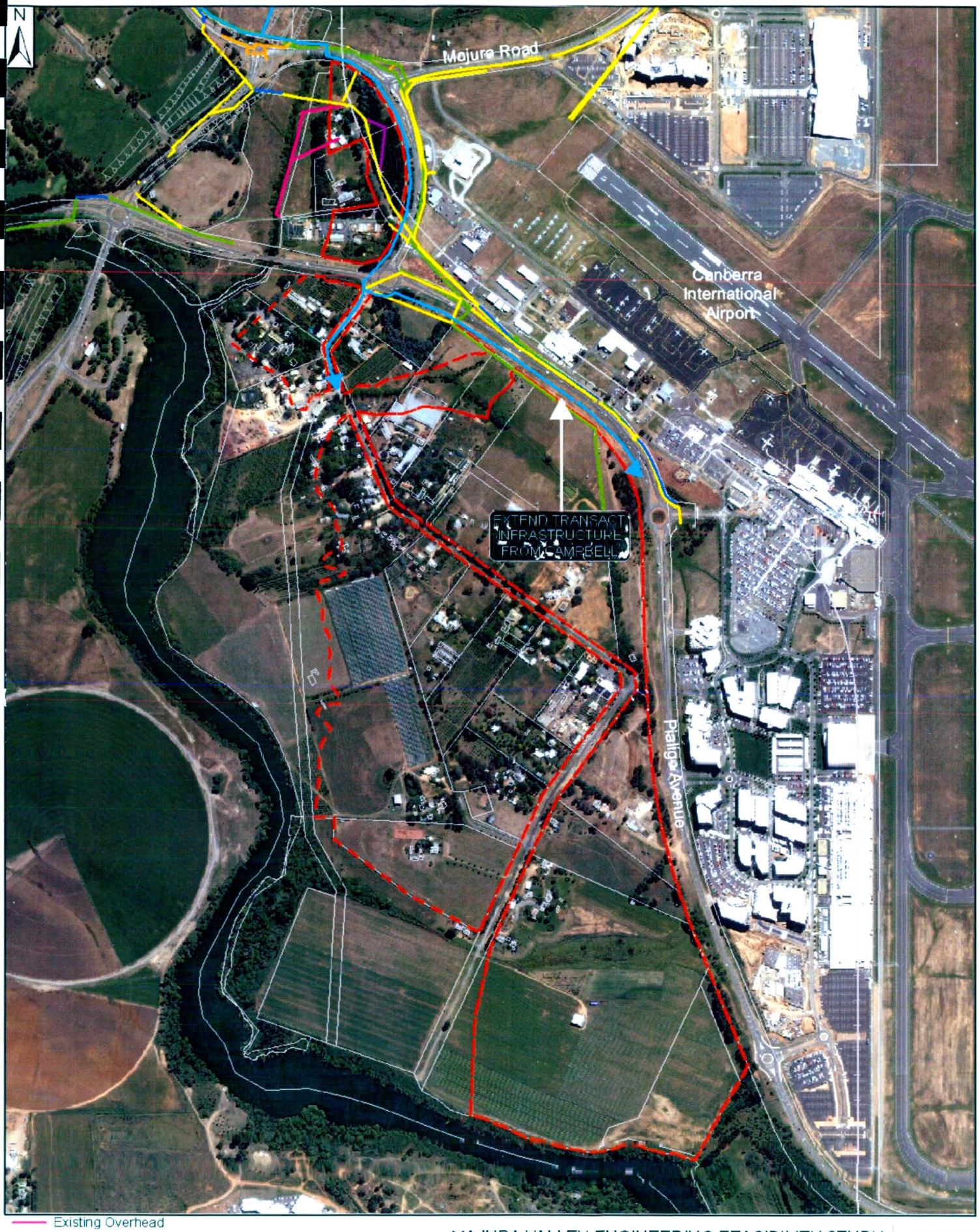
AECOM



Existing Overhead
Existing Telstra Optical Fibre
Existing Optus
Existing Telstra
Existing Traffic
Existing Vision Stream
Proposed TransACT
Proposed Majura Parkway & VHST Route
Investigation Area Boundary

MAJURA VALLEY ENGINEERING FEASIBILITY STUDY

INVESTIGATION AREA D - TELECOMMUNICATIONS SERVICES

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

0 125 250 500 m

APRIL 2010

60143881

5.0 Water Sensitive Urban Design Strategy

Potential development of Investigation area D considered two scenarios.

- Scenario 1 (given as Scenario B in ACTPLA table) was based on potentially developing 30% (30.6 ha) of the total 102 ha area with the remainder being retained and enhanced with the current land uses. Potential development has been identified as staged at 100% by 2041. For the purposes of modelling the pre-development land use has been estimated at 40% impervious. Further information regarding the likely location of potential development will be required to refine this further and quantify the pre-development runoff characteristics.
- Scenario 2 was based on the potential development of the entire 102 ha investigation area. This redevelopment would occur by 2041. For the purposes of modelling the pre-development land use has been estimated at 40% impervious.

MUSIC modelling was undertaken to size treatment elements for best practice water quality objectives (80, 45, 45) for rainfall runoff discharged from the site. Modelling only considered the redeveloped portions of the total area as it is considered unlikely that water quality treatment would be included for existing private land uses and modelling of such treatment would require further detailed information regarding the existing impervious areas, drainage connections and treatment objectives. 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 D/ scenario 1.

Investigation Area D/ scenario 1			
	2021	**2031**	**2041**
Pre development runoff (ML/yr)	74	74	74
Total developable area (ha)	.	.	31
Development impervious area (ha)	.	.	27
Post development runoff (ML/yr)	.	.	163
Investigation Area wetland area @ 3.5% total impervious (m2)	.	.	9,425
Maximum treated yield from wetlands (ML/yr)	.	.	69
Harvested volume to achieve regional targets (ML/yr)			35
Distributed SZ bio area @ 1% road/hardstand (m2)	.	.	857
Maximum treated yield from bio (ML/yr)	.	.	29
Maximum yield from roof area (ML/yr)	.	.	91

These results show a factor of two increase in runoff from the 30.6ha potential developable area following full construction by 2041 (assumes 40% impervious in pre-development land use). Of the 89 ML/yr additional water resultant from development, approximately 78% (69ML/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 120 ML/yr could theoretically be harvested from the site. This represents more water than the increase from development and may not be preferable when considering preservation of predevelopment flows. In saying that, the pre-development situation has been modelled as having significant modification and would require further work if focusing on maintaining in stream hydrology and natural flow regimes.

Harvesting 35 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 35 ML/yr could support approximately 7 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 (4 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) 16,000 kg/yr
- Total Phosphorous (TP) 31kg/yr
- Total Nitrogen (TN) 220 kg/yr

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

Investigation Area D/ scenario 2			
	2021	**2031**	**2041**
Pre development runoff (ML/yr)	246	246	246
Total developable area (ha)	.	.	102
Development impervious area (ha)	.	.	90
Post development runoff (ML/yr)	.	.	541
Investigation Area wetland area @ 3.5% total impervious (m^2)	.	.	31,420
Maximum treated yield from wetlands (ML/yr)	.	.	233
Harvested volume to achieve regional targets (ML/yr)			120
Distributed SZ bio area @ 1% road/hardstand (m^2)	.	.	2,856
Maximum treated yield from bio (ML/yr)	.	.	99
Maximum yield from roof area (ML/yr)	.	.	379

These results show a factor of two increase in runoff from the 102 ha potential developable area following full construction by 2041 (assumes 40% impervious in pre-development land use). Of the 295 ML/yr additional water resultant from development, approximately 79% (233ML/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 478ML/yr could theoretically be harvested from the site. This represents more water than the increase from development and may not be preferable when considering preservation of predevelopment flows. In saying that, the pre-development situation has been modelled as having significant modification and would require further work if focusing on maintaining in stream hydrology and natural flow regimes.

Harvesting 120 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 120ML/yr could support approximately 24 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 (12 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) 53,500 kg/yr
- Total Phosphorous (TP) 105 kg/yr
- Total Nitrogen (TN) 730 kg/yr

Treatment Areas

Drainage Lines

Area D Boundary

8500 Area (m2)

MAJURA VALLEY ENGINEERING FEASIBILITY STUDY

INVESTIGATION AREA D - INDICATIVE FOOTPRINT AND LOCATION OF WETLANDS

Source: ActewAGL (2009), ACTPLA (2009)

0 125 250 500

Meters

APRIL 2010

60143881

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 D are detailed in Table 4.

Table 4 Summary of Investigation Area D Costs

Description	Approximate Cost (excluding GST)		Comment
Water Distribution main from the Campbell reservoir to the Investigation Area boundary.	$880,000		May not be required depending on level of proposed development.
Electricity 11kV overhead to underground relocation	$210,000		ActewAGL will be responsible for extending 11 kV feeders from Eastlake Zone substation.
Telecommunications Extend TransACT infrastructure from Campbell.	$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 $1,540,000	Option 2 $160,000	Option 1: Off-take station located within Investigation Area B. Option 2: Off-take station located within Investigation Area C.
Subtotal:	$2,930,000	$1,550,000	
40% Contingency:	$1,172,000	$620,000	
Investigation Area A Total:	$4,102,000	$2,170,000	

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.

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 D will be developed after B and C. However, services for these other Investigation Areas may need to extend through Investigation Area D and then north into C. Table 5 summarises staging for Investigation Area D. Overall staging is discussed in more detail in Section 9.0 in the body of the main report.

Table 5 Investigation Area D Staging

Service	Staging Comments	Investigation Area Dependencies
Water	Distribution main from Campbell reservoir to Investigation Area C.	Requirement of new distribution main dependent upon level of development.
Sewer	Connect to trunk sewer located within Investigation Area D.	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 may be required.	None
Telecommunications	TransACT infrastructure extended from Campbell.	None


Collaborate. Innovate. Create.

www.aecom.com