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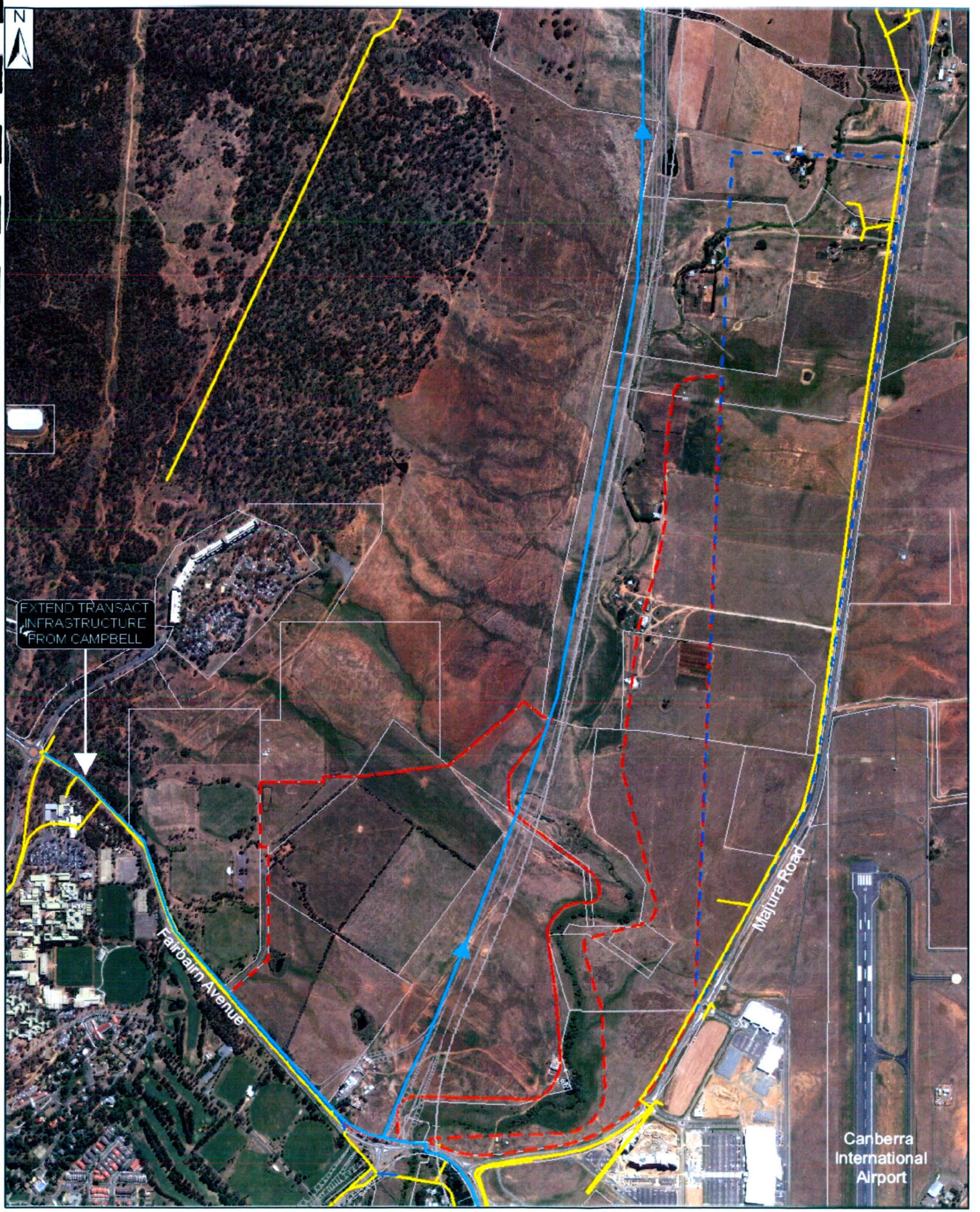

Proposed TransACT
Existing Telstra Optical Fibre
Existing Telstra
National Land
Investigation Area Boundary
Proposed Majura Parkway & VHST Route

MAJURA VALLEY ENGINEERING FEASIBILITY STUDY

INVESTIGATION AREA C - TELECOMMUNICATIONS SERVICES

Source: Telstra (2009), TransACT (2009), Optus (2009), Diverse (2009), ACTPLA (2009)

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5.0 Water Sensitive Urban Design Strategy

Development of Investigation Area C considered two scenarios.

- Scenario 1 was based on 153 ha of land identified in Investigation Area; development is staged with 75% by 2021 and 100% by 2031.
- Scenario 2 was based on the 153 ha in scenario 1 plus additional land presently occupied by the Australian Defence Force; development is staged with 75% by 2021 and 100 % by 2031.

MUSIC modelling was undertaken to size treatment elements for best practice water quality objectives (80, 45, 45) for rainfall runoff discharged from the site. Maximum treated yields represent the treated component of water through the proposed systems with overflows resultant from either peak storm events or sustained rainfall bypassing the treatment elements. Table 2 and Table 3 summarise the key findings.

Table 2 Treatment areas and yields for Investigation Area C/ scenario 1.

Investigation Area C/ scenario 1			
	2021	**2031**	**2041**
Pre development runoff (ML/yr)	60	60	60
Total developable area (ha)	89	118	118
Development impervious area (ha)	78	104	104
Post development runoff (ML/yr)	470	626	626
Investigation Area wetland area @ 3.5% total impervious (m2)	27,258	36,344	36,344
Maximum treated yield from wetlands (ML/yr)	203	271	271
Harvested volume to achieve regional targets (ML/yr)	100	135	135
Distributed SZ bio area @ 1% road/hardstand (m2)	2,478	3,304	3,304
Maximum treated yield from bio (ML/yr)	87	115	115
Maximum yield from roof area (ML/yr)	264	306	306

These results show an order of magnitude increase in runoff from the 118 ha potential developable area following full construction by 2031. Of the 566 ML/yr additional water resultant from development, approximately 48% (271ML/yr) could be harvested from centralised treatment wetlands sized for best practice. By harvesting directly from roof surfaces (assuming 80 % capture efficiency) and using distributed SZ bioretention systems up to 74% (420 ML/yr) of the additional runoff could be harvested. All areas required for treatment and resultant potential maximum yields can be scaled by the percentage of development completed (i.e. 75% of development is proposed by 2021 with 25% reductions in ultimate land take and yields at this time).

Harvesting up to 135 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 135 ML/yr could support approximately 27 ha of open space irrigation (based on 500mm annual application). Based on the assumed development densities this area exceeds the anticipated area of open space (14 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.

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 62,500 kg/yr
- Total Phosphorous (TP) –up to 120 kg/yr
- Total Nitrogen (TN) –up to 835 kg/yr

Table 3 Treatment areas and yields for Investigation Area C/ scenario 2.

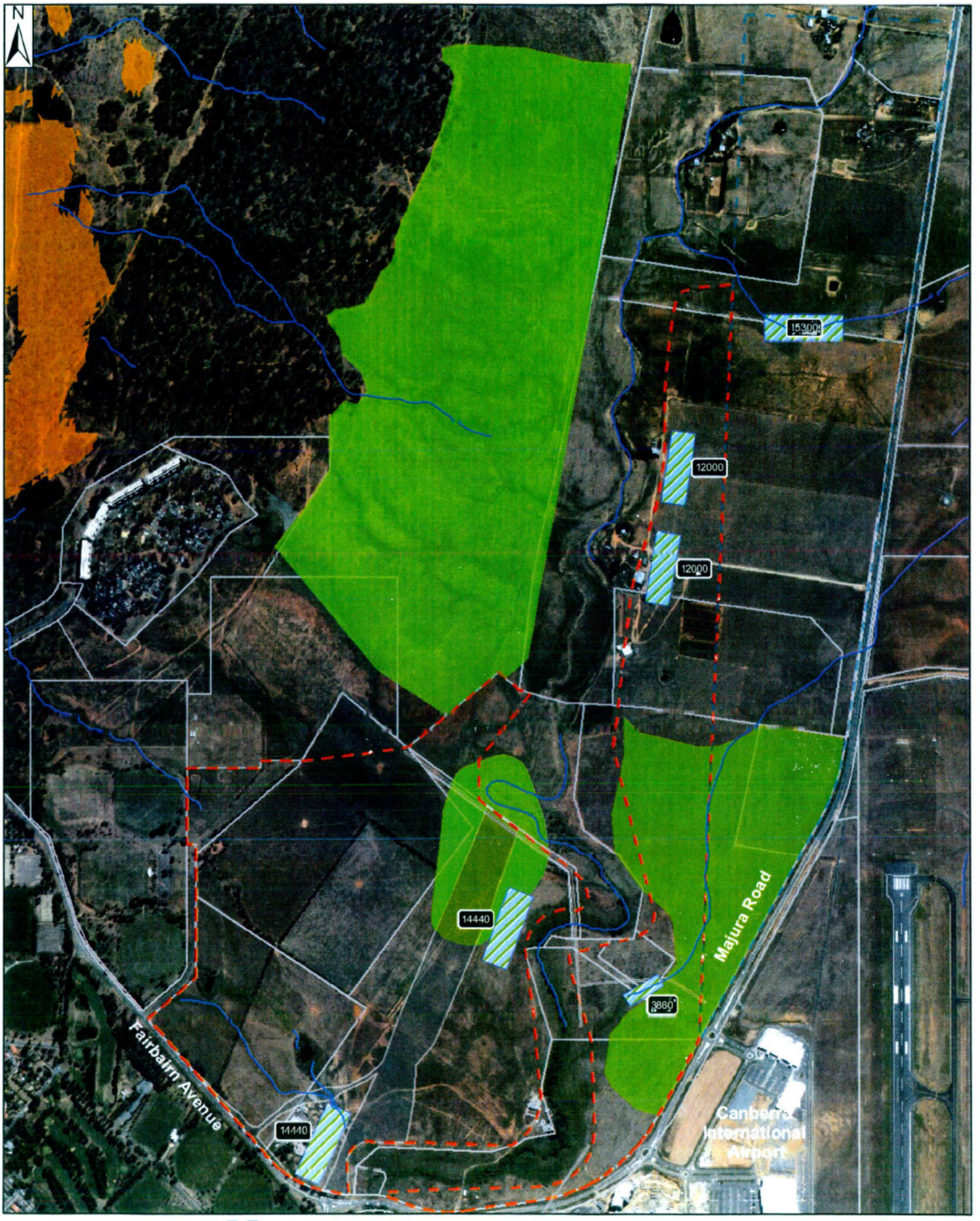
Investigation Area C/ scenario 2			
	2021	**2031**	**2041**
Pre development runoff (ML/yr)	135	135	135
Total developable area (ha)	103	205	205
Development impervious area (ha)	90	180	180
Post development runoff (ML/yr)	544	1,090	1,090
Investigation Area wetland area @ 3.5% total impervious (m^2)	31,570	63,140	63,140
Maximum treated yield from wetlands (ML/yr)	234	473	473
Harvested volume to achieve regional targets (ML/yr)	120	235	235
Distributed SZ bio area @ 1% road/hardstand (m^2)	2,870	5,740	5,740
Maximum treated yield from bio (ML/yr)	100	231	231
Maximum yield from roof area (ML/yr)	305	610	610

These results show up to an order of magnitude increase in runoff from the 205ha development area following full construction by 2031. Of the 955 ML/yr additional water resultant from development, approximately 50% (473ML/yr) could be harvested from centralised treatment wetlands sized for best practice. By harvesting directly from roof surfaces (assuming 80 % capture efficiency) and using distributed SZ bioretention systems up to 88% (841ML/yr) of the additional runoff could be harvested. All areas required for treatment and resultant potential maximum yields can be scaled by the percentage of development completed (i.e. 50% of development is proposed by 2021 with 50% reductions in ultimate land take and yields at this time).

Harvesting up to 235 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 235 ML/yr could support approximately 47 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 (25 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.

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 110,000kg/yr
- Total Phosphorous (TP) up to 210 kg/yr
- Total Nitrogen (TN) up to 1,500 kg/yr



Drainage Lines
Treatment Wetland (2041 Scenario #)
Investigation Area C Boundary
National Land
Slope > 15%
8500 Area (m2)

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

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

0 125 250 500
Meters

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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 C are detailed in Table 4.

Table 4 Summary of Investigation Area C costs

Description	Approximate Cost (excluding GST)		Comment
Water Distribution main from the Campbell reservoir to the Investigation Area boundary.	$4,240,000		Developer responsible for cost of distribution mains.
Sewer Extend trunk sewer main from Investigation Area B to Investigation Area C.	$2,310,000		FSTP and MSPS improvements by ActewAGL at ActewAGL's expense.
Electricity 11kV overhead to underground relocation	$1,000,000		ActewAGL will be responsible for extending 11 kV feeders from Eastlake Zone substation.
Telecommunications Extend TransACT infrastructure from Campbell.	$200,000		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 Includes cost of off-take station.	Option A $3,970,000	Option B $3,690,000	Option 1: Off-take station located within Investigation Area B. Option 2: Off-take station located within Investigation Area C.
Subtotal:	$11,720,000	$11,440,000	
40% Contingency:	$4,688,000	$4,576,000	
Investigation Area C Total:	$16,408,000	$16,016,000	

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 area 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.

6.1.3 Total Acquisition Costs

The estimates of Total Acquisition Costs are as follows:

Bioretention Systems

- If implemented in a distributed way = $1000 per m^2.
- If implemented at the Investigation Area-scale = $300 per m^2.

Constructed Wetlands

For constructed wetland systems sized between 100 m^2 and 1000 m^2, total acquisition costs are estimated to be between $200 to $400 per m^2. Smaller systems cost more on a per m^2 basis due to the high initial start up costs associated with construction.

6.1.4 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 m^2
- Constructed wetland systems = $3 to $5 per m^2

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 C will be developed before A, B and D. Only gas may have a dependency on extending infrastructure through Investigation Area B. However, Investigation Area C is not dependent upon other potential development, provided a service corridor is allowed for within other Investigation Areas. Table 5 summarises staging dependencies for Investigation Area C. Overall staging is discussed in more detail in Section 9.0 in the body of the main report.

Table 5 Investigation Area C Staging

Service	Staging Comments	Investigation Area Dependencies
Water	Distribution main from Campbell reservoir to Investigation Area C must be constructed.	None
Sewer	Connect to trunk sewer located within Investigation Area C.	None
Gas	Gas main from new off-take station to Investigation Area boundary.	Dependent on location of off-take station. Gas infrastructure may be required from Investigation Area B or from Majura Lane (east of Investigation Area C).
Electricity	11 kV feeders from new Eastlake Zone Substation and construction of distribution substation.	None
Telecommunications	TransACT infrastructure extended from Campbell.	None

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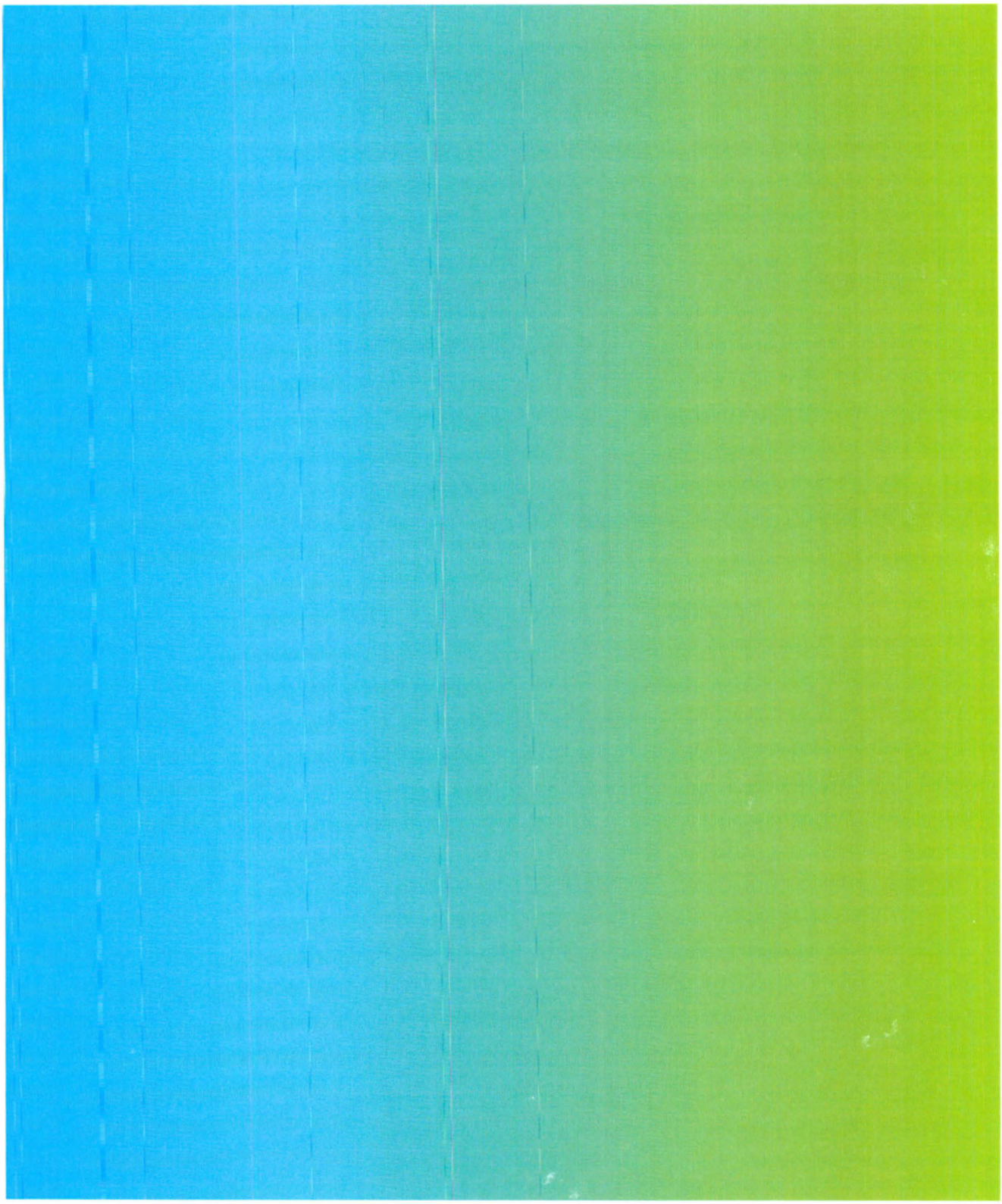
Appendix D
Investigation Area D



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