attract flying foxes and birds such as lorrikeets. Where high attracting trees and shrubs already exist in the landscape, it is recommended they are replaced with more suitable species.

Plants that attract insects may also pose a risk in attracting small numbers of birds.

Continual monitoring and maintenance of vegetated landscape should be undertaken to minimise birdstrikes and ensuresafe airport operations.

Recommended planting species in the assessment report include:

Dillwynia tenuifolia

Fraxinus 'Raywoodii'

Juncus usitatus

Carex appressa

Wianamatta-South Creek

4.3 Ecology and Environment

Protected Flora and Fauna

Aligned with *The Cumberland Plain Recovery Plan* (NSW DECCW 2011) the landscape masterplan prioritises ecological restoration along the creek corridors.

Considered planting of native species assist in maintaining waterway health and provide critical habitat that will contribute to the long-term survival and protection of seven threatened species, four endangered populations and nine threatened ecological communities that are found only in the Cumberland Plain bioregion.

The landscape and ecology strategy presented within this report seeks to realise the conservation objectives of The Cumberland Plain Recovery Plan and Conservation Plan, whilst also mitigating the risk of bird strike in key locations.

Eastern Dwarf Tree Frog

Cumberland Plain Land Snail

Freckled Duck

Sydney Water Environment Strategy

In 2018 Sydney Water's *Environment Strategy 2030* was released. The strategy reflects Sydney Water's ambition to strengthen their environmental stewardship; going beyond just providing water services but playing a pivotal role in enhancing community and cultural values, being leaders in innovation and collaboration, protecting and restoring natural environments and driving towards net-zero emissions.

The AWRC presents the unique opportunity to holistically embody the values and ambition of Sydney Water as well as the wider region; a showcase in the integration of true innovation and the community and cultural values of Western City District.

The four objectives of Sydney Water's Environmental Strategy are:

1. Healthy Waterways & Clean Beaches

We'll contribute to healthy waterways and clean beaches in delivering our services to safeguard ecosystems that our communities can continue to enjoy

2. Create Resilient & Liveable Places

We'll increase our resilience to a changing climate, connect with customers and use water in landscape to shape liveable places

3. Care for Nature, Land & Heritage

We'll protect and restore valuable biodiversity and share the natural spaces, land and heritage in our care with the community

4. Efficient & Sustainable Resource Use

We'll use our resources wisely, work with the customers to save water and increase our recovery of energy towards net-zero emissions

4.4 Water Sensitive Urban Design

Integrated water sensitive urban design (WSUD) strategies contribute to the site's stormwater management relative to the surface water management with the aim to minimise hydrologic impacts and improve water quality.

The mean annual runoff volume (MARV) is used to describe the total volume of runoff along a waterway reach. It is a useful indicator of hydrologic change as it represents the shear quantum of change in catchment runoff volumes.

The following table outlines the variety of WSUD strategies that have been adopted within the landscape-led masterplan to provide a balanced set of benefits as well as cost effective MARV reductions. The table also identifies the associated wildlife attraction risks and methods of mitigation.

Table 2: Water Sensitive Urban Design

WSUD MEASURE	RISK	MITIGATION MEASURE
Detention basin and biofiltration	Detention basins can attract significant numbers of wildlife	• Detention areas will hold water temporarily and fully drain within 24-48 hours • Biofiltration basins will contain 300mm to 600mm high vegetation
Biofiltration street trees	Offer feeding, sheltering, roosting, and nesting opportunities Shrubs and trees that produce nectar, berries, fruit or seeds will attract birds and flying foxes.	• Will hold water on the surface temporarily and fully drain within 24-48 hours • Maximum mature height of any tree: 10m • No more than 5 trees planted in any one group • Minimum interval between tree groups is ideally 12.5m to achieve stormwater management. Low shrubs should be substituted where this cannot be achieved. • Trees may be staggered at a spacing of 25m between any other street tree groups
Wetlands	Artificial wetlands can attract significant numbers of wildlife	• Water depth between 0.5m and 1.18m is less likely to attract hazardous flocking bird such as pelicans, swans, and cormorants; or upending ducks such as Pacific Black Ducks; or wading birds such as ibis and egrets • Wetland would be in the floodplain adjacent to existing water bodies and farm dams in the riparian corridor • Bank slopes approaching the wetland should not exceed 4V:1H. • Vertical sandstone blocks will form the wetland edge to a depth of 0.5m in permanent water • Total water surface area is 5,000m²
Irrigated lands and grassed lined basins	-	• Stormwater and recycled water will be applied to landscape areas • Bank slopes for landscape zones, earthworks, detention areas and stormwater drains will not exceed 4V:1H to facilitate mowing • Dense zones of native sedges and grasses will be provided within steeper swale channel.
Discharge channels	-	• Grassed bank slopes in stormwater drains will not exceed 4V:1H to facilitate mowing • Dense zones of native sedges and grasses will be provided within steeper channels
Impervious surface area (57%)	-	-

4.5 Sustainability

The AWRC Masterplan aims to not only achieve compliance but to exceed and go beyond with innovative design initiatives that provide long lasting, positive environmental, social and economic outcomes in the medium to long term.

For the centre, sustainability means designing, developing, operating and maintaining an asset which adapts to future fluctuations in demand, climate variability and resource scarcity, whilst also maintaining operations and functionality within a minimised environmental footprint. The landscape-led masterplan has reflected these principals throughout the masterplan with particular consideration for water quality, anthropogenic and natural heritage and infrastructure that reflects its' community.

Some of these initiatives include:

+ flexibility and resilience - the masterplan has been developed based on a set of principles which enables flexibility in the design and delivery of the site to respond to changes in demand, technology and context.
+ future proofing - the masterplan has been designed to facilitate future expansion to cater for increased demand. This includes the design of the administration building to cater for increase in staff and/or operations.
+ engineered wetlands - controlled water capture and release to maintain quality of the creeks, downstream estuaries and wildlife hazard mitigation.
+ environment - considered planting of local native species with a focus on restoration and habitat creation along the riparian corridor.

Infrastructure Sustainability Council of Australia

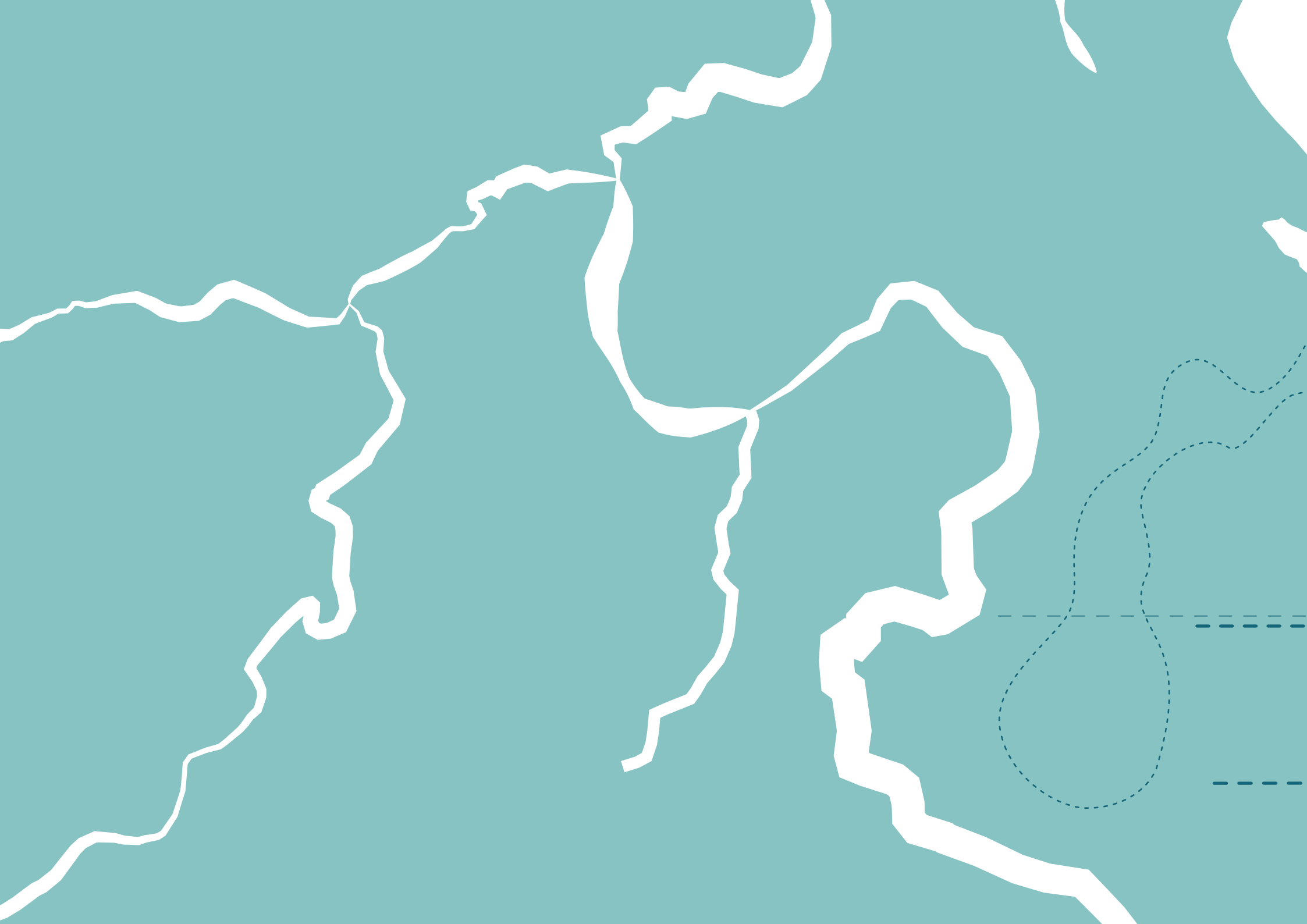
To integrate sustainability throughout the Project, the centre has been designed to align with an Ecological Sustainable Development (ESD) rating system. The IS Rating Tool was developed by Infrastructure Sustainability Council of Australia (ISCA) in collaboration with the industry, to drive and measure sustainability within infrastructure projects and assets.

The IS rating tool evaluates sustainability performance across the quadruple bottom line (Governance, Economic, Environmental and Social) during planning, design, construction and operational phases of infrastructure. Sydney Water will seek an 'Excellent' Design and As-Built rating from ISCA for the centre.

Initiatives detailed within the landscape-led masterplan that will meet credits for AWRC's ISCA rating have been identified throughout this report using the following icons:

ISCA Credit Categories:

- CLI Climate change adaptation
- ENE Energy and carbon
- MAT Materials
- WAT Water
- DIS Discharge to air, land and water
- LAN Land
- WAS Waste
- ECO Ecology
- HER Heritage
- STA Stakeholder participation
- URB Urban and land design
- INN Innovation



5.
Concept Design

5.1 Introduction

The AWRC goes beyond business as usual and offers a parkland setting with habitat creation, the application of architectural treatments for visual screening and recreational opportunities alongside the water recycling function.

The AWRC adopts a landscaped-led approach by integrating greater aspects of the heritage and natural assets of the site into both the centre and the wider landscaped park area.

The following pages present the masterplan's key design features, informed by the design principles. The key design features presented reflects the vision for the AWRC including its future stage.

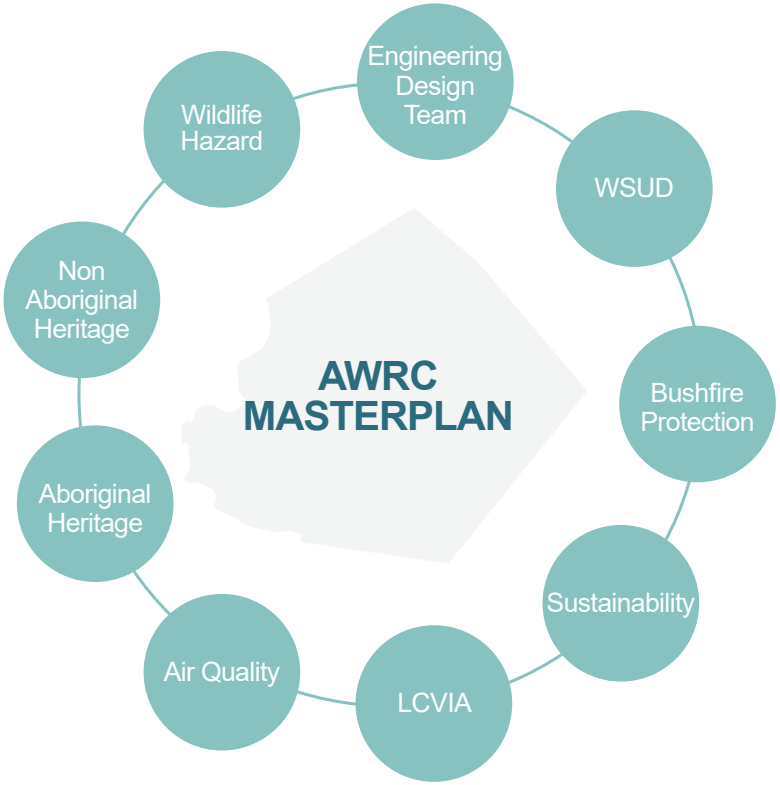
These are indicative of how the principles may be translated into a masterplan allowing for flexibility to respond to future changes to the centre footprint, context, demand, technology and processes.

Methodology

Given the special nature of the site, its physical location and strategic positioning within the Greater Sydney context it was important to undertake a collaborative design approach.

An initial scoping workshop was held to establish an aligned vision and objectives for the project team. Following this, a series of workshops with technical specialists and consultants were held at the earliest possible stage and involved an iterative process of liaison, reporting, evaluation and updating throughout the design process.

This ensured the development of a contextually responsive, sustainable and resilient masterplan that balances functional requirements with environmental and community benefits to achieve the vision of the site.



5.2 Masterplan Features

water treatment | resource recovery | sustainability | community | built environment approach

Water Treatment

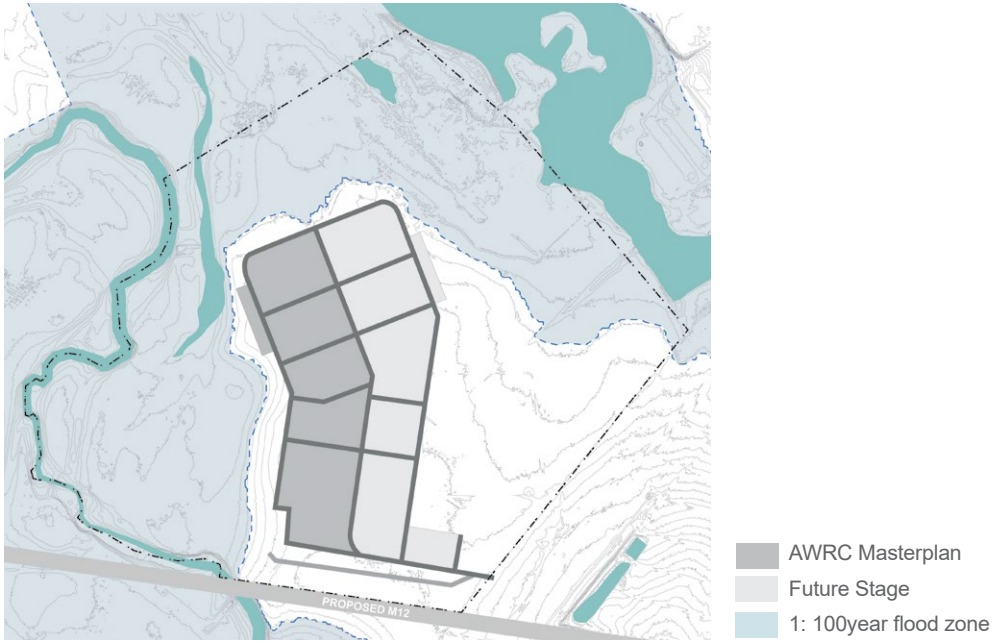


Figure 26 Masterplan Features: Water Treatment - Flood Levels Plan

CLI ENE DIS LAN

AWRC is strategically located to leverage off the natural topography of the site. The processes within the centre maximises gravitational pull and minimises the need for excavation and construction. AWRC is situated above the one in 100 year flood line to increase resilience to flooding and reduce disruption.

Heritage

Figure 27 Masterplan features: Heritage - Radio-Astronomy

HER

The area has been identified as being culturally significant to the local Dharug people. Ways to integrate and celebrate the indigenous values of the land should be explored in collaboration with the local Aboriginal community.

Retention of the existing parabolic antennaes create focal points while remnant radio-astronomy infrastructure present the opportunity for material re-use where possible. Interpretation of the radio-telescope array can be achieved through change in ground covering such as paving to indicate original footprint.

5.2 Masterplan Features

Landscape and Ecology

Figure 28 Masterplan Features: Landscape and Ecology - Woodland Planting Plan

DIS

New planting will restore habitats and strengthen biodiversity within the DPIE conservation area. Concentration of planting along the riparian corridor will reduce run-off and soil erosion, improving the health of the waterways.

New planting will help integrate the centre into its landscape as well as improve the recreational and educational potential of the wider site.

Movement

Figure 29 Masterplan features: Movement Plan

Movement on site is focused around two primary user groups: centre staff and visitors and; parkland visitors

Public will not have access to the centre site and all visitor access to the parkland will be via a security point at the main site entrance on the new access road in the south east corner.

Architecture

Figure 30 Masterplan Features: Architecture Location Plan

The administration building is located at the entrance of the AWRC, acting as a gateway building of quality, sustainable architecture. The building is set within the landscape and will incorporate open spaces, natural lighting and ventilation to ensure maximum health and well being benefits for staff.

Visual Screening

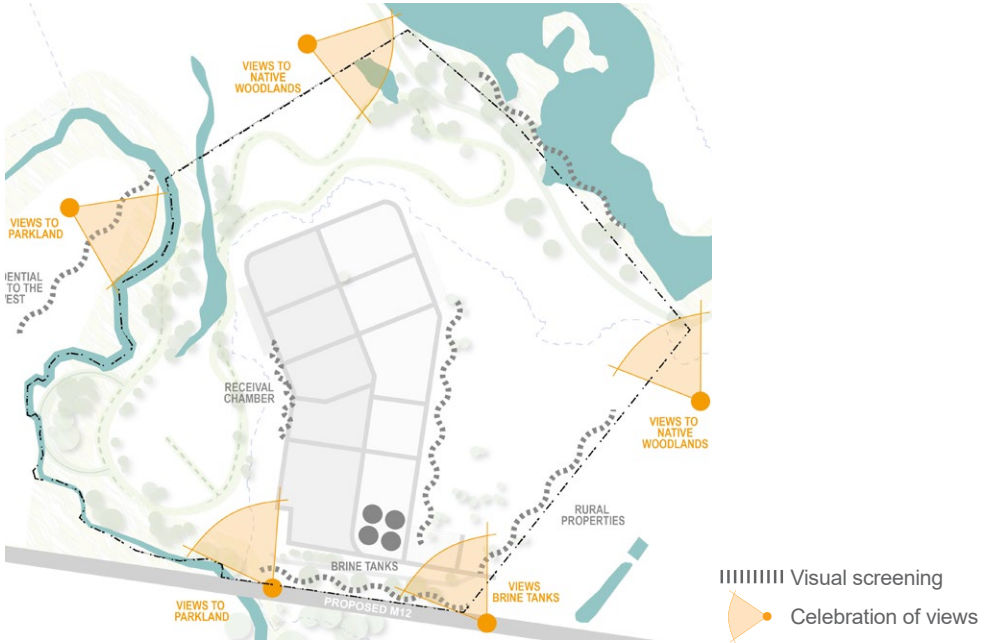


Figure 31 Masterplan features: Visual Screening and Corridors Plan

Any potential adverse effects of the centre to key views from nearby residents, transport (M12) and recreational users will be mitigated with the use of landscape planting, earthworks and material selection to the brine tanks and other ancillary buildings.

5.2 Masterplan Features

Education and Interpretation

Figure 32 Masterplan Features: Education and Interpretation Plan

STA

An outdoor learning area and education trail presents the opportunity to engage with local community groups and businesses, providing pathways to knowledge sharing and research around environmental sustainability, Aboriginal culture and values, water and land management practices and local heritage.

Aerial View

Figure 33 Masterplan features: Aerial View Plan

The rigid grid of the centre and the fluid more natural formation of the surrounding landscape and waterways create a playful juxtaposition that is only can be seen from above.

The eye-catching architecture and colourful canopies dispersed across the site, in combination with significant tree canopy and landscaped areas provide visual amenity from aircraft taking off and landing at the new Western Sydney airport.

5.3 Illustrative Masterplan

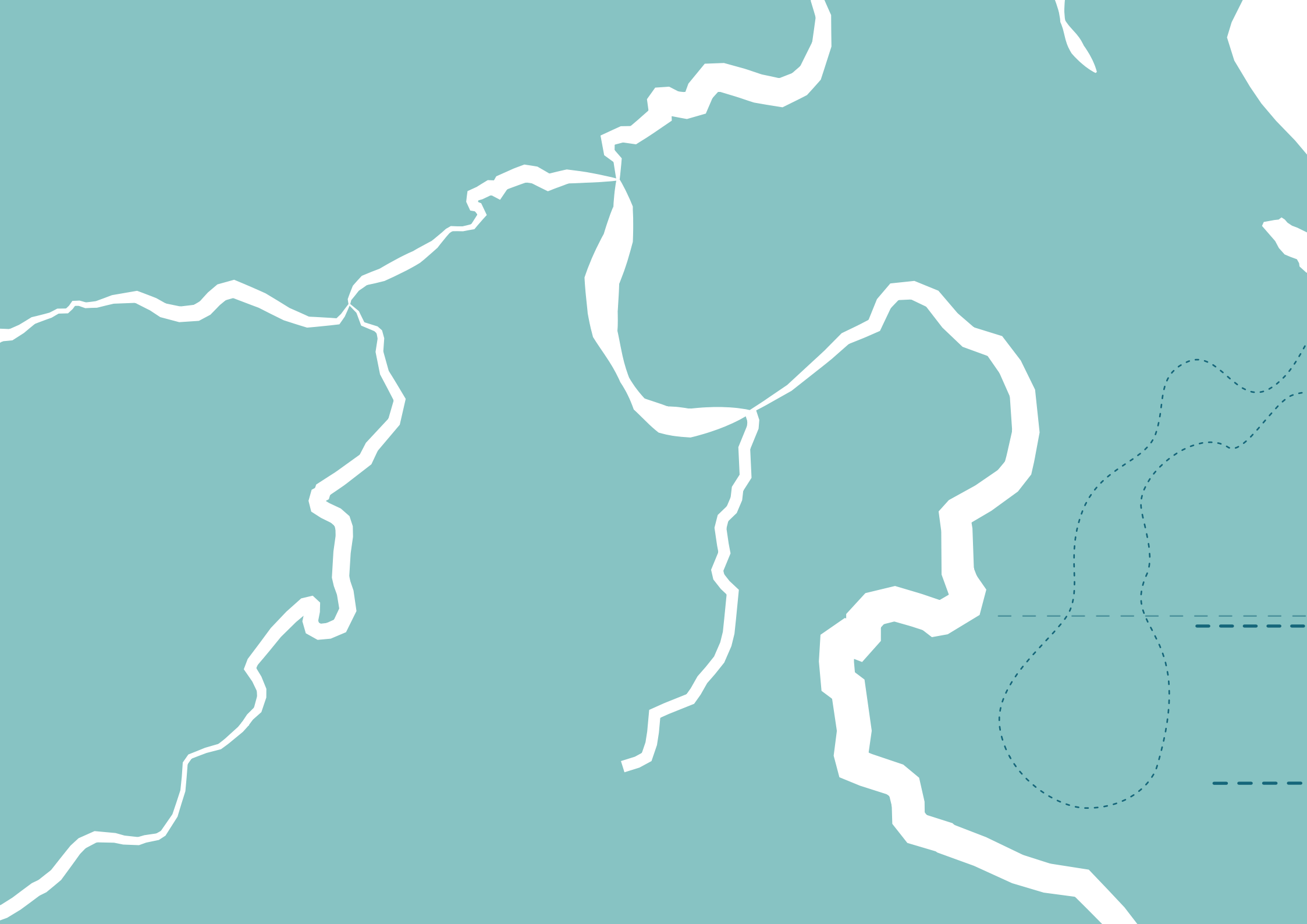
water treatment | resource recovery | sustainability | community | built environment approach

	WATER TREATMENT	
	Waterways restoration	1
	RESOURCE RECOVERY	
	Re-use of on-site waste and resources	2
WAT	Water capture and re-use	3
	SUSTAINABILITY	
	Conservation Area	4
ECO	Environmental Restoration	5
ECO	Biodiversity + habitat creation	6
	COMMUNITY	
	Outdoor Learning	7
HER	Celebration of heritage	8
URB	Celebration of Aboriginal heritage	9
	BUILT ENVIRONMENT	
	Administration Building	10

Legend

- Functional Roads
- Parkland Road
- Fire Access Road
- Rising Mains
- Walking Trail
- Facilities Fence
- Native Grassland
- Outdoor Learning
- Formal Landscape - Street trees and shrubs
- Ecological Riparian Corridor Planting
- Canopies

Figure 34 Illustrative Masterplan



6.
Developed Design

6.1 Detailed Masterplan

6.1.1 AWRC Masterplan

The AWRC Masterplan demonstrates a landscape-led approach to delivering a water recycling centre with an operational capacity of 50ML/d ADWF.

Figure 35 Upper South Creek AWRC Masterplan

6.1.2 Future Stage

The Future Stage reflects the ability of the masterplan to be adapted and expanded to an operational capacity of 100ML/d. Adopting the same landscape principles and strategies within the facilities masterplan footprint.

Flexibility has been designed into the masterplan to enable the centre to respond to changes in future demand, technology and processes without compromising the landscape intent and objectives.

Figure 36 Upper South Creek AWRC Masterplan Future Stage

6.2 Landscape Design

6.2.1 Landscape Zones

The landscape design is composed of a series of diverse and complementary elements that aim to improve the liveability and experience of people who live and work in the Western Parkland City.

The landscape initiatives outlined in the following section prioritises waterway health, biodiversity and the protection of native species along Wianamatta-South Creek and Kemps Creek corridors.

The AWRC blue-green infrastructure supports the Premier's Priorities on increasing tree canopy and access to open space with strategic planting and water management across the site that also minimises wildlife hazard for the airport and bushfire risk.

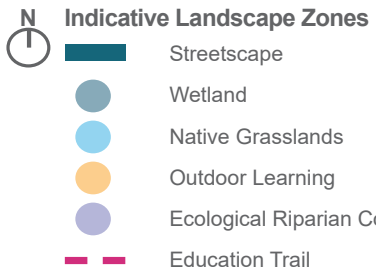


Figure 37 Landscape Zoning Plan (100ML/d)

6.2.2 Streetscape

DIS LAN

- Incorporate grass swales along hard surfaces such as roads to capture rain water run-off
- Increase tree canopy and shrub layer to offer cool micro-climate for operatives and visitors
- Plant street trees and ornamental planting at 10-15m centres and introduce seating and lighting to improve walkability and reduce the heat-island effect
- Ensure all planting associated with screening ancillary buildings is coordinated with swales and soakaways to ensure that run-off is captured for irrigation
- Reduce the impacts of rainwater run-off and urban heat effect by incorporating light coloured permeable paving where possible
- Monitor and manage vegetation regularly in accordance landscape wildlife strike mitigation guidelines

Swales, green facades, embankments and street trees

Figure 38 Streetscape treatment precedents

Planting integral to WSUD strategy

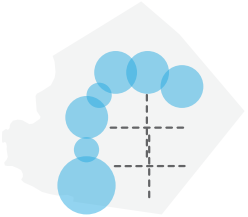
Fraxinus 'Raywoodii'

Melaleuca thymifolia

Carex appressa

Figure 39 WSUD plant species

6.2.3 Wetland and Native Grasslands



- Extending Sydney's Green Grid through new grasslands, native planning and engineered wetlands form part of the WSUD strategy for the site, responding to flood and stormwater management by providing a means of slowly releasing stormwater over many days to match the baseline hydrologic discharges, and improving waterway health.
- Boardwalks and interpretation boards improve access to these areas whilst safeguarding habitats.
- Strengthen existing riparian habitats by introducing new native planting and providing connectivity to existing patches of habitat.
- Water depth between 0.5m and 1.18m is less likely to attract hazardous flocking birds or upending ducks .
- Wetland to be designed in a way that reduces perching and potential nest platforms.

Meandering boardwalks over wetland and native grasslands


Sydney Park


River Forest Island


Princetown Boardwalk


River Forest Island

Figure 40 Wetland and Native Grassland design precedents

Native planting species


Carex appressa

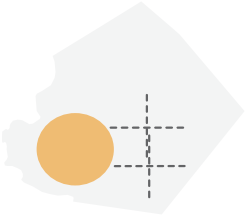

Lomandra longifolia 'Katrinus Deluxe' PBR


Juncus usitatus

Figure 41 Native plant species

6.2.4 Outdoor Learning

URB INN



- A new outdoor learning space utilising the excavated soil from the construction of the water recycling centre.
- Water installations to showcase water treatment process and culture from indigenous to modern days.
- Opportunity to have an interactive mini installation of the water recycling centre to engage and educate visitors.
- Takes advantage of access and setting to the natural reserve to showcase endangered flora and fauna species in the Cumberland Plain bioregion to raise public awareness.

Water Management Showcase

Darling Quarter

Museum of Water

Interactive water installations

Shading Structure

Houtan Park

Castell d'Emporda

Artistic shade canopy creates attractive aerial view

Figure 42 Streetscape treatment precedents

Endangered Species

Acacia pubescens
Downy Wattle

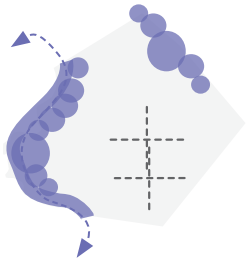
Dillwynia tenuifolia

Pimelea spicata

Figure 43 Endangered plant species

6.2.5 Ecological Riparian Corridors

ECO



- Protect and enhance existing River Red Gum habitats along Kemps Creek and Wianamatta-South Creek, and including existing billabong.
- Create matrices of various ecological habitats – grassland, scrub and forest utilising remnant native woodland patches.
- Contribute to Greater Sydney Commission's vision for the Wianamatta-South Creek Corridor, creating opportunity for greater and improved strategic pedestrian and cycle accessibility along the waterway.
- Management regimes will prioritise habitat creation rather than wildlife strike mitigation.

Habitat regeneration for endemic wildlife

Existing billabong on site

Wianamatta-South Creek

Figure 44 Photographs of the Wianamatta-South Creek Ecological Corridor

Regenerate Endangered Forest Red Gum Woodland habitat

Eucalyptus amplifolia

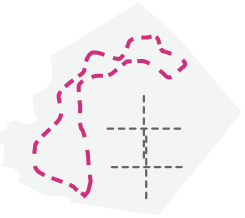
Angophora subvelutina

Casuarina cunninghamiana

Figure 45 Endangered Woodland species

6.2.6 Education Trail

WAS URB



- Through future engagement with local Aboriginal communities, the site could be a place for research and education e.g. traditional land and water practices to help maintain and protect the landscapes on and around the site now and into the future.
- Provide interactive cultural and heritage trail with interpretation and wayfinding.
- Cultural and heritage trail; Aboriginal culture, European agricultural heritage, radio-astronomy heritage, water recycling centre.
- Provide new and improved access to the creek, waterways and natural environment.
- Create opportunities for seating, and public art installations which could include sculptural art or the creation of soundscape landscapes
- Retention of two parabolic antennas.

A cultural walk, an educational walk, an art walk, a leisure walk

Amanda Feher Installation

Existin telescop on site

Figure 46 Education Trail Precedents

Vegetation for refuge and Forest Red Gum Woodland habitat

Eucalyptus moluccana

Eucalyptus tereticornis

Lomandra longifolia 'Katrinus Deluxe' PBR

Figure 47 Woodland Habitat species

6.3 Section

East-West Section

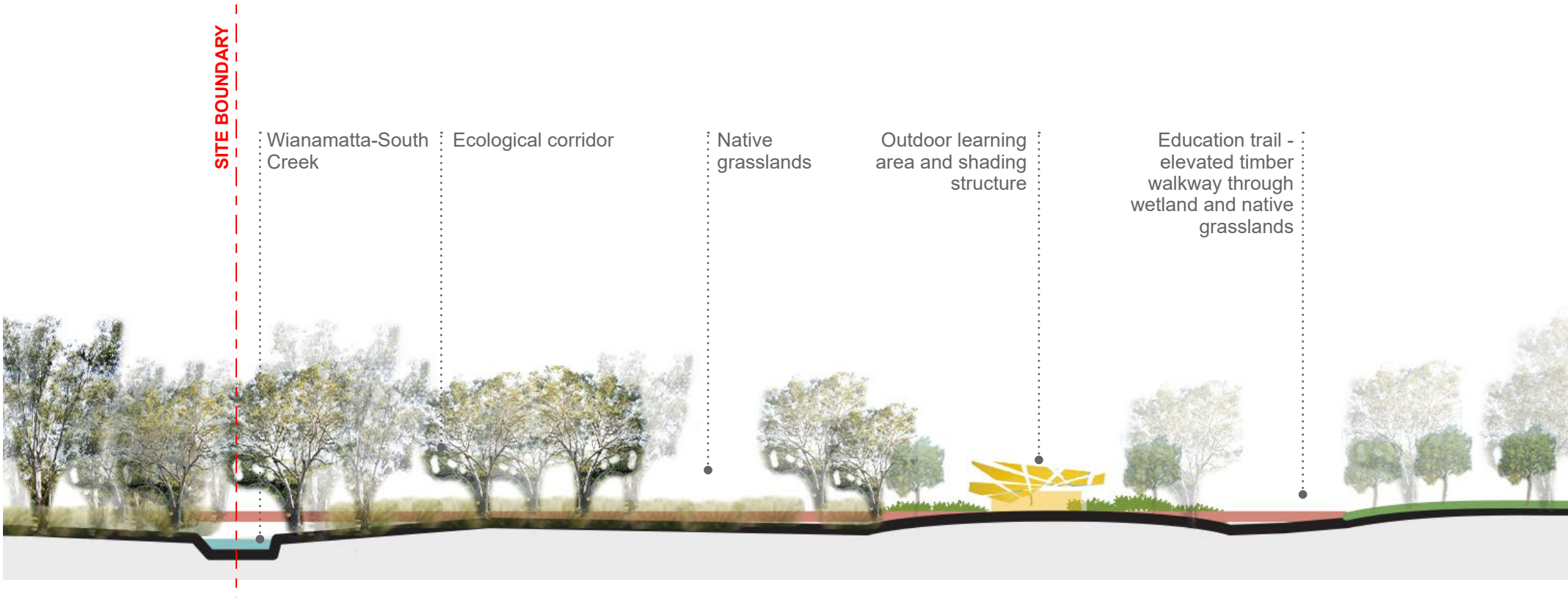


Figure 48 East West Section through the AWRC Site

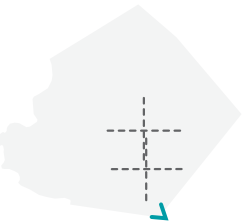
Landscaped pedestrian pathway between Administration building and parkland

Advanced Water Recycling Centre (Beyond)

Potential future commercial area

Wianamatta-South Creek (SOURCE: NSW Government and Western Sydney Planning Partnership' Western Sydney Aerotropolis Plan,' 2020)

6.4 Perspectives



Aerial

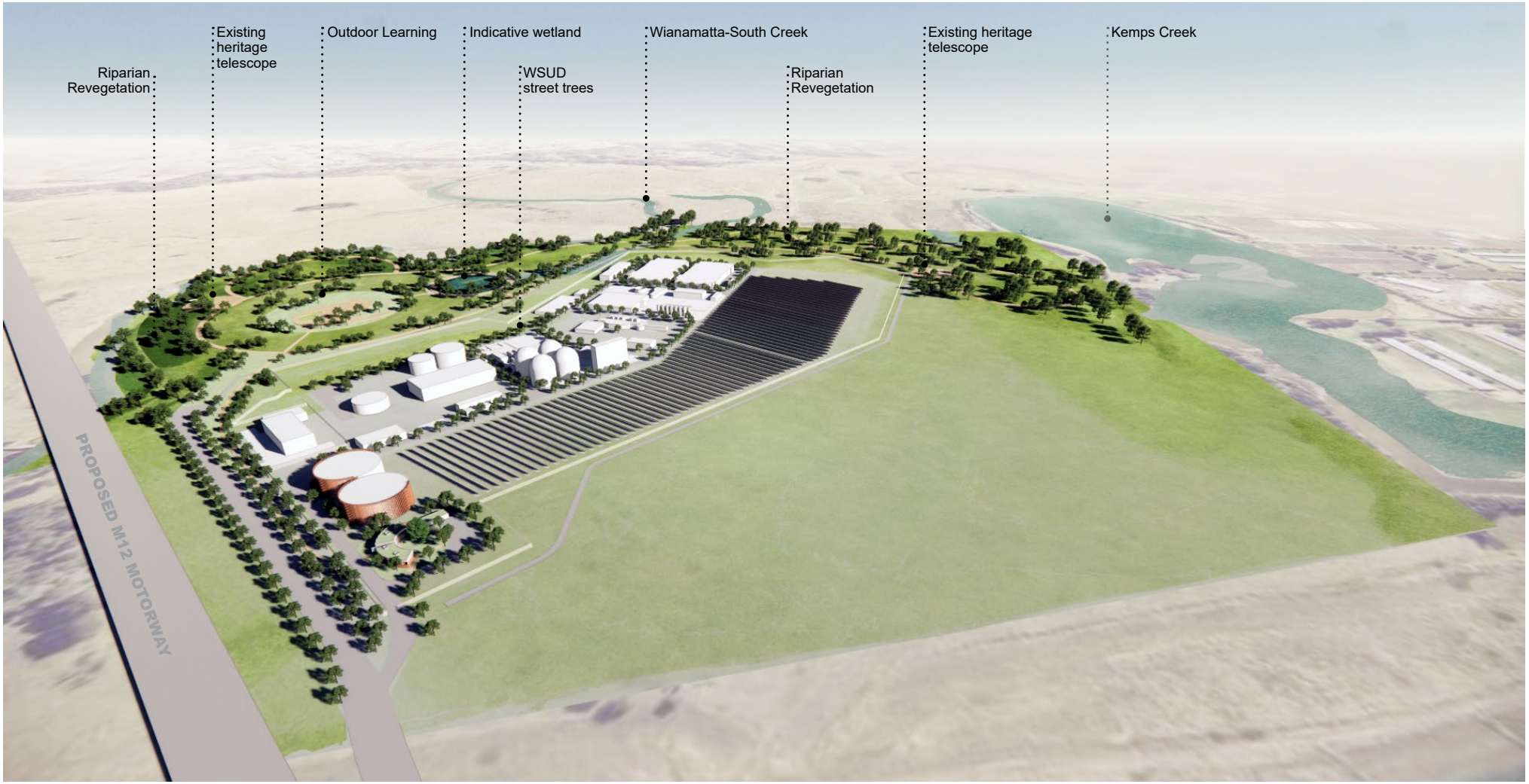


Figure 49 Upper South Creek AWRC - Aerial View

6.5 Architecture Design

6.5.1 Introduction

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The following section reflects an indicative concept design to demonstrate what could be achieved for the administration and architectural finishes on site.

The architectural design development is driven by three primary factors:

1. Recovery & reuse. To reduce waste, transportation and construction costs, earth excavated during construction is re-purposed to create landscaped embankments, rammed earth walls and green roofs.

2. Sustainability. Energy consumption is carefully managed through the positioning and orientation of built form in relation to the sun, the use of thermal mass to regulate temperature, shading to glazed facades and hybrid passive ventilation.

3. Construction techniques & materials are shared across built elements on site to streamline construction and provide a unified architectural language.

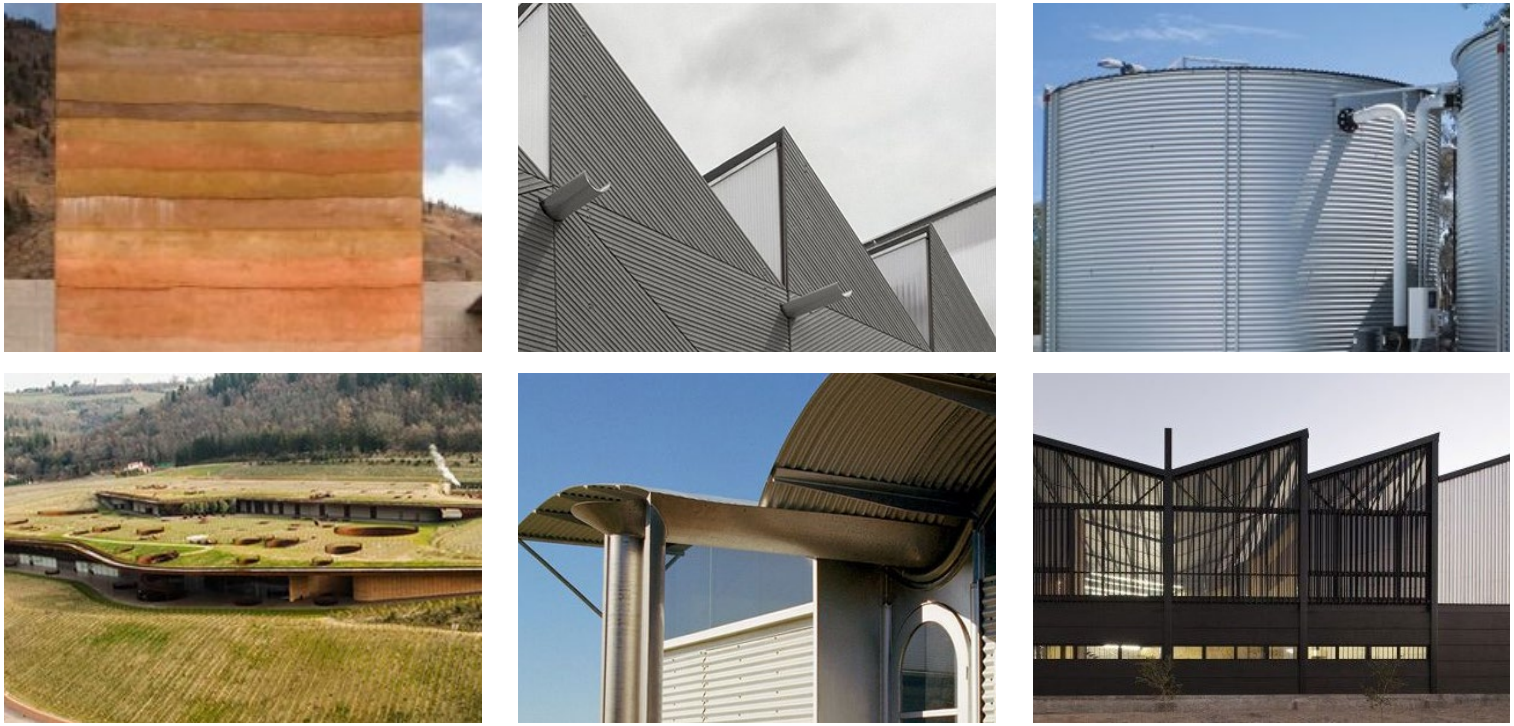


Figure 50 Architectural design development precedents

1. Recovery & reuse:

+ earth embankments
+ soil for green roofs
+ rammed earth walls

2. Sustainability:

+ rainwater collection
+ channeling surface run-off
+ solar/renewable energy

3. Complimentary construction

+ structural framing
+ modularity
+ unified approach to cladding

6.5 Architecture Design

6.5.2 Concept Design

Concept Design

An administration building is proposed at the south-east entrance to the site. This new building will accommodate 15 full-time staff as well as provide a check-in facility for visitors and contractors.

The building is designed to allow future expansion to accommodate an increased number of staff, or the addition of a visitors centre.

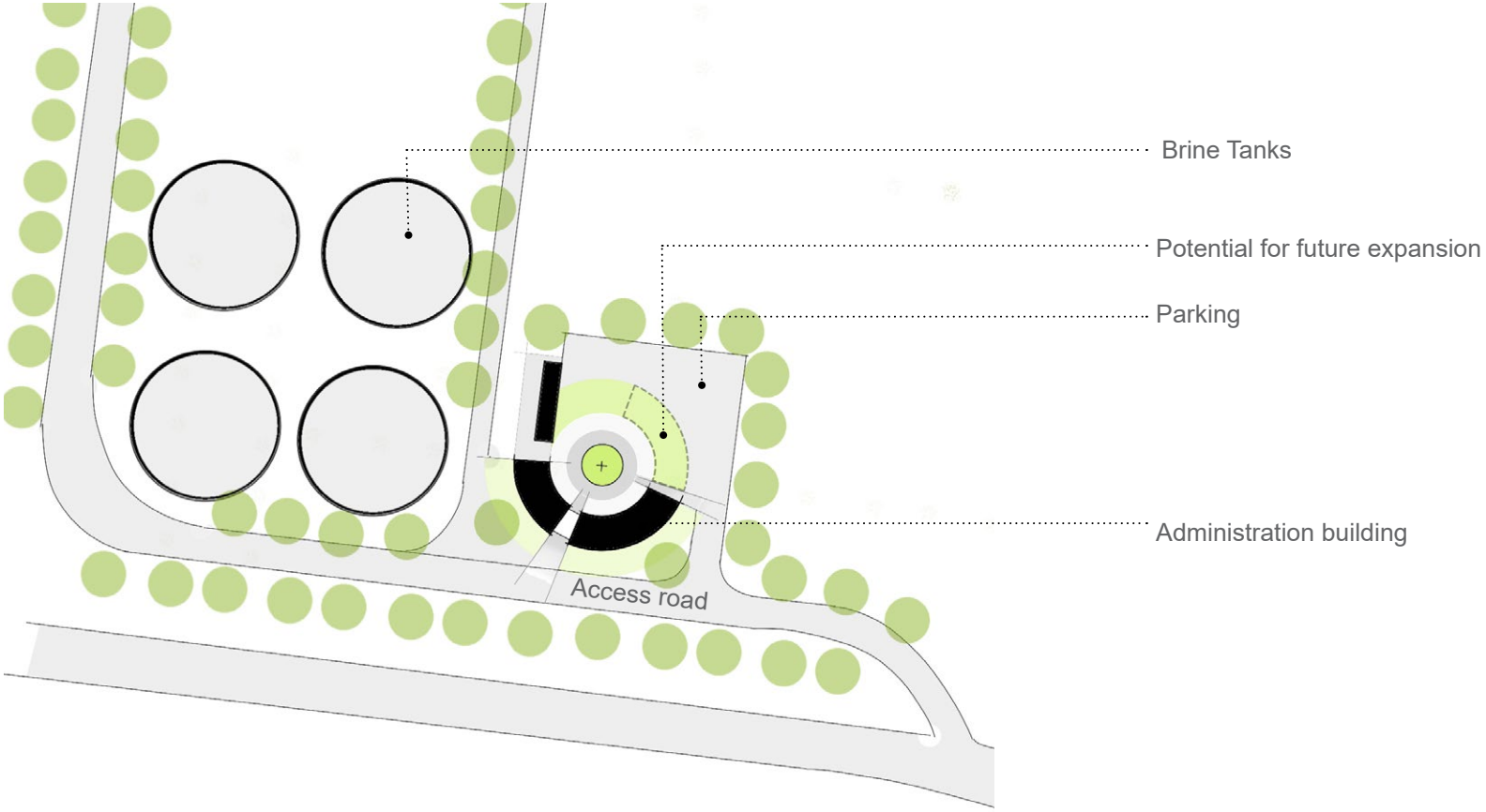


Figure 51 Administration building indicative concept design

6.5 Architecture Design

6.5.2 Concept Design

CLI

There are several design drivers for the administration building, which respond to the building's function, location, construction methodology and the experience of staff and visitors.

+ Located at the south eastern corner of the site, the administration building acts as an effective gateway and entrance marker to the AWRC
+ The circular language of the building responds to the form and language of the adjacent 9.5m high brine tanks. Whilst this is a playful acknowledgment and contextual response to these dominant built forms in the landscape, the setting of the lower administration building in a semi landscaped setting helps to mitigate the visual impact of the brine tanks by creating a visual gradient of the circular forms upon approach from the entrance road.
+ The arrival sequence to the building and the use of the area surrounding the building are also fundamental to the form. As the formal greeting point for staff and potential visitors, it is important for the administration building to address the south-east entry point for the site
+ A 'slice' has been cut out of the building to form the entrance, which has been purposely angled towards the main access road and pathway towards the western park area. The 'slice' also provides visual connectivity between the internal formal landscaped courtyard and the external more natural landscape that connecting to the western park area and visitor education trail
+ Through its circular geometry and northern orientation the building is able to capture a staff courtyard that acts as the focal point and connective open space for all the administration building rooms
+ At the same time with more solid finishes, fewer openings and by placing the circulation spaces along the outer ring, the offices and staff spaces within the building benefit from the north facing orientation and are protected from the road noise coming from the proposed M12 and site access road.

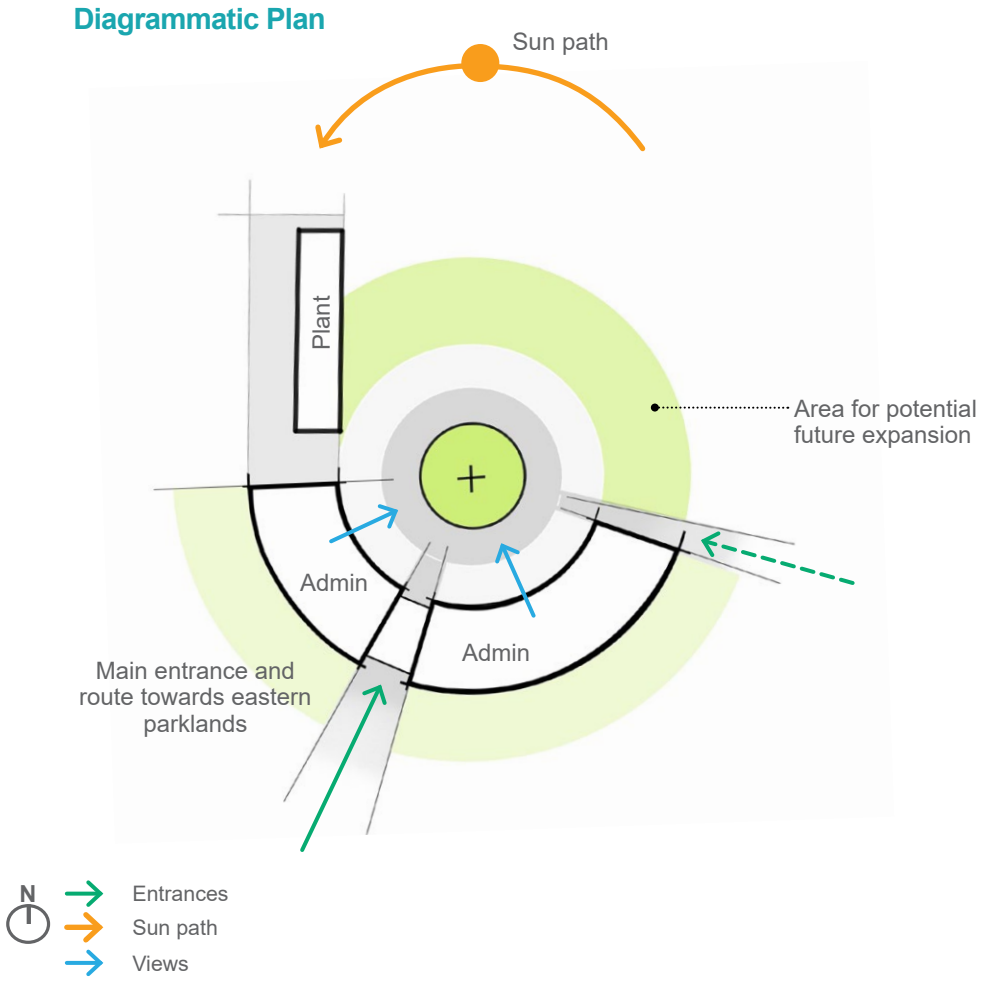
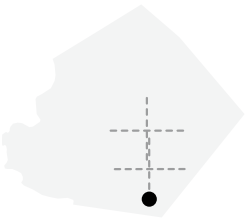


Figure 52 Administration building Diagrammatic Plan

6.5.3 Materials

CLI MAT



Diagrammatic sketch

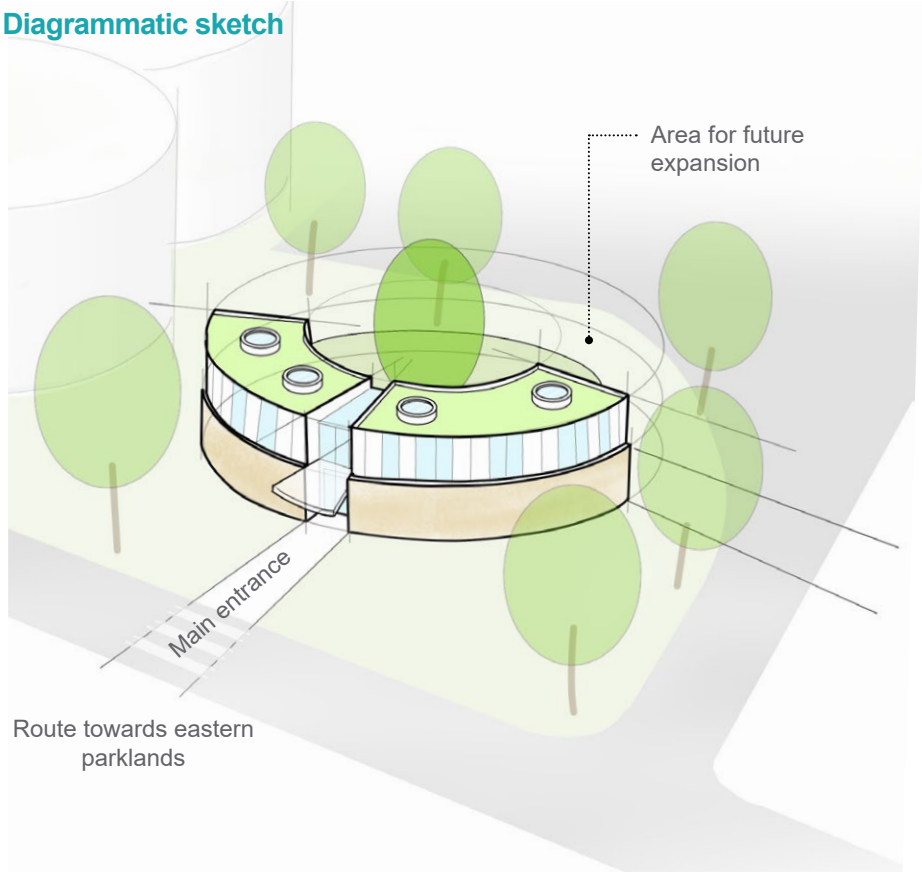
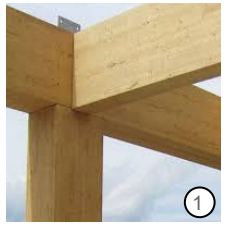
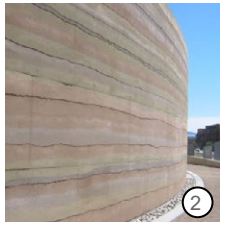


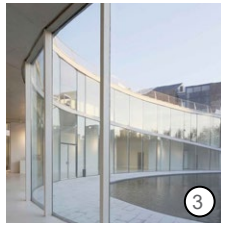
Figure 53 Administration building indicative sketch

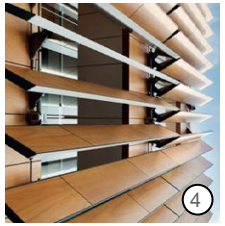
Indicative materials are proposed as follows:

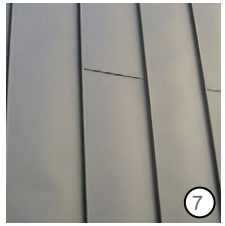
1. exposed cross laminated timber (CLT) for primary structure.
2. curved rammed earth wall to perimeter of outer facade at low level.
3. full height glazed curtain wall to inner facade.
4. horizontal sun shading louvers to upper potion of glazed facade.
5. green roof
6. roof lights
7. powder coated metal cladding with vertical expression to outer facade.
8. vertical strip windows to outer facade.











6.5 Architecture Design

6.5.3 Concept General Arrangement Plans

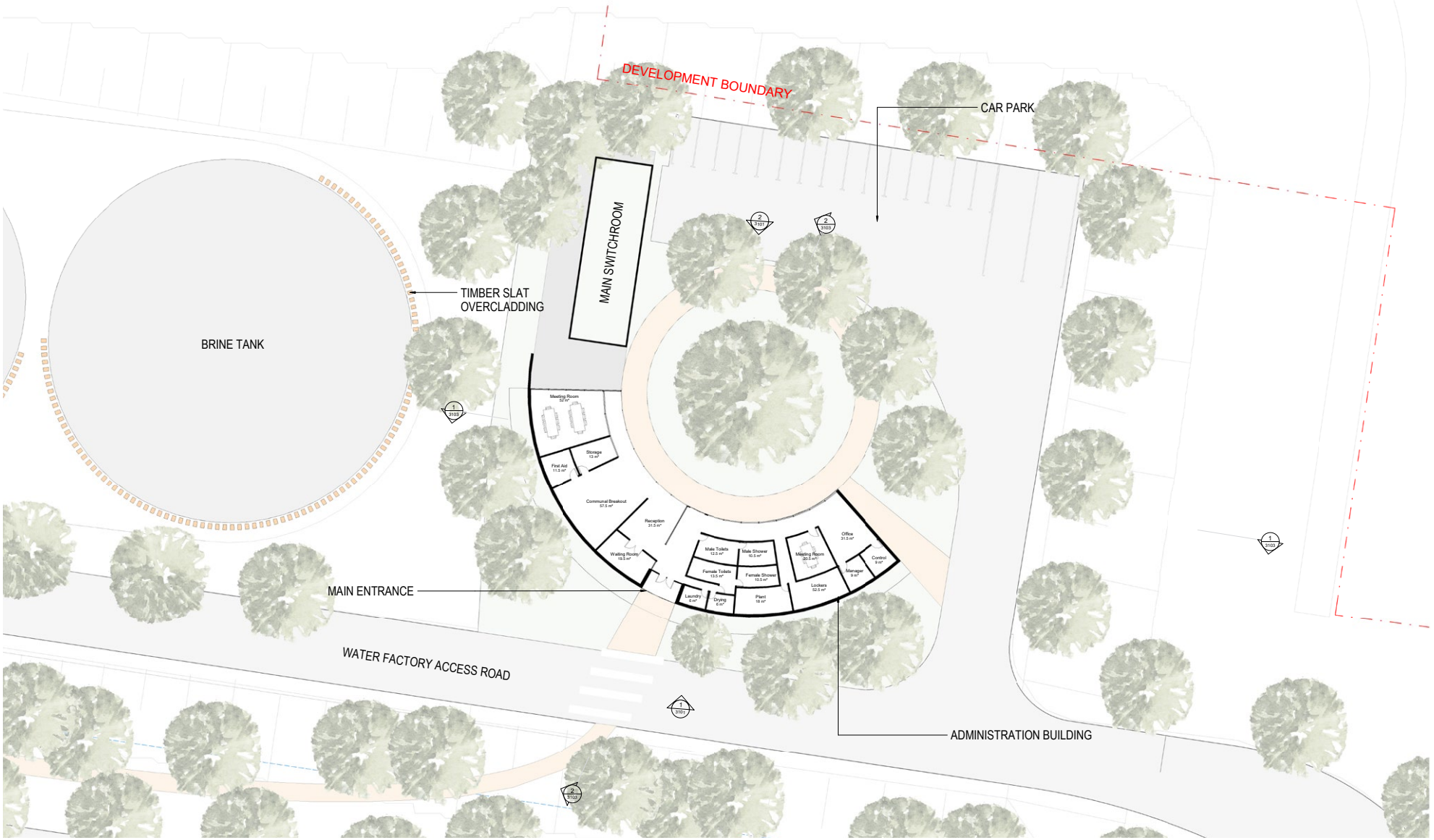
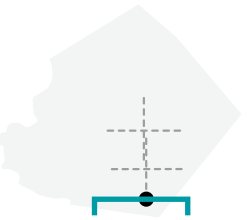


Figure 54 Administration Building Concept General Arrangement Plans

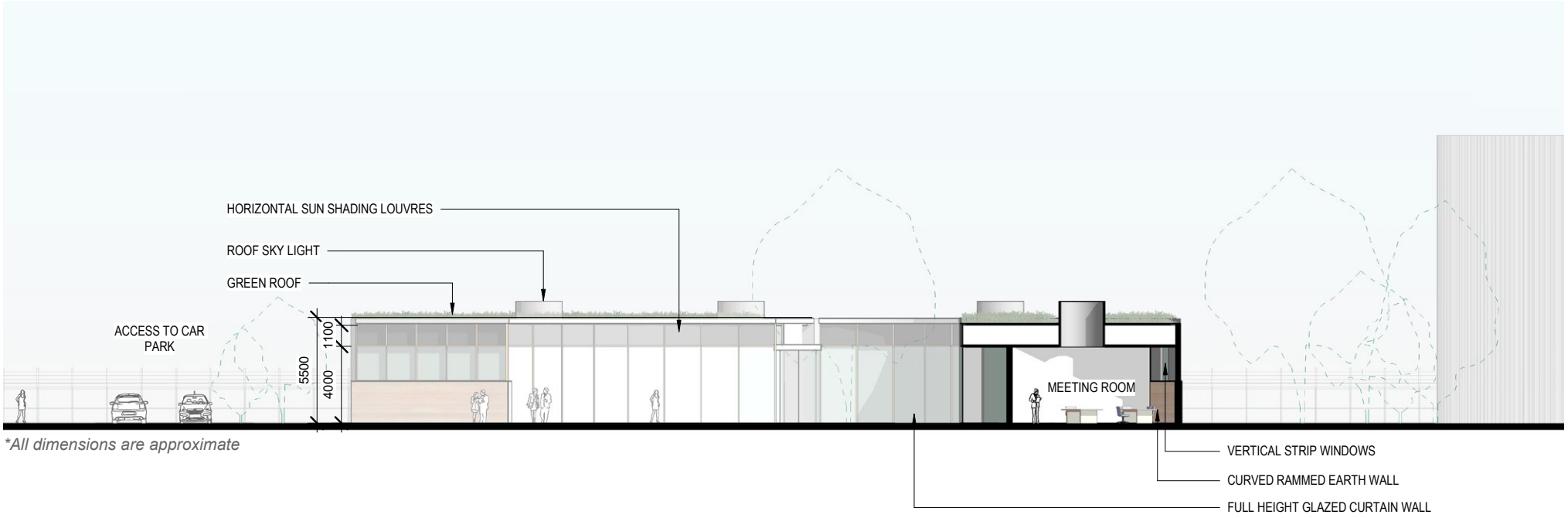
Figure 55 Administration Building Concept General Arrangement Roof Plan

6.5 Architecture Design

6.5.4 Concept Sections



Section 1 - 1: 100



**All dimensions are approximate*

Figure 56 Administration Building Section 1 - 1: 100

Section 2 - 1: 100

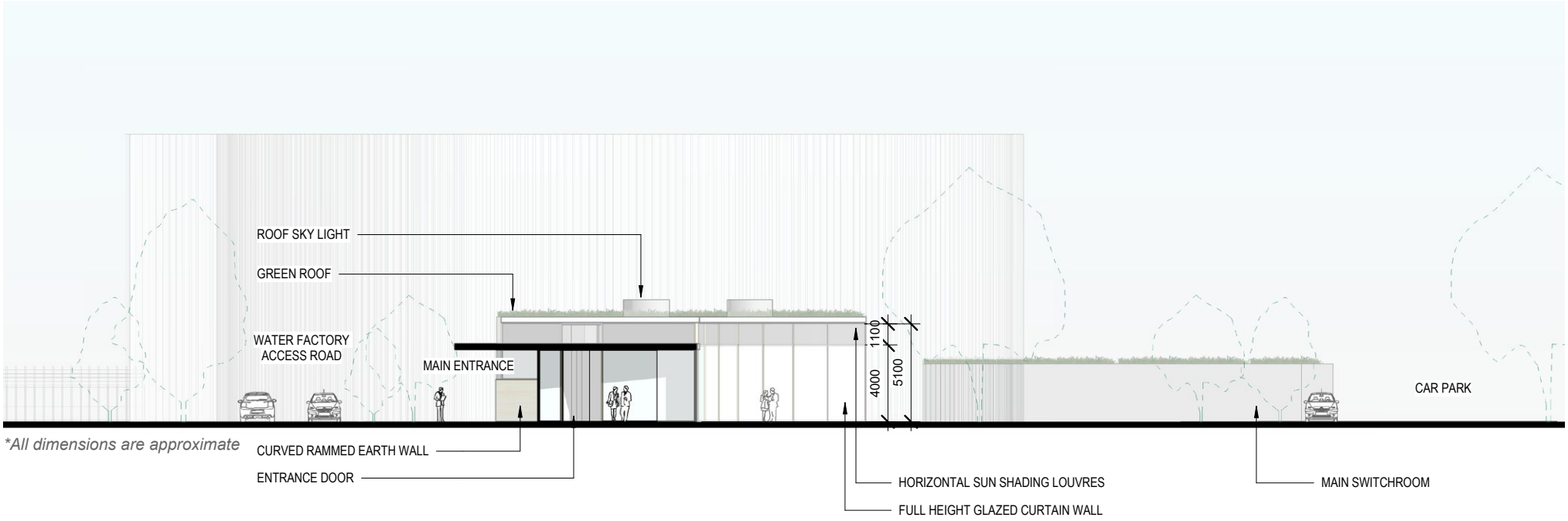
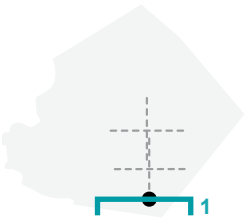


Figure 57 Administration Building Section 2 - 1: 100

6.5 Architecture Design

6.5.5 Concept Elevations



Elevation 1 - 1: 100

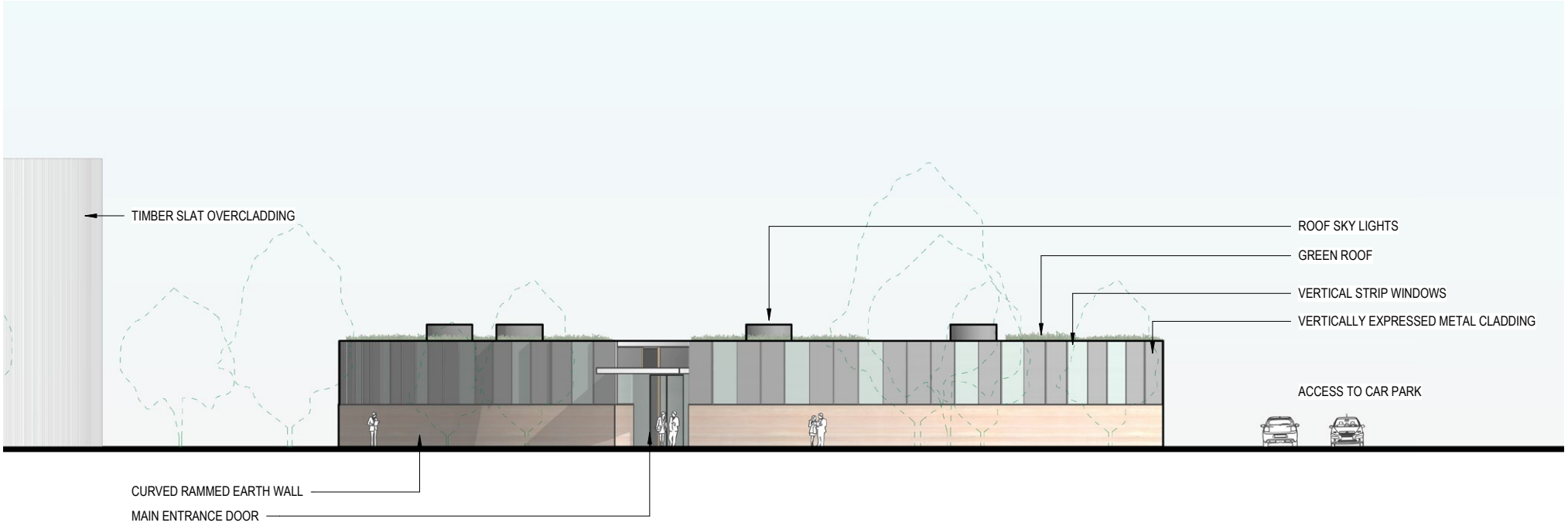
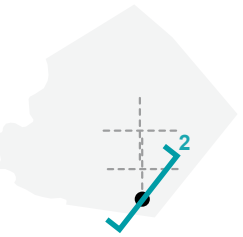


Figure 58 Administration Building Elevation 1 - 1: 100

Elevation 2 - 1: 100



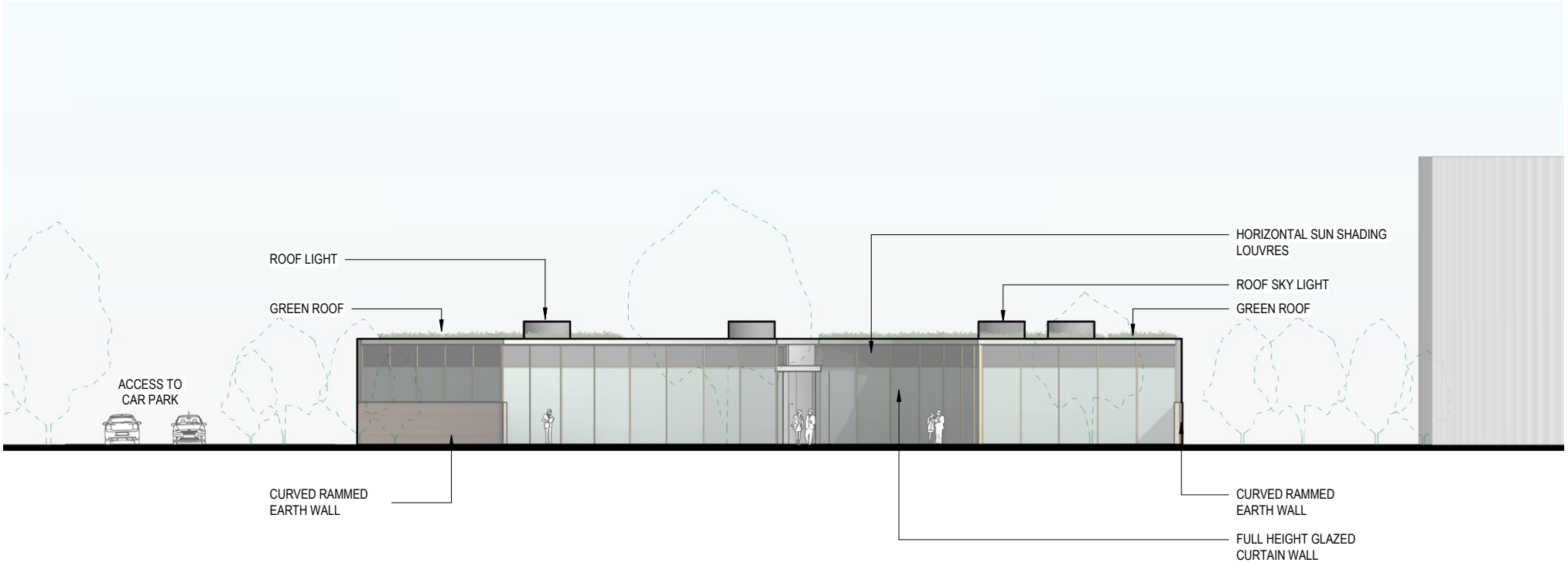
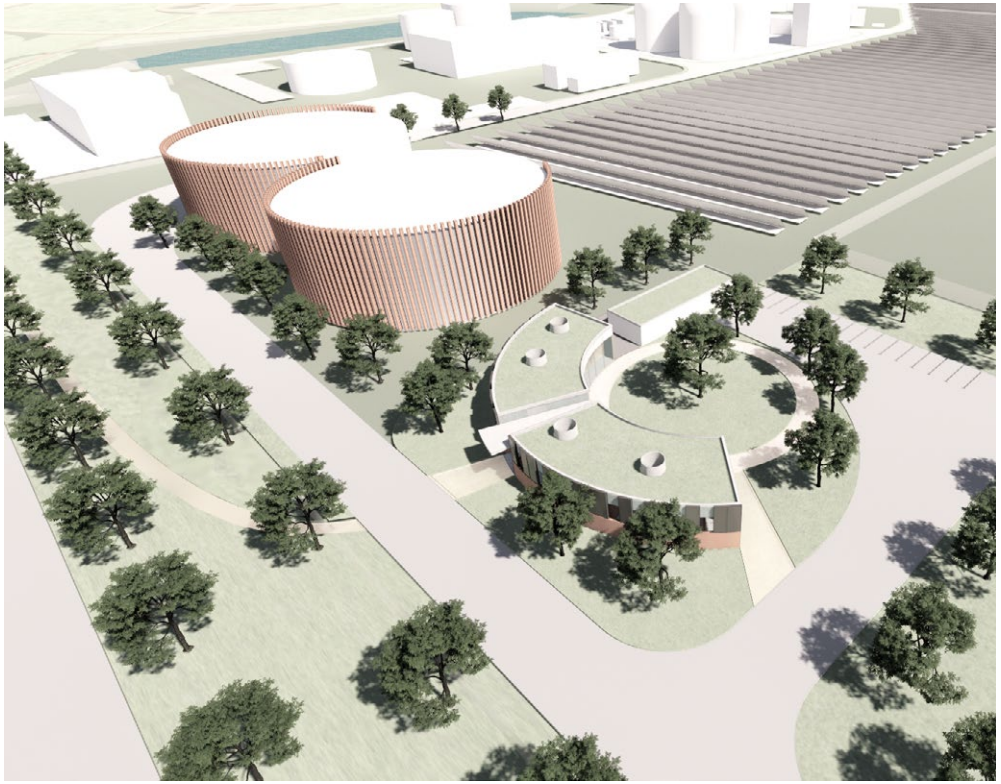


Figure 59 Administration Building Elevation 2 - 1: 100

6.5 Architecture Design

6.5.6 Concept Aerials

A. Looking west



B. Looking south-west

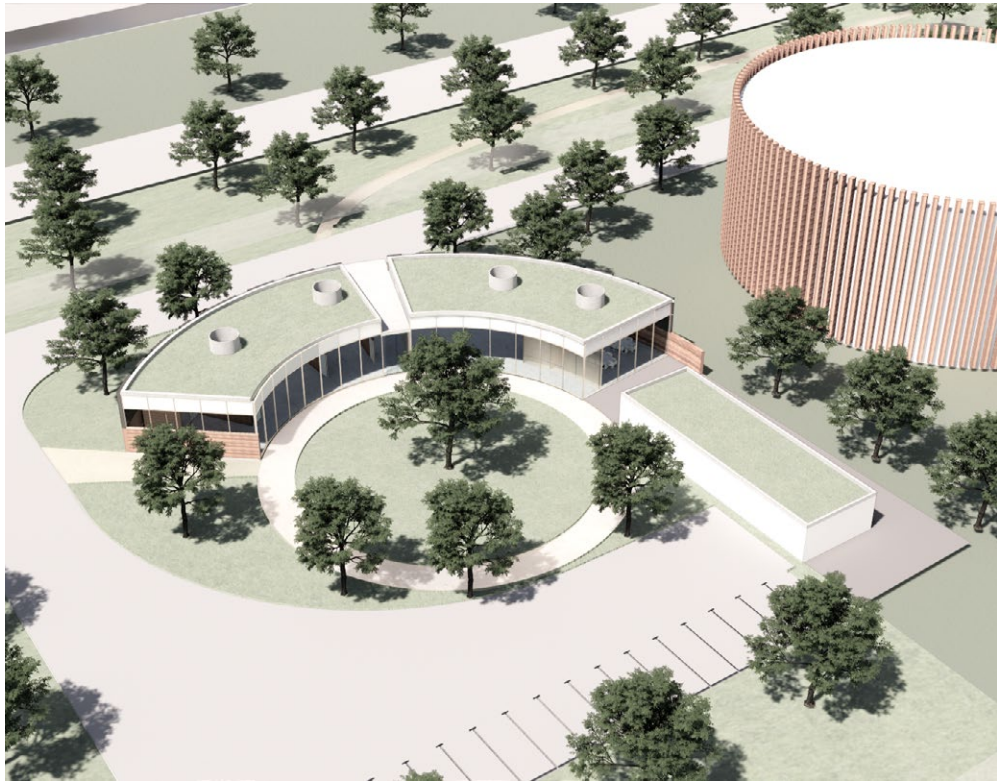


Figure 60 Administration Building Aerial - looking west and looking south-west

6.6 Visual Impact

6.6.1 Approach

CLI ENE

Mitigation of negative visual impacts could be considered through architectural treatments of ancillary buildings and tanks in combination with landscape screening. Adoption of architectural cladding is considered on the most visible ancillary buildings and along critical view corridors as identified in the LCVIA.

Ancillary Buildings and Tanks

A standardised approach is taken to building treatment on site, including the use of light coloured powder-coated metal cladding and roofs. Where key façades are exposed on buildings and tanks, vertical blades are applied to break up the form and to improve the appearance.

Screening

Visual impact mitigation screens are proposed in strategic areas to control views of the . Opportunities for off-site screening could be investigated for view corridors with increased sensitivities.

Architectural cladding and screening to be applied to:

1. administration building
2. AWTP (building)
   80 x 45 x 25m height
3. AWTP balance tank 16dia. x 10m
4. blower room 30 x 10 x 4m height
5. brine storage tanks
   40dia. x 9.5m height
6. co-gen and gas cleaning (building)
7. CCT tanks 28x16 x 3m height
8. digesters and gas storage
   25m dia. x 19m
9. outloading (building)
   30 x 50 x 25m height
10. switch rooms 4m height (various dimensions and locations)
11. transfer PS (building)

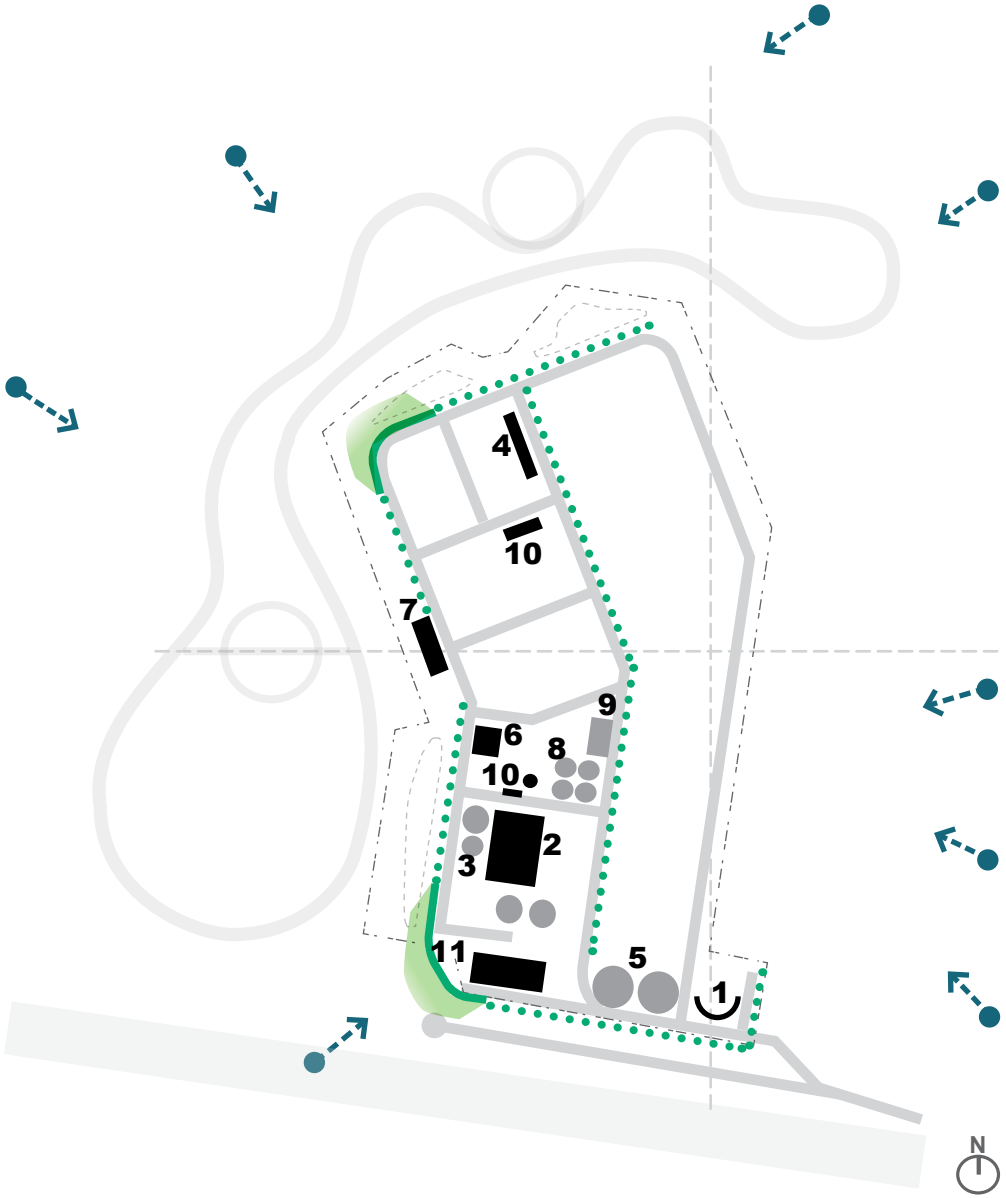


Figure 61 Visual Impact mitigation screening and architectural treatments approach
*Based on AWRC Masterplan layout, same principles apply to Future Stage

6.6 Visual Impact

6.6.1 Approach

CLI ENE MAT

Ancillary Buildings and Tanks

Cladding:

+ light coloured powder-coated metal panels
+ varying scape of vertical expression
+ concealed gutters and downpipes

Over-cladding:

+ applied directly to tanks and buildings
+ only used in exposed areas where views are common
+ introduce colour and texture
+ apply only where needed

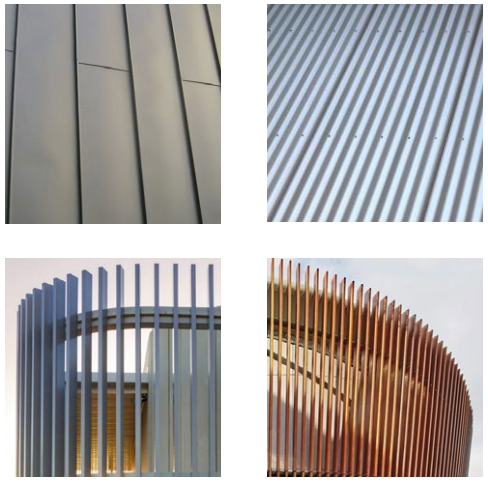


Figure 62 Cladding and Over-cladding Precedents

Screening

Embankments:

+ blend into the natural landscape
+ limit noise
+ re-use of centre's excavated earth for embankment screening
+ use of retaining walls
+ planting to embankment for additional visual screening, increase cooling benefits and to prevent soil movement

Living walls and planting:

+ blend into trees and planting
+ landscape
+ lightweight and economical
+ climbing plants encouraged
+ simple construction
+ planting selections to require limited maintenance

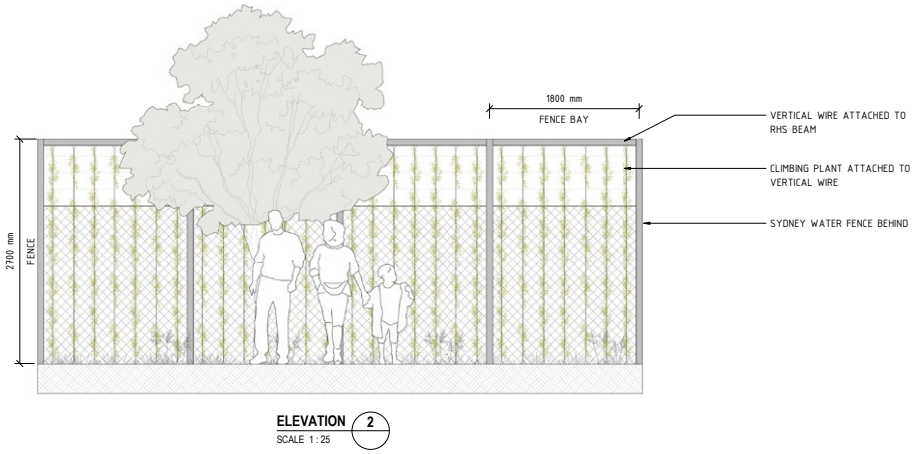
Figure 63 Landscaped screening precedents

6.6 Visual Impact

6.6.2 Screening Details

The use of living walls, such as vertical planted screens, contributes to the visual amenity and security of the centre. Density of the planting can be controlled to increase screening properties in areas that have higher visibility or in recreational areas that are more sensitive to air pollution.

Living walls also contribute to cooling, biodiversity and health and well being benefits for staff and visitors.



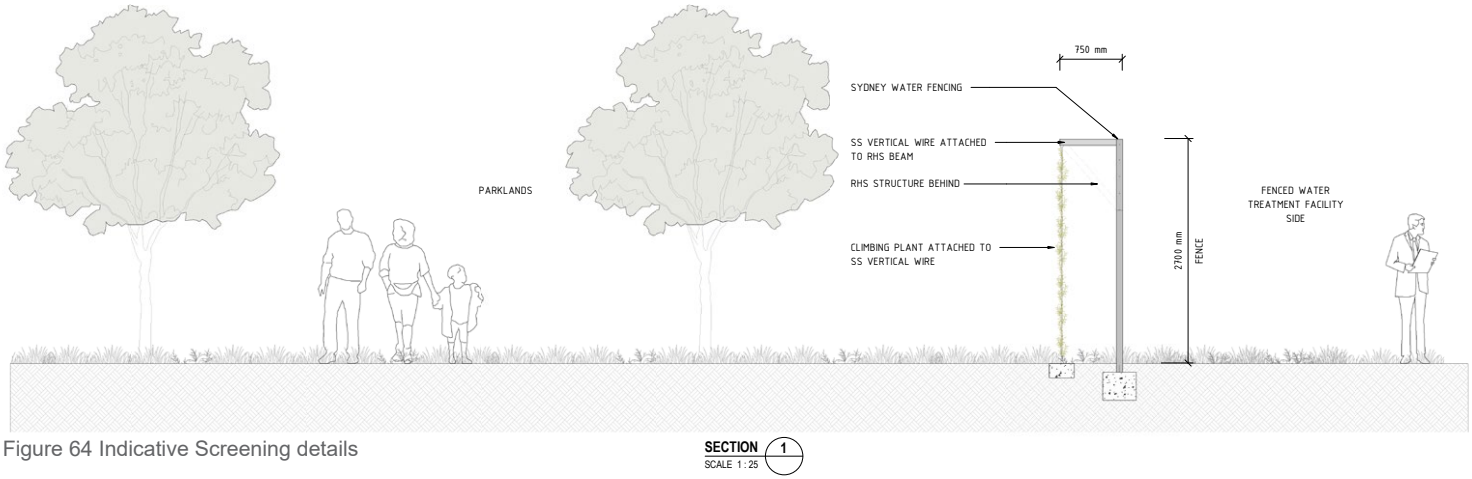


Figure 64 Indicative Screening details

Attachment B – Indicative images of solar generation infrastructure


Solar Farm


Micro inverters

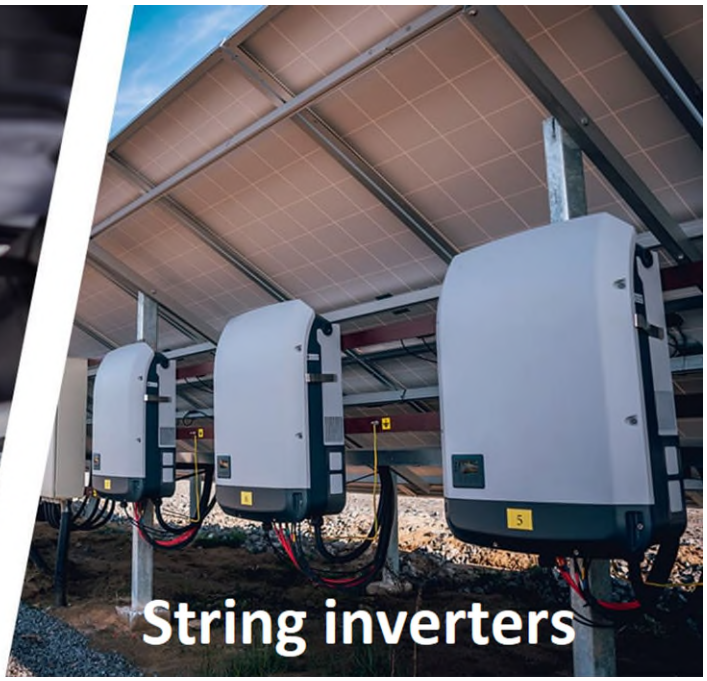

String inverters


ABB
HV Inverter


Screw piles


Concrete foundations