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Figure 20 Constructed wetland integrated with surrounding woodland – Balyang Wetland, Geelong



Figure 21 Constructed wetland with integrated public amenities – Mernda Wetland, Melbourne

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8.6 Computational Modelling

8.6.1 MUSIC

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been used to analyse the potential impact of the identified Majura Valley investigation areas and to inform the formulation of the WSUD strategy. Calibration of parameters used in MUSIC was required to ensure that the relationship between rainfall and runoff is accurately represented in the model. This is of particular importance in situations where a significant proportion of the catchment is pervious and where runoff from these pervious areas sets baseline operating conditions that regulate the harvesting of stormwater generated from the proposed developments. The MUSIC model set-up varies from that recommended in the Water Sensitive Urban Design General Code. Our experience in the performance of a wide array of treatment strategies (including ponds, wetlands and bioretentions systems) and our involvement in research relating to the modelling of these systems supports the approach followed (and detailed below). A comparison with the approach detailed in Water Sensitive Urban Design General Code gave minimal variation in results.

Stormwater harvesting opportunities can be determined and prioritised by comparing flow volumes between pre and post development scenarios. Catchment runoff will be sensitive to soil moisture conditions and calibration of the model is considered essential to ensure reliable estimates of available stormwater resources.

Following calibration the MUSIC models have been run on a continuous record of rainfall data (at 6 minute time steps) for the period of 1967-1977 from Canberra Airport (70014). The mean annual rainfall over this period was 655 mm which is considered to be representative of the entire Majura Valley.

Land uses were represented in the model separately as roof areas (100% impervious) road/hardstand (100% impervious) and general landscape (100% pervious). Stormwater contaminant concentrations were varied for each of these land uses to represent the likely variation in runoff water quality from different surface types. Table 19 summarises the pollutant concentrations used.

Table 19 Stormwater Runoff Pollutant concentrations (Fletcher et al. 2004)

Base Flow Concentrations (mg/L-log ₁₀)						
Surface Type	TSS		TP		TN	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Roofs	1.20	0.17	-0.85	0.19	0.11	0.12
Sealed Roads	1.20	0.17	-0.85	0.19	0.11	0.12
General	1.20	0.17	-0.85	0.19	0.11	0.12
Storm Flow Concentrations (mg/L-log ₁₀)						
Surface Type	TSS		TP		TN	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Roofs	1.30	0.32	-0.89	0.25	0.30	0.19
Sealed Roads	2.43	0.32	-0.30	0.25	0.34	0.19
General	2.15	0.32	-0.60	0.25	0.30	0.19

The inflow stormwater contaminant concentrations used in the modelling of Majura valley are the default MUSIC parameters. These parameters apply a mean and standard deviation for TSS, TP and TN (for both base and storm flows) and stochastically generate concentration profiles during modelled events. The input means and std dev are consistent with the stormwater quality distribution as shown in Australian Runoff Quality (ARQ) and are based on a comprehensive review of over 700 statistically valid water quality sampling studies from around the world. ARQ's intention is to provide appropriate standards to be applied in the stormwater industry. The referenced review confirms that urban runoff quality displays more consistency than rural runoff, especially as the size of the contributing urban catchment increases; and that the parameters provided as MUSIC defaults can be generally applied to confidently represent urban catchments. In the absence of any long term, peer reviewed event based data specifically sampled from the Woolshed Creek catchment, the default MUSIC parameters have been accepted as the recognised best input.

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The Water Sensitive Urban Design General Code recommends an approach to water quality parameters whereby event mean concentrations (EMC) values are used in the MUSIC model. The code states that the reason for this is to avoid the variation in model output with concurrent models run with unchanged parameters. Typically this variation is considered to be minor and within the level of accuracy reasonably accepted in dynamic computational models such as MUSIC. The stochastic pollutant concentrations reflect the observed stochastic variation in stormwater runoff from urbanised catchments throughout the world. It is important to ensure that any MUSIC model is run over an extended period (5 years as a minimum) when assessing water quality performance and the model should be run on short (6 minute) time steps to enable accurate interpretation of system operation (such as inundation frequency analysis).

8.6.2 Soils Calibration

The calibrated soil parameters provided in the Water Sensitive Urban Design General Code have been applied in the modelling of the Majura Valley investigation areas. In reality, a detailed soils calibration exercise will involve and in depth geotechnical assessment of soils across the catchment and would likely yield variable soil properties across the site. In modelling development areas, the influence of runoff from impervious surfaces will always direct the WSUD strategy as the impervious runoff volumes will always greatly exceed the pervious runoff volumes. The approximation of soils parameters for MUSIC modelling is accepted industry practice. We have compared the results estimated with the Design Code calibrated parameters with parameters developed from an earlier calibration exercise undertaken for a comparable catchment and found that the results in both instances are very similar.

Detailed calibration of the soil parameters used in MUSIC would require observed flow data from a watercourse (Woolshed Creek) with a defined contributing catchment. In the case of Woolshed Creek there is no gauge in the area off the potential development and therefore no long term flow record. Previous MUSIC calibration has been undertaken using a flow gauge located in the Four Mile Creek which lies approximately 20 km south of the Majura Valley. The Four Mile creek catchment is comparable to the Woolshed Creek with moderately sloping hill country rising to a ridge line orientated in a north south alignment. Climatic variation is not considered to be significant with comparable rainfall patterns.

8.6.3 Development models

MUSIC models were developed for each of the development precincts with runs representing the different scenarios and staging combinations within the precincts. Building areas were taken as 60% of the total investigation area (minus the identified constraints). This 60% proportion was taken as effective roof area. It is assumed that design objectives will stipulate maximisation of roof area connected with collection drains. A harvest efficiency of 80% has been applied to allow for some areas not suited to collection and excess flows during extreme rainfall events. Of the remaining 40% of the development area, 70% has been assumed to comprise impervious land use (roads, car parks and hard stand) with the remaining 30% being gardens and landscaped areas.

In consideration of land requirements, development staging and opportunity to integrate treatment elements within the landscape the preferred approach is to size treatment elements to achieve recognised best practice (80, 45, 45) and harvest a proportion of the treated water to further remove contaminants in accordance with the ACTPLA regional treatment targets (85, 70, 60). From the development areas, volumes of site generated runoff were quantified along with the potential maximum yields of treated water. The proportion of treated yield required to boost the treatment performance to achieve the regional targets was quantified. Treated yields were assessed on the basis of two distinct treatment strategies:

- Centralised treatment for each precinct in wetlands receiving combined rainwater and stormwater flows. This has been modelled as a single treatment wetland with a permanent pool depth of 400 mm and extended detention depth of 350 mm. In practice, the same level of treatment could be readily achieved in two or more separate wetland cells located in response to topography, urban design and space constraints. We have provided an indicative representation of treatment wetlands for each investigation area based on topography and existing natural drainage lines. These provide a visualisation of the land take required to achieve treatment targets but will be modified following further refinement of the development areas and overall site objectives.

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- Source separated treatment with rainwater collected at source (no additional land take required for treatment) from roof surfaces and stormwater (shed from roads, paving and general hardstand) diverted into bioretention systems with saturated zones (SZ) included. SZ bioretention systems have been modelled with a 200 mm detention depth, 500 mm filtration media depth and a 400 mm underlying saturated zone. The saturated zone improves the treatment efficiency (particularly nitrogen removal) and provides a reservoir of water which is available to plants during prolonged dry spells.

A final 'whole of development' model was run to calculate the land area required to achieve the regional targets in either online wetlands or ponds. This option is considered to be inferior as it will provide no environmental benefits to the Woolshed Creek, will require significant engineered stabilisation of Woolshed Creek and will prevent the inherent opportunities to integrate treatment elements within the development areas to enhance the landscape of the area.

8.7 Regional centralised treatment

A final consideration was given to the strategy of constructing a large scale centralised treatment element to capture and treat runoff from the entire catchment. This approach was modelled as runoff from the four investigation areas configured as the scenarios with the highest proportion of impervious land cover. These were:

- Investigation A scenario 2
- Investigation area B
- Investigation area C scenario 2
- Investigation area D scenario 2

MUSIC modelling predicts that to achieve the stated regional water quality targets of 85%, 70% and 60% for TSS, TP and TN respectively would require either a treatment wetland with a footprint approximately equal to 8% of the contributing impervious catchment or a large open water body pond with a footprint at 10% of the contributing impervious catchment. These land areas equate to approximately:

- 50 ha wetland
- 65 ha pond

Clearly these would be very significant structures with high earthworks costs. Sizes could be reduced with inclusion of distributed pre-treatment or integration with harvest initiatives. Constructing these centralised ponds as 'on line' water bodies at the downstream end of the Woolshed Creek will reduce the opportunities to rehabilitate the existing creek channel and will likely result in further degradation through stabilisation works. Section 8.4.1 details our reservations with regards to large open water bodies as water quality elements and we would specify the need for the inclusion of either pre-treatment upstream of any pond and/or recirculation treatment to manage the water quality within the pond/s. If ponds are considered desirable from a community amenity perspective, they could be included in a treatment train as storage of treated water and possible connected with wider non-potable water supply reticulation.

However, with stormwater treatment systems distributed in the catchment a pond/lake system could still be created to store treated stormwater for reuse in a regional network. Such a storage would be treated as a receiving water and be protected by the distributed network of stormwater treatment systems. This option also allows for the protection and rehabilitation of Woolshed creek. An online storage would interfere with creek connectivity, but in an ephemeral waterway this may not be critical for waterway health

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8.8 Summary of WSUD Recommendations and Strategy

The land areas specified in the above tables have been based on water quality objectives. Based on the MUSIC modelling using rainfall data from the Canberra Airport gauge treatment elements have been sized to remove 80% of TSS, 45% TP and 45% TN. This is achieved with a notional treatment time of 72 hours in a well vegetated wetland with bathymetry and hydraulics designed to optimise the ecological function of the system. All further functional and detailed design will need to be in accordance with the ACT Design Standards for Urban Stormwater Infrastructure and should be undertaken by a qualified and experienced designer familiar with such systems. The exact configuration and positioning of WSUD elements will in practice be based on more detailed information on specific development layouts. The integration of WSUD elements within the potential developments should be considered through the early stages of structure planning to ensure optimised outcomes both in terms of environmental performance and landscape amenity.

Iterative analysis has found that treatment wetland receiving all runoff (rain and stormwater) from the development areas will need to be designed with a vegetated surface area (measured at normal water level) equivalent to 3.5% of the contributing impervious catchment. These can be constructed as multiple wetland cells sized based on the same spatial relationship. This allows wetlands to be constructed (or expanded) as development staging progresses. Specific design of the treatment wetlands will need to be based on parameters used in modelling with the wetland bathymetry, planting specifications and hydraulic configuration based on appropriate system analysis and inundation frequency/duration analysis. Wetlands are typically designed with negligible infiltration into the subsoils. This is required to preserve the function of the wetland (i.e. avoid drying during summer), enable optimisation of harvestable yield and reduce uncontrolled interaction with the groundwater. Due to factors including topography, drainage grades, safe batter slopes and inlet zones (sedimentation basins) the final footprint of constructed wetlands is likely to be approximately 4 % of the contributing impervious catchment. The attached plan views provide a preliminary visual representation of these 4% land areas within the context of the sites. The location of these wetlands indicated on the plans is based on the existing topography of the area and likely drainage lines and sub-catchments.

Bioretention (rain garden) systems have been modelled with the inclusion of an underlying saturated zone. This layer comprises a 200 mm thick layer of higher porosity material mixed with a carbon source such as woodchips. The inclusion of the saturated zone has been found (and modelled) to improve the nitrogen removal efficiency and provide resilience to the plants in the upper filtration media during long dry periods such as that experienced in the Canberra region throughout the summer months. The saturated zone requires lining to avoid seepage losses. Monitoring of plant health will still be required during periods of drought and supplementary periodic irrigation with alternative water may be required. Iterative analysis has found that bioretention receiving all runoff from roads, paved areas and general hardstand within the development areas will need to be designed with a surface area (measured at top of filtration media) equivalent to 1.0% of the contributing impervious catchment. These can be constructed as multiple bioretention cells sized based on the same spatial relationship. Bioretention systems are well suited to be integrated into the development landscape and can be designed as linear systems along road corridors or nested systems within landscaped open spaces.

Third pipe reticulated non-potable water supply infrastructure should be included in servicing developments. Non-potable demands can include demands related to population rates (employees and residents) such as toilets and private open space irrigation. Analysis of runoff volumes indicates that these population based demands will be readily met by rainwater and/or stormwater.

Irrigation water can be supported either through the harvest of treated stormwater or the use of treated waste water from a multi precinct treatment plant. Irrigable areas will be dependent on storage sizes (irrigation has peak demands during low rainfall periods) and the crop types grown. Productive landscapes both within the development precincts and beyond can be supported. Other unspecified non potable demands can be realised and serviced within employment lands through the targeting of specific industries which require a quantified volume of non-potable water. Specific end users will determine the exact level of treatment required. This may include additional treatment such as filtration.

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The final size of the treatment elements will directly influence the volume of treated water available for harvest. By increasing the size of systems beyond the areas given, increased volumes of pollutants will be removed from the annual discharge and more treated water may become available for re-use. The decision to harvest further water (if any) may be governed by overall flow preservation in the existing Woolshed Creek whereby treated discharges are designed to match the predevelopment runoff characteristics. The option of harvesting additional water will likely necessitate the export of treated water outside of the development area. Downstream growth areas can be linked with gravity fed transfer pipes which will convey treated water to storages beyond the Majura Valley. Further water quality treatment may also be achieved throughout the development by dispersed passive treatment. This may include road side swales, riparian restoration along sections of Woolshed Creek, permeable paving and passive irrigation from paved surfaces. These have not been included in the modelling to date.

8.9 Cost estimation

Costs incurred for the construction of precinct wide treatment systems will vary significantly depending on the ultimate design of the overall development and final treatment strategy adopted. Stormwater treatment measures most appropriate for the respective precincts will need to be formulated in conjunction with development layout and configuration as part of precinct-based water management plans. Detailed costing of these measures can then be undertaken.

Approximate costs for typical systems can be estimated using guidelines provided by Landcom (2009). Total Acquisition Costs and Annual Maintenance Costs have been estimated for bioretention systems and constructed wetlands. A range of costs is given. The range reflects the relatively high start up cost and the increase in cost efficiency associated with the construction of larger systems. Therefore, on an aerial basis it is expected that smaller treatment systems designed to treat runoff from individual lots will be more expensive than large precinct-scale treatment systems.

8.9.1 Total Acquisition Costs

The estimates of Total Acquisition Costs are as follows:

Bioretention systems

- If implemented in a distributed way = \$1000 per m².
- If implemented at the precinct-scale = \$300 per m².

Constructed Wetlands

For constructed wetland systems sized between 100 m² and 1000 m² total acquisition costs are estimated to be between \$200 to \$400 per m². Smaller systems cost more on a per m² basis due to the high initial start up costs associated with construction.

8.9.2 Maintenance Costs

Annualised maintenance costs for these treatment systems have also been calculated. Like construction costs, maintenance also becomes less costly on an aerial basis for treatment systems that are larger rather than smaller. A range of estimates is provided to accommodate this.

Annualised maintenance costs are:

- Bioretention systems = \$2 to \$4 per m²
- Constructed wetland systems = \$3 to \$5 per m²

Maintenance costs will typically include general maintenance of public areas, litter control, weed control (especially during establishment phase) and inspection (with occasional repairs) of hydraulic structures (pipes/pits/weirs etc).

DRAFT**9.0 Staging Strategy**

ACTPLA's program of potential developments indicates that the order of development for Investigation areas will be C B/ D, then A. Water, sewer, gas, electricity and telecommunications have dependencies on infrastructure being extended through Areas C and D. However, each Investigation Area is not entirely dependent upon the other areas constructed as long as service corridors are allowed for. Table 20 summarises staging dependencies the Investigation Areas. Additional details are provided on the individual Investigation Areas in Section 6.2 of the attached appendices.

Table 20 Investigation Area Staging

Investigation Area	Service	Staging Comments
C		
	Water	Provide new distribution mains from Campbell Reservoir.
	Sewer	Extend trunk sewer to northern boundary of Investigation Area.
	Gas	Gas main from new off-take station. Infrastructure is dependent upon location of the off-take station: <ul style="list-style-type: none"> Location no. 1 – extend gas main into Investigation Area from east, and then extend north and south within Investigation Area. Location no. 2 – extend gas main south through Investigation Area B and into C.
	Electricity	Extend 11 kV feeders from new Eastlake Zone Substation through Investigation Area D and to northern limits of Investigation Area boundary. Construct distribution substation(s) within Investigation Area.
	Telecommunications	Extend TransACT infrastructure from Campbell to northern boundary of Investigation Area.
B		
	Water	Provide new distribution main from Upper Hackett Reservoir to northern and southern boundaries of Investigation Area. Construct new Majura Reservoir and provide transmission main north to Investigation Area boundary.
	Sewer	Extend trunk sewer from northern boundary of Investigation Area C to northern boundary of Investigation Area B.
	Gas	Gas main from new off-take station. Infrastructure is dependent upon location of the off-take station: <ul style="list-style-type: none"> Location no. 1 – extend gas main into Investigation Area B from northern boundary of Investigation Area C. Location no. 2 – extend gas main from off-take station north to northern boundary of Investigation Area.
	Electricity	Extend 11 kV feeders from northern boundary of Investigation Area C to northern boundary of Investigation Area B.
	Telecommunications	Extend TransACT infrastructure from northern boundary of Investigation Area C to northern boundary of Investigation Area B.
A		
	Water	Extend transmission mains (from Majura and Upper Hackett Reservoirs) from northern boundary of Investigation Area B north into Investigation Area A.
	Sewer	Extend trunk sewer from northern boundary of Investigation Area B into Investigation Area A.
	Gas	Extend gas main from northern boundary of Investigation Area B into Investigation Area A.
	Electricity	Extend 11 kV feeders from northern boundary of Investigation Area B into Investigation Area A.
	Telecommunications	Extend TransACT infrastructure from northern boundary of Investigation Area B into Investigation Area A.

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Investigation Area	Service	Staging Comments
D		
	Water	Extend transmission main from (Campbell Reservoir) from near Investigation Area C boundary into Investigation Area D (if required).
	Sewer	No interdependencies. Additional connections to trunk main located within Investigation Area D may be required.
	Gas	Extend gas main south from Investigation Area C into Investigation Area D (if required).
	Electricity	Connect to 11 kV underground feeders which have been extended through Investigation Area D as part of the works associated with Investigation Areas C.
	Telecommunications	Connect to TransACT infrastructure extended as part of Investigation Area C works. Extend to Investigation Area D as required.
	Water	Connect to distribution main extended as part of Investigation Area C works.
	Sewer	No interdependencies. Connect to trunk sewer located within Investigation Area D.

9.1 Additional investigations

The information presented in this report is based largely on desktop investigations, supplemented with extensive agency and stakeholder consultation. As such there are a number of limitations associated with the information provided, and as specific development scenarios become more clearly understood, some additional investigations may be required including:

- More detailed field assessments of vegetation in order to determine the definitive extent of Box Gum Woodland, in accordance with both ACT legislation and the Commonwealth EPBC Act.
- Contamination (if present) within the Investigation Areas has not been considered. As such a preliminary Phase 1 contamination assessment is recommended to identify any areas where, owing to historical land use activities, contamination that could influence or preclude development may be present.
- Liaison with the Majura Parkway design consultant regarding allowing for servicing corridors within the reserve of Majura Parkway and coordination of stormwater management and water quality within the Majura Valley. Construction of the Parkway will precede the potential developments, therefore it will be important to plan for the developments as part of the detailed design of Majura Parkway.

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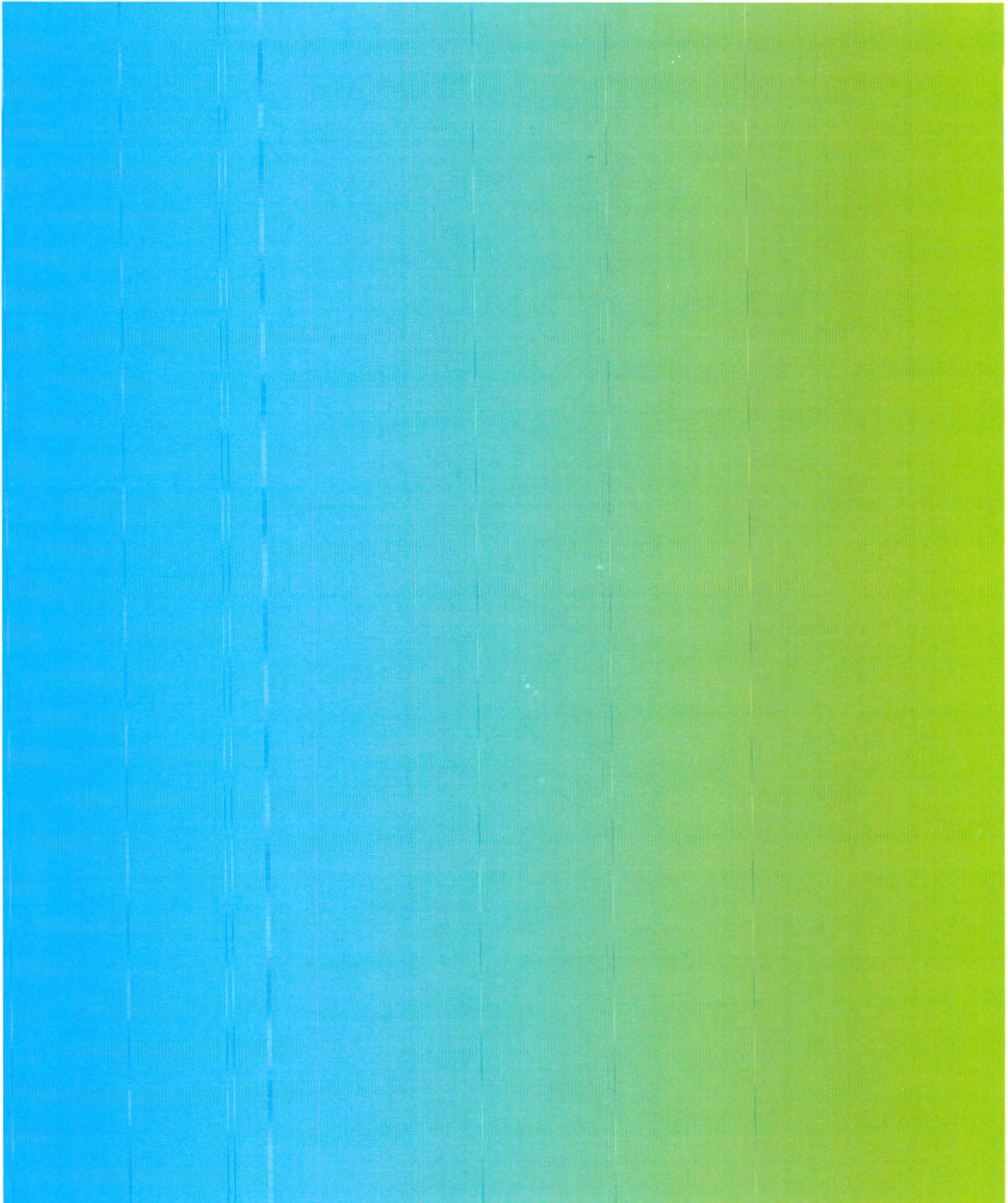
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Appendix A

Investigation Area A



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1.0 Zoning and Permissibility

Investigation Area A comprises part Designated Land under the National Capital Plan (NCP) and part Territory Land.

National Capital Plan

The far western portion of the Investigation Area is subject to the provisions of the NCP. This portion of the Investigation Area is known as 'The Inner Hills', which is a 'Designated Area' forming part of the 'Hills, Ridges and Buffer Spaces' under the NCP. The NCP provides that the 'Hills, Ridges and Buffer Spaces', are to remain substantially undeveloped in order to protect the symbolic role and Australian landscape character of the hills and ridges as the scenic backdrop to the Parliamentary Zone, Civic and other National Capital Investigation Areas.

Further, the NCP notes that 'The Inner Hills' provide the scenic backdrop and natural setting for Canberra's urban areas, therefore planning, design and development of this area as open space is considered to be central to the maintenance and enhancement of the National Capital.

Section 8.5 of the NCP deals with hills, ridges and buffer spaces, including 'The Inner Hills' Designated Area within which part of Investigation Area A lies. Section 8.5.3(h) lists the land uses which are permitted in these areas and includes 'public utility'.

The following policies are identified in relation to development within hills, ridges and buffer areas of relevance to the proposed project:

- The Inner Hills will be protected as key symbolic and landscape elements in the National Capital Plan expressing the defined land, water and municipal axes and providing the dominant backdrop feature to the city.
- The hilltops will continue to be used as key vantage points for viewing and understanding the National Capital. Development will be sited so as to minimise its visual impact on the Central National Area and
- The environment and Australian landscape character of the hills and ridges will be protected and enhanced to provide a unified landscape setting for the National Capital.
- The rural landscape in the areas adjacent to the ACT border between Hall and the Murrumbidgee River and along the Barton Highway will be retained as an intrinsic part of the National Capital character and with additional landscape treatment provide physical containment to the part of Belconnen and a buffer between Belconnen and Gungahlin.
- Black Mountain, Mt Taylor, Tuggeranong Hill and Isaacs Ridge will continue to provide locations for current telecommunications facilities

Appendix H to the NCP provides Design and Siting conditions for development in the Inner Hills area but does not include standards of relevance to development for the purposes of infrastructure and servicing as proposed by the project.

Chapter 12 of the NCP deals specifically with infrastructure and includes the following policies of relevance to the project:

- The planning and provision of electricity and telecommunications facilities should be undertaken in a manner which takes all reasonable steps to minimise the visual effects of transmission lines, substations and telecommunications facilities on the natural and built environments of the National Capital.
- Public utilities infrastructure and facilities for Commonwealth needs and activities, including those on National Land, shall be established and maintained at adequate capacity.

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Section 12.4 deals specifically with telecommunications infrastructure and includes the following policies for such infrastructure proposed within Designated Areas such as the Inner Hills area:

- Large scale facilities, such as towers and masts will only be approved where no other alternative exists and where the proposal does not create any significant disruption to the visual environment.
- No additional towers and masts will be approved on Red Hill, Mount Mugga, Black Mountain, Isaacs Ridge, Mount Pleasant or Mount Ainslie which:
 - Break the natural skyline;
 - Significantly impact on the side slopes.
- Ground level facilities such as equipment shelters and electrical equipment boxes are to be located in the least conspicuous position and are to be suitably screened from public view. Such facilities will generally not be permitted in front of buildings.
- Approval within Designated Areas for overhead cable rollout will only be given where overhead services already exist and where the National Capital Authority is of the opinion that the proposed cable will not impact adversely on the locality. Underground cabling is the preferred method.
- In Designated Areas, the National Capital Authority may withhold approval in any particular case where it is of the opinion that the proposed facility would impact adversely on the appearance of the building or the locality to an unacceptable degree.

The remainder of the Investigation Area is identified as Broadacre Areas. Although this land is subject to the Territory Plan, the NCP outlines special requirements for national land not included within a designated area of the NCP.

Territory Plan

The remainder of the investigation area along the far eastern side is subject to the provisions of the TP and is zoned NUZ1 – Broadacre.

The objectives of the NUZ1 zone are:

- *Make provision in a predominantly rural landscape setting for a range of uses which require larger sites and/or a location outside urban areas.*
- *Make provision for activities requiring clearance zones or protection from conflicting development*
- *Ensure that development does not adversely impact or visually intrude on the landscape and environmental quality of the locality*
- *Ensure, where appropriate, that development and the use of land does not undermine the future use of land which may be required for urban and other purposes.*

In the NUZ1 Broadacre zone, major utility installations are assessable under the merit assessment track.

The Non-Urban Zones Development Code is applicable to development within the NUZ1 zone. Of relevance to the project is section 7.3 of the Code which deals with utilities and provides the following rule:

A Statement of Compliance from each relevant utility provider (for water, sewerage, stormwater, electricity and gas) is provided, which confirms that the location and nature of earthworks, utility connections, proposed buildings, pavements and landscape features comply with utility standards, access provisions and asset clearance zones.

The associated criteria states that:

If a Statement of Compliance is not provided the application will be referred to the relevant agency in accordance with the requirements of the Planning and Development Act 2007.

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2.0 Overview of Existing Services

Sections 2.1 through 2.5 provide a description of existing services infrastructure located within Investigation Area A. An overview of existing services located within and adjacent to all Investigation Areas is located within Section 3.0 in the body of the main report.

2.1 Water

Existing and proposed water infrastructure located within and adjacent to Investigation Area A is illustrated in Figure 3.

ActewAGL's records do not show any water infrastructure located within Investigation Area A. Existing lessees may obtain their potable water from other sources, such as rainwater collection tanks.

A 150 mm diameter main is located adjacent to the southern boundary of Investigation Area A. This main provides service to the AFP site located to the south of Investigation Area A.

2.2 Sewer

Existing and proposed sewer infrastructure located within and adjacent to Investigation Area A is illustrated in Figure 4.

ActewAGL's records do not show any sewer infrastructure located within Investigation Area A. Existing lessees may use septic systems.

A 65 mm diameter sewer rising main owned by Defence is located adjacent to the southern boundary of the Investigation Area. It connects the Defence property (to the east of Investigation Area A) to the gravity main located to the northeast of the airport.

AFP (south of Investigation Area A) has an on-site sewer treatment plant, and does not connect into the ActewAGL system.

2.3 Gas

Existing and proposed gas infrastructure located within and adjacent to Investigation Area A is illustrated in Figure 5.

A 250 mm diameter high pressure steel gas primary main is located in the road reserve of Majura Road and extends across (east-west) across Investigation Area A.

2.4 Electricity

Infrastructure is located throughout the Investigation Area in the form of high (11 kV) and low voltage, and underground and overhead cables. Existing and proposed electricity infrastructure located within and adjacent to Investigation Area A is illustrated in Figure 6.

2.5 Telecommunications

Existing and proposed telecommunications infrastructure located within and adjacent to Investigation Area A is illustrated in Figure 7.

Neither TransACT nor ICON infrastructure is located within Investigation Area A. Telstra infrastructure is located within the Investigation Area, primarily parallel to Majura Road. The Sydney-Melbourne-Gundaroo low/ high integrity data is also located within the Investigation Area.

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3.0 Planning Constraints and Opportunities

3.1 ACTPLA Potential Development Scenarios

Proposed development scenarios and permissibility for Investigation Area A are summarised in the table below.

Table 1 Investigation Area A – Development Scenarios

Investigation area / development scenario	Existing uses	Permissible land uses
<p><u>Scenario A</u></p> <p>No change</p>	Rural uses, Mount Majura Winery, Truffle farm.	<p>Land subject to the NUZ1 Broadacre Zone under the Territory Plan, permits: agriculture, caravan park/camping ground, farm tourism, outdoor recreation facility, tourist facility.</p> <p>Land subject to the Designated Area – Inner Hills under the National Capital Plan permits the following relevant land uses: agriculture, general farming, landscape buffer.</p>
<p><u>Scenario B</u></p> <p>Includes resort or tourist facility on 20 ha. Balance of area unchanged.</p>	As above	Tourist facility / tourist resort are permissible land uses.

Under Scenario A of Investigation Area A, potential land uses are identified as a continuation of current uses, including rural, tourism and recreation as defined under the Territory Plan below:

- Agriculture – means broadacre animal farming, crop and pasture production, and horticulture for commercial wholesale production, but does not include animal husbandry or any cultivation or animal farming carried out primarily for the personal enjoyment of, or consumption by, the owner(s) or occupant(s) of land.
- Ancillary use – means the use of land for a purpose that is ancillary to the primary use of the land.
- Communications facility – means the use of land for the provision of facilities for postal, telecommunications and other communication purposes including facilities used for receiving and transmitting radiated signals using radio masts, towers, and antennae systems but does not include cabling or ducting used for the carrying of electromagnetic signals.
- Caravan park/camping ground – means the use of land for the placement of caravans or tents for the purpose of temporary accommodation and may include cabins for overnight and holiday accommodation, amenity buildings, recreational and entertainment facilities, manager's office and residence and shops which cater for the occupants of the caravan park/camping ground.
- Farm tourism – means operating a craft workshop, shop, guesthouse, outdoor recreation facility, overnight camping area or other activity for tourists that is secondary to the use of the land for the primary purpose authorised by the lease.
- Outdoor recreation facility – means the use of land for a recreation facility serving the sporting or recreational needs of people where the activities are undertaken predominantly outdoors.
- Tourist facility – means the use of land for providing entertainment, recreation, cultural or similar facilities for use mainly by the general touring or holidaying public and may include a restaurant, cafe, bar, service station, tourist accommodation and the retail sale of arts and crafts, souvenirs, antiques and the like.

In the Inner Hills Designated Area under the NCP, agriculture, general farming and landscape buffer are permitted land uses.

A Draft Variation to the Territory Plan will be required to change the land use zoning for commercial/ employment areas.