

- Proposed Electrical 11kV Underground
- Existing Electrical 11kV Overhead
- Existing Electrical 11kV Underground
- Existing Electrical LV Overhead
- - Existing Electrical LV Underground
- Powerpoles
- Investigation Area Boundary
- Proposed Majura Parkway & VHST Route

MAJURA VALLEY ENGINEERING FEASIBILITY STUDY
INVESTIGATION AREA B - ELECTRICITY SERVICES

Source: ActewAGL (2009), ACTPLA (2009), SMEC (2009)

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5.0 Water Sensitive Urban Design Strategy

Investigation Area B was considered and assessed as three distinct regions.

- The first region comprises 486ha of land presently used for low density rural and recreational uses. This land area has been identified as most likely for future development within the investigation area. Constraints of 76 ha were identified for this investigation area. Potential development is staged with 0% by 2021, 50% by 2031 and 100% by 2041.
- The remaining two regions comprise 82 ha of land constituting Designated Land (National Capital Plan) and an additional 82 ha of land within the Majura Pines recreation area. This land is not been considered for potential development and has not been included in the subsequent modelling of development impacts.

Based on the above, only the 486 ha of potential development land within investigation area B was modelled for stormwater runoff. MUSIC modelling was undertaken to size treatment elements for best practice water quality load reduction objectives (80/45/45) for rainfall runoff discharged from the site. Maximum treated yields represent the treated component of water through the system with overflows resultant from either peak storm events or sustained rainfall bypassing the treatment elements. The proportion of treated flows required to further boost performance in accordance with the regional targets was quantified. ACTPLA development targets (60/45/40) will be exceeded in all instances. Table 2 summarise the key findings.

Table 2 Treatment areas and yields for Investigation Area B

Investigation Area B/ scenario 1			
	2021	2031	2041
Pre development runoff (ML/yr)	218	218	218
Total developable area (ha)	.	205	410
Development impervious area (ha)	.	180	361
Post development runoff (ML/yr)	.	1,090	2,175
Investigation Area wetland area @ 3.5% total impervious (m ²)	.	63,140	126,280
Maximum treated yield from wetlands (ML/yr)	.	475	953
Harvested volume to achieve regional targets (ML/yr)	.	240	475
Distributed SZ bio area @ 1% road/hardstand (m ²)	.	5,740	11,480
Maximum treated yield from bio (ML/yr)	.	203	406
Maximum yield from roof area (ML/yr)	.	610	1,220

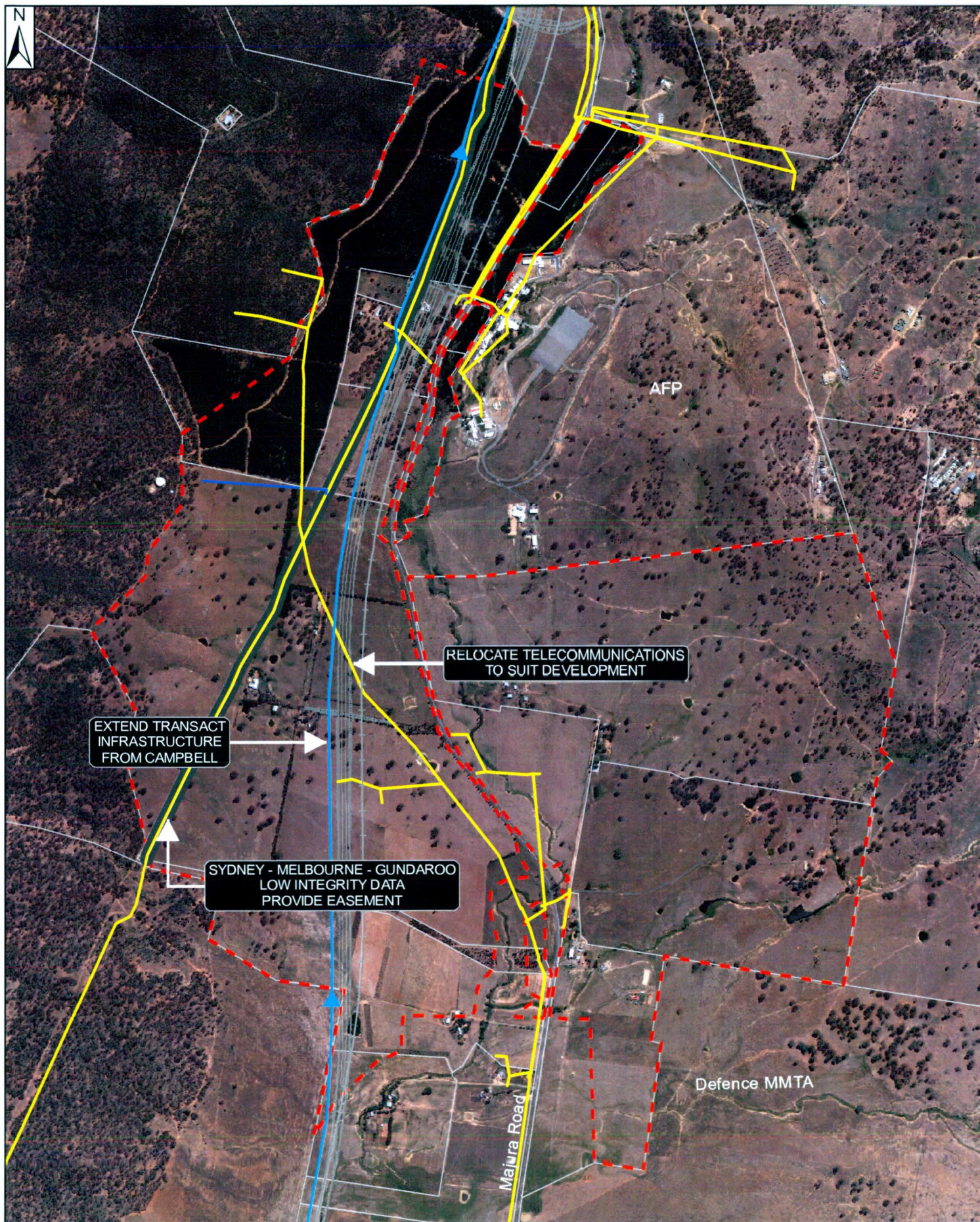
These results show an order of magnitude increase in runoff from the 410ha potentially developable area following full construction by 2041. Of the 1,960 ML/yr additional water resultant from development, approximately 49% (953 ML/yr) could be harvested from centralised treatment wetlands sized for best practice. By harvesting directly from roof surfaces (assuming an 80 % capture efficiency) and using distributed SZ bioretention systems up to 83% (1,630 ML/yr) of the additional runoff could be harvested. All areas required for treatment and resultant potential maximum yields are scaled by the percentage of development completed (i.e. 50% of development is proposed by 2031 with 50% reductions in land take and yields at this time).

Harvesting up to 475 ML/yr of the treated stormwater will increase the removal of contaminants in accordance with the Water Sensitive Urban Design General Code regional targets. This harvested volume represents approximately 50% of the outflow from treatment wetlands sized for best practice and all of the flow from bioretention systems sized for best practice. This 475 ML/yr could support approximately 95 ha of open space irrigation (based on 500 mm annual application). Based on the assumed development densities this area exceeds the anticipated area of open space (49 ha). Further demands can be serviced including internal non potable uses (i.e. toilets and/or commercial uses), irrigation of planted zones within constraint areas or reticulated distribution to out of precinct demands/storages.

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Based on the treatment provided in the wetland sized at 3.5% of total impervious area and harvest of flows to achieve regional targets the following approximate mean annual pollutant load reduction can be achieved:

- Total Suspended Solids (TSS) up to 220,000 kg/yr
- Total Phosphorous (TP) up to 417 kg/yr
- Total Nitrogen (TN) up to 3,000 kg/yr

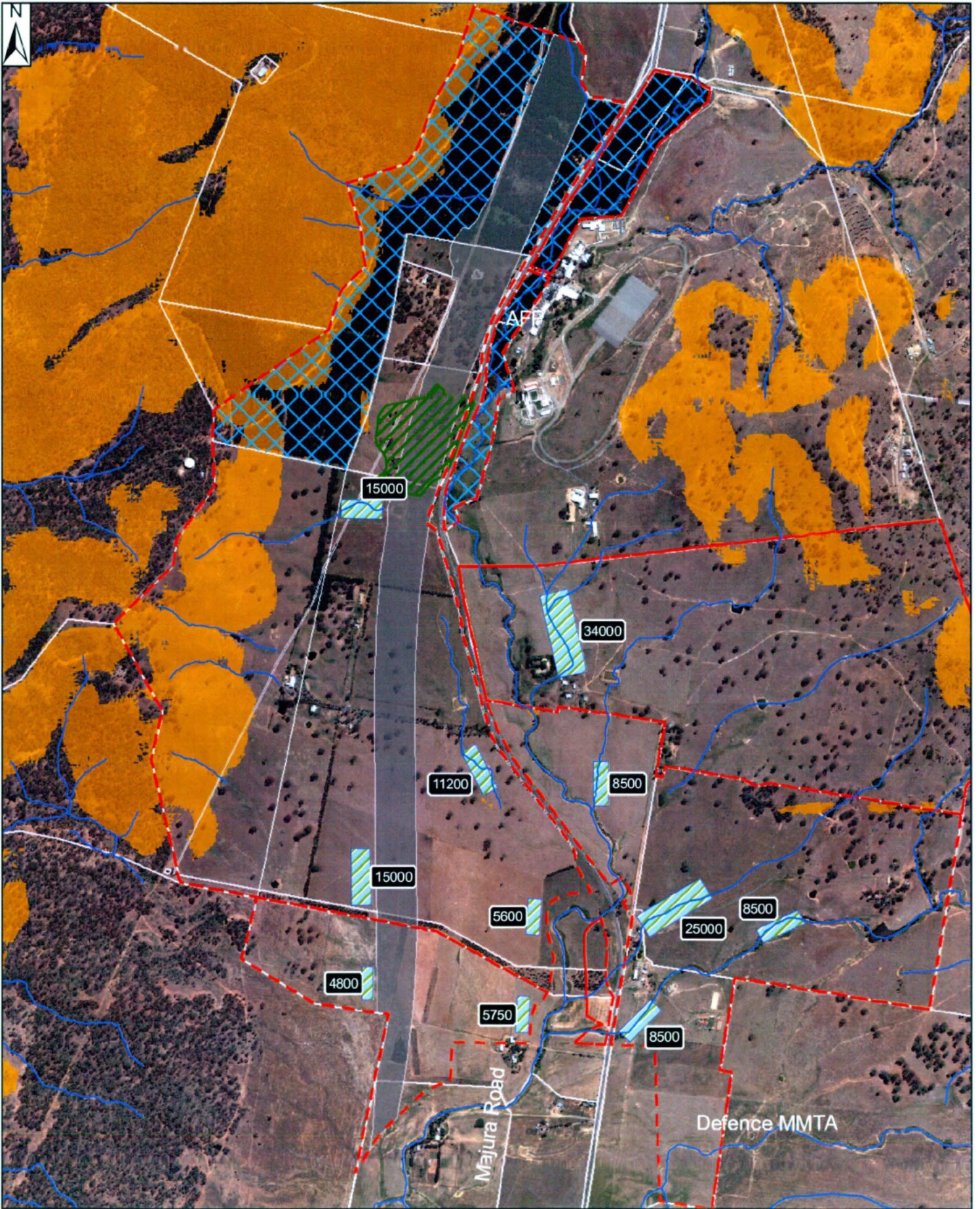


- Proposed TransACT
- Existing Telstra Optical Fibre
- Existing Telstra
- Investigation Area Boundary
- Proposed Majura Parkway & VHST Route

MAJURA VALLEY ENGINEERING FEASIBILITY STUDY
INVESTIGATION AREA B - TELECOMMUNICATIONS SERVICES
Source: Telstra (2009), TransACT (2009), Optus (2009), Diverse (2009), ACTPLA (2009), SMEC (2009)

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- Drainage Lines
- ⊗ Majura Pines Rec Area
- Slope >15%
- Treatment Wetland (2041 Scenario)
- Investigation Area B Boundary
- Box Gum Woodland EEC
- Physical & Servicing Constraint
- 8500 Area (m2)

**MAJURA VALLEY ENGINEERING FEASIBILITY STUDY
INVESTIGATION AREA B - INDICATIVE
FOOTPRINT AND LOCATION OF WETLANDS**

Source: Telstra (2009), TransACT (2009), Hogg (2009),
Navin (2009), ACTPLA (2009), SMEC (2009)



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6.0 Cost Estimate and Staging

6.1 Estimated Cost of Construction

6.1.1 Services Infrastructure

The approximate costs for providing water, sewer, electricity, telecommunications, and gas services to Investigation Area B are detailed in Table 3.

Table 3 Summary of Investigation Area B costs

Description	Approximate Cost (excluding GST)		Comment
Water Distribution mains from the Upper Hackett and Majura reservoirs to the Investigation Area boundary	\$3,360,000		Developer responsible for cost of distribution mains. Cost of reservoir, pump station and mains between reservoirs borne by ActewAGL.
Sewer Extend trunk sewer main from Investigation Area B to Investigation Area C.	\$3,710,000		FSTP and MSPS improvements by ActewAGL at ActewAGL's expense.
Electricity 11kV overhead to underground relocation	\$2,460,000		ActewAGL will be responsible for extending 11 kV feeders from Eastlake Zone substation.
Telecommunications Extend TransACT from Investigation Area C into through Investigation Area B.	\$300,000		Approximate cost. Final cost to developer will be a percentage of TransACT's costs and will be determinate by TransACT at a later date.
Gas	Option 1 \$470,000	Option 2 \$750,000	Option 1: Off-take station located within Investigation Area B. Option 2: Off-take station located within Investigation Area C.
Subtotal:	\$10,300,000	\$10,580,000	
40% Contingency:	\$4,120,000	\$4,232,000	
Investigation Area B Total:	\$14,420,000	\$14,812,000	

6.1.2 Water Sensitive Urban Design Strategy

Costs incurred for the construction of Investigation Area 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 Investigation Areas will need to be formulated in conjunction with development layout and configuration as part of Investigation Area-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 areal basis it is expected that smaller treatment systems designed to treat runoff from individual lots will be more expensive than large Investigation Area-scale treatment systems.

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6.1.2.1 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 Investigation Area-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.

6.1.2.2 Maintenance Costs

Annualised maintenance costs for these treatment systems have also been calculated. Like construction costs maintenance also becomes less costly on an areal 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).

6.2 Staging

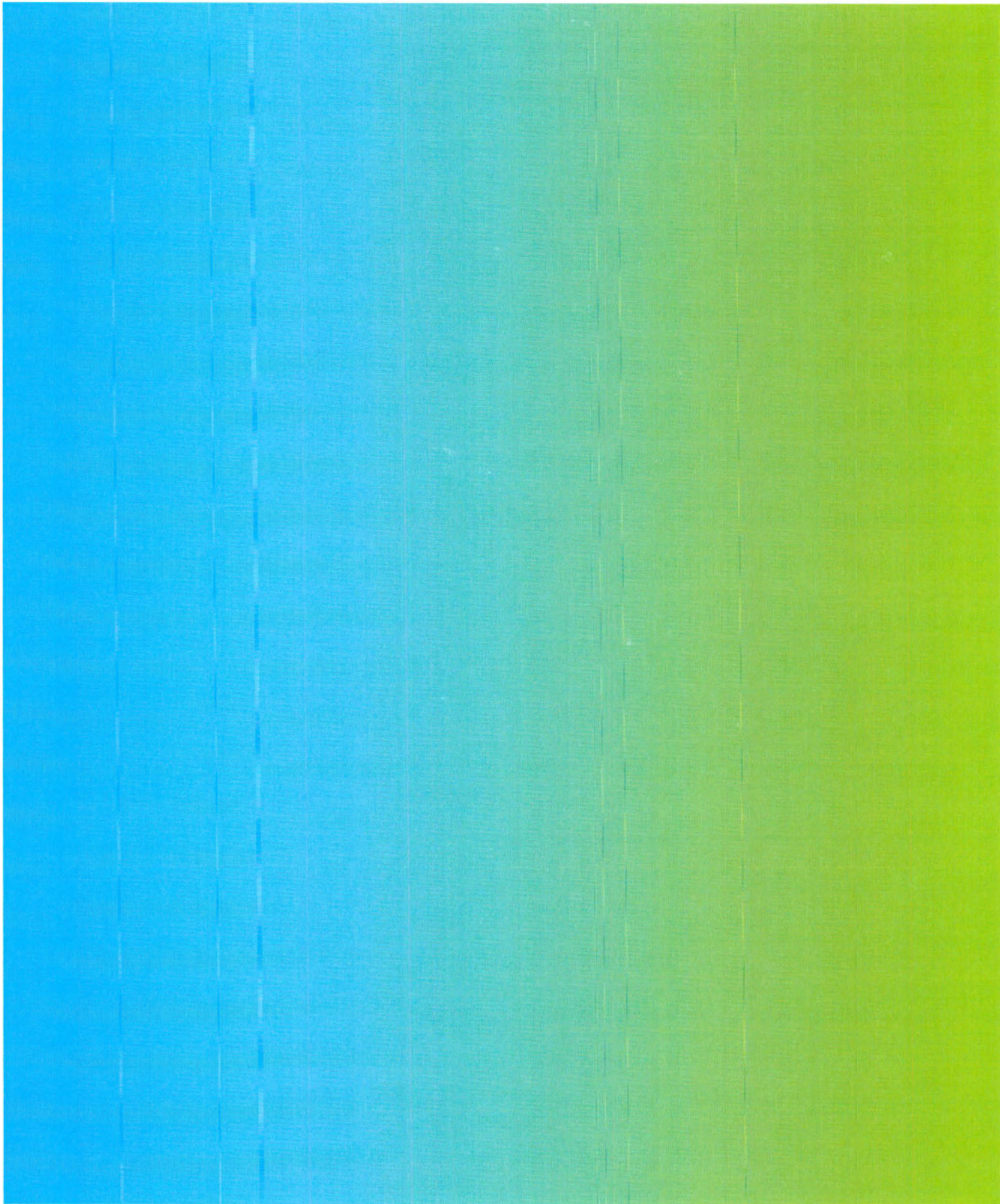
ACTPLA's program of potential developments indicates that Investigation Area B will be developed after Investigation Areas C and prior to A and D. Sewer, gas, electricity and telecommunications have dependencies of on infrastructure being extended through Areas C and D. However, Investigation Area B is not dependent upon potential developments being constructed within those areas provided service corridors are allowed for. Table 4 summarises staging dependencies for Investigation Area B. Overall staging is discussed in more detail in Section 9.0 in the body of the main report.

Table 4 Investigation Area B Staging

Service	Staging Comments	Investigation Area Dependencies
Water	Majura reservoir and distribution mains from Majura and Upper Hackett must be constructed prior to development.	None
Sewer	Extend trunk sewer from Investigation Area C through Investigation Area B.	Trunk sewer in Investigation Area C.
Gas	Gas main from new off-take station to Investigation Area boundary.	Dependent on location of off-take station. Gas infrastructure may be required within Investigation Areas B and C or only B.
Electricity	11 kV feeders from new Eastlake Zone Substation and construction of distribution substation.	11 kV feeders likely extended through Investigation Areas D and C then into B.
Telecommunications	TransACT infrastructure extended from Campbell.	Infrastructure to be extended through Investigation Area C and into B.

Appendix C

Investigation Area C



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1.0 Zoning and Permissibility

Land within Investigation Area C is zoned NUZ1 Broadacre under the TP and as discussed major utility installations are assessable under the merit assessment track. The relevant Development Code for the Non-Urban Zones Development Code is discussed in the main body of the report.

In addition, the Territory Plan Map indicates that the southern border of the Investigation Area is subject to special requirements as it flanks the Main Avenues and Approach Routes, as described under the NCP.

The NCP provides that it is in the interests of the National Capital that development flanking Approach Routes to the city is of a type and quality complimentary to the role and status of the city. The relevant Approach Route in Investigation Area C is Fairbairn Avenue. Development is to conform to Development Control Plans agreed by the Authority which seek to enhance the surrounding predominantly rural character and landscape outside the urban areas. As the Approach Routes enter the built up areas, the emphasis shall shift to a more formal character. Therefore, development of Approach Routes will be subject to development control that has been agreed with by the Authority, to ensure development that occurs along these Approach Routes is of a kind that is considered appropriate for these areas.

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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 B. 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 C is illustrated in Figure 3.

A 225 diameter main extends across Investigation Area C from Fairbairn Avenue to Majura Road. It provides service to the Canberra International airport.

The Campbell reservoir (TWL 656) is located to the west of Investigation Area C.

2.2 Sewer

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

The 675 mm diameter trunk sewer main extends through Investigation Area C.

2.3 Gas

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

No gas infrastructure is present within Investigation Area C. A 250 mm diameter high pressure steel main is located adjacent to the Investigation Area, in the road reserve of Majura Road.

2.4 Electricity

Existing and proposed electricity infrastructure located within and adjacent to Investigation Area C is illustrated in Figure 6.

Infrastructure is located throughout the Investigation Area in the form of high (11 kV) and low voltage, both overhead and underground.

2.5 Telecommunications

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

No existing telecommunications infrastructure is located with Investigation Area C. TransACT, Telstra, Optus and ICON are located adjacent to the southern boundary of 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 C are summarised in Table 1 below.

Table 1 Investigation Area C – Development Scenarios

Investigation area / development scenario	Existing uses	Permissible land uses
Scenario A Whole Investigation Area	Rural	Land subject to the Territory Plan permits: communications facility, transport depot, store (storage), defence installation.
Scenario B Whole Investigation Area + Defence land if transferred from Commonwealth	Rural	Land subject to the Territory Plan permits: transport depot, store (storage), defence installation.

Under Scenario A and B of Investigation Area C, industry is identified as a potential future land use, which is comprised of a number of sub-categories.

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

3.2 Summary of Constraints

3.2.1 Physical Features and Constraints

Investigation Area C lies at the southern end of the Majura Valley, immediately north of the intersection of Majura Road and Fairbairn Avenue, and to the northwest of the Canberra Airport. Topographically, Investigation Area C is generally flat, sitting in the flood plain of the Woolshed Creek, as such the height of the Investigation Area does not vary greatly from an approximate 570m. The Investigation Area is characterised by a distinct lack of canopy trees, save for some specimens who grow in the immediate riparian zone adjacent to Woolshed Creek. The majority of the Investigation Area is a mix of exotic pasture, native grassland pasture, and components of the natural temperate grassland community, which is recognised as an area exhibiting ecological characteristics of considerable significance, given the diversity and abundance of threatened species recorded from the surrounding areas.

Woolshed Creek

Woolshed Creek (refer to Section 4.0 of the main report) is located within Investigation Area B. All land located within Woolshed Creek's 100 year flood line is included as a constraint, i.e. not developable.

Easements

Easements will be required for existing services located within Investigation Area C, as described in Section 4.0. Service authorities were not able to provide required easement sizes, so a width of 5 m has been assumed for both ActewAGL's 225 mm diameter water main and trunk sewer main.

Majura Parkway

A corridor has been allowed for the future Majura Parkway and VHST. The corridor extends approximately 25 m to either side of the parkway's anticipated limit of earthworks.

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3.2.2 Ecological Features and Constraints

From an ecological perspective, the key feature of the lower Majura Valley, of which Investigation Area C is a part, is the extensive areas of natural temperate grassland and native pasture. The significance of these features is based on the fact that the grassland is listed as an endangered ecological community, and is known to support a number of threatened species, including the Grassland Earless Dragon, the Golden Sun Moth, and the striped Legless Lizard. The assessment of ecological opportunities and constraints prepared by David Hogg Pty Ltd identified this area as being one of the most significant areas in the ACT for threatened species conservation.

Investigation Area C largely avoids these constraints, however based on the information provided in David Hogg Pty Ltd assessment, and the more recent ecological assessment prepared for the Majura Parkway Environmental Impact Statement (EIS), there are some notable ecological constraints located within Investigation Area C. These constraints are present in Figure 1, and include:

- An extension of the Grassland Earless Dragon Habitat, which lies adjacent to the Mount Ainslie Nature Reserve, into Investigation Area C.
- A small patch of identified Golden Sun Moth habitat, identified from the recording of seven individuals during fieldwork for the Majura Parkway EIS (it should be noted that this constraint exists almost entirely within the footprint of the proposed alignment of Majura Parkway).
- A small patch of Striped Legless Lizard, and adjacent Golden Sun moth Habitat on the western side of the existing Majura Parkway, and adjacent to the northern end of the Canberra Airport.

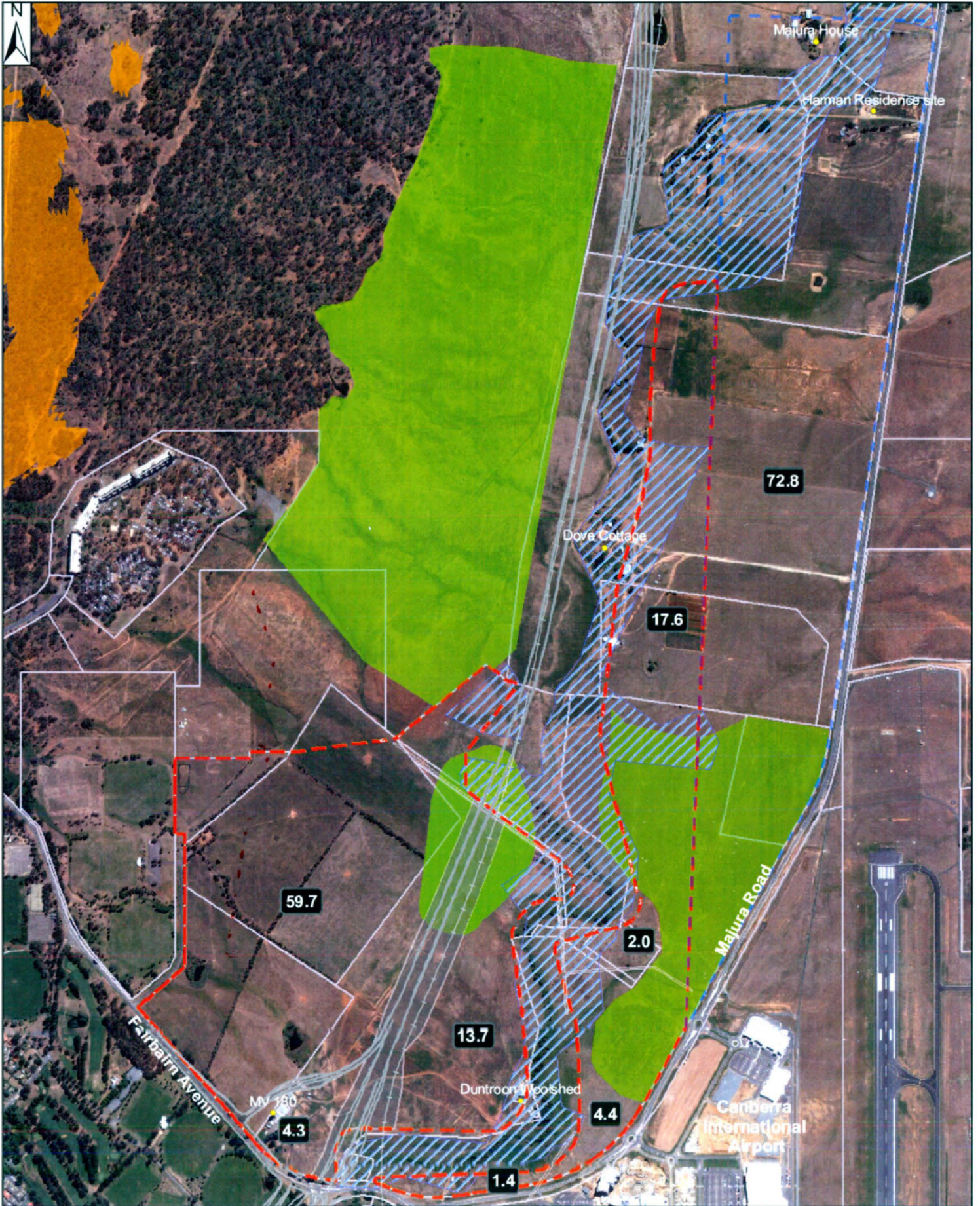
It is likely that any major development proposal within or directly adjacent to these areas would involve extensive and detailed environmental assessment under both the *ACT Planning and Development Act 2007* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*.

3.2.3 Heritage Features and Constraints

Within Investigation Area C, there are a number of identified heritage sites considered to be of moderate to high heritage significance. In addition there are a number of other potential heritage sites, which to date have not been assessed in detail. Figure 1 presents an indication of where these sites exist in Investigation Area C. The assessment completed by Navin Officer in 2007 proposed an indicative assessment for some of these sites, as presented in more detail below:

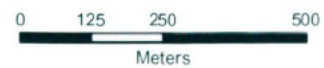
- Duntroon Woolshed is located adjacent to Woolshed Creek in the south eastern corner of Investigation Area C. The site was built in three stages, and used as a shearing shed between c1833 – 1912; it was later used as a place for Presbyterian services. The site is considered to have high regional significance, being listed on the ACT Heritage Places Register, reserved on Territory Plan, Register of the National Trust (ACT), Register of the National Estate, and the Commonwealth Heritage List. The management recommendations for the site involve conservation *in situ* with an appropriate contextual buffer and follow the existing conservation strategies.
- Dove Cottage is a nineteenth century cottage and shearing shed, and former residence of the Dunn family, then Jo and Esther Mayo (c.1915). Poplars are said to have been planted by Jo Mayo c.1880 and the cottage is said to date from 1838. The buildings in the complex are in relatively poor condition. Depending on the exact footprint of the site, it is considered that Dove Cottage exists just outside the boundaries of Investigation Area C. Regardless, the management recommendations include conservation *in situ*, and the completion of a detailed recording and assessment of site's significant elements, with a view to establishing an appropriate plan of management.

Given the desktop nature of the review of heritage constraints conducted to date, a number of potential heritage issues have been identified, which would need to undergo further specific assessment in order to definitively ascertain the influence these sites would have on future development activities. The main consideration in this respect is determining the significance of these heritage sites (currently not listed on any statutory registers), and in doing so understanding the level of development which would be acceptable, and to what degree these sites would practically influence development generally.



MAJURA VALLEY ENGINEERING FEASIBILITY STUDY
INVESTIGATION AREA C - CONSTRAINTS
 Source: ActewAGL (2009), ACTPLA (2009), SMEC (2009), Hogg (2009), Navin (2009)

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3.3 Net Developable Area

There are physical and servicing constraints within Investigation Area C, as discussed in Section 3.2. As noted in Table 9 of the main report, there are two potential development scenarios for Investigation Area C. The actual scenario is dependent upon the nation land located to the east of Investigation Area C is transferred to the Territory (Scenario B).

The two potential development scenarios are graphically illustrated below in Figure 2. Physical and environmental constraints account for 33% (Scenario A) and 30% (Scenario B) of the entire Investigation Areas.

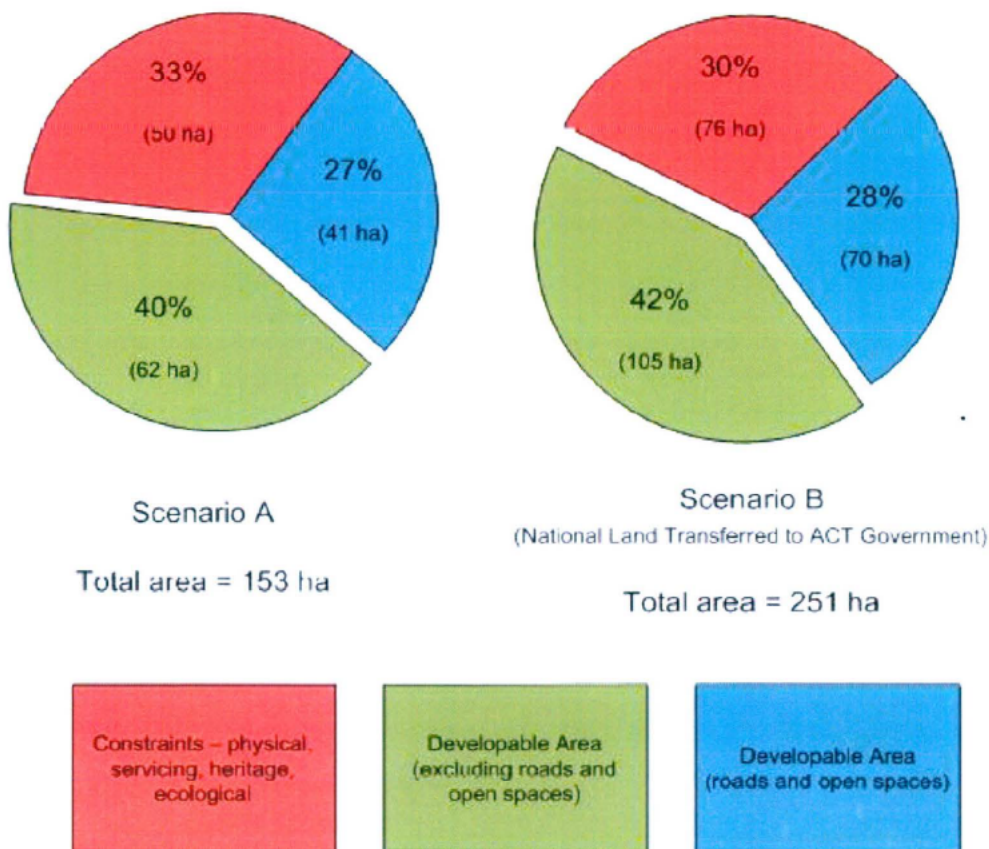


Figure 2 Potential development scenario