Huntingwood East Precinct

Civil Infrastructure & Stormwater Report

Date: 17 October 2007

Report No: NT027816

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DBL Property

Huntingwood East Precinct Civil Infrastructure & Stormwater Report

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1 Introduction

Hyder Consulting Pty Ltd has been engaged by DBL Property to undertake a civil infrastructure services report for the Huntingwood East Precinct, hereafter referred to as the Precinct. DBL Property is managing and co-ordinating the project works on behalf of the Land Owner Group.

The Precinct is an area of land identified in State Environmental Planning Policy No. 59 (SEPP 59), Central Western Sydney Economic and Employment Area as land suitable for release for employment related development. It is the intent of this report to provide the necessary documentation with regard to general services and stormwater management to assist in the preparation of a Precinct Plan.

This report details the following civil infrastructure items:

General Services:

- Locations of existing services and the likely connection points to supply the Precinct
- Potential service upgrades required to ensure adequate capacity to the Precinct
- Timing of service upgrades
- Land requirements - location of major service infrastructure requiring dedication of land, such as regional zone sub stations
- Costs to the Precinct
- Letters/correspondence confirming availability of supply

Road Network:

- Road Hierarchy
- Access Points
- Location of civil structures such as bridges, major culverts, retaining walls etc

Stormwater Management:

- Define internal and external catchments
- Flood extents for 100 year ARI
- Major trunk drainage routes and location and sizes of easements - existing and proposed
- Calculations to define flows through catchments, quantify detention volumes, and address water quality issues in accordance with accepted local practice
- Location of detention / water quality ponds and potential land take required

1.1 Land Ownership

The Precinct has a combined area of approximately 82 ha, not including roads. It is comprised of the following landowners:

- Roads and Traffic Authority 6.755ha (8.27%);
- Sydney Water 21.775ha (26.64%);
- Honeman Estate 5.541ha (6.78%);
- Macquarie Goodman (formerly Salvation Army) 13.883ha (16.99%);
- Blacktown City Council 5.071ha (6.20%);
- Redlea Chickens Pty Ltd (inc Teuma Lands) 5.962ha (7.30%);
- Forests NSW 1.629ha (1.99%);
- Ms Maria Mercia 0.81ha (0.99%);
- Telstra Corporation 0.2ha (0.24%);
- Department of Planning 20.101ha (24.60%).

1.2 Locality

The area subject to this report is defined in SEPP 59 as the land in the Blacktown Local Government Area between the Great Western Highway to the north, the Western Motorway to the south, and Blacktown Creek to the east. For the purposes of this report the Precinct Area has been extended past Blacktown Creek and is now bound by Prospect Highway to the east. Refer attached SKC001 in Appendix A.

2 General Services

The following asset owners are located within the vicinity of the precinct:

- Sewer - Sydney Water
- Water - Sydney Water
- Gas - Agility
- Electrical - Integral Energy
- Telecommunications - Telstra

2.1 Sewer

There is no existing sewerage system currently servicing the Precinct.

The Precinct is divided between two sewerage catchments. The eastern area of the Precinct drains to the Northern Suburbs Ocean Outfall System (NSOOS) while the western area of the Precinct drains to the Quakers Hill Sewerage Treatment Plant catchment (QHSTP):

1. The eastern catchment occupying approximately 50% of The Precinct naturally drains to the NSOOS 9-13 system. Refer attached SKC002 in Appendix A. The eastern catchment is divided into two sub-catchments, therefore reticulation for the eastern catchment will likely cross the Great Western Highway at two locations:
    - East of Flushcombe Road - Approximately 50 meters of 400mm diameter boring and an additional 200 meters of new pipe, will be required to connect into the existing infrastructure.
    - Blacktown Creek - Approximately 50 meters of 400mm diameter boring and an additional 100 meters of new pipe, will be required to connect into the existing infrastructure.
2. The western catchment occupying approximately 50% of The Precinct naturally drains to the QHSTP. Refer attached SKC002 in Appendix A.

Replacement/amplification of approximately 900 meters of existing pipework may be required to service the Precinct. However this will depend on final load.

DSP charges area applicable and will be levied by Sydney Water based on Pure Net Hectare (which approximately equates to developable area). The DSP charges for the Precinct are additional to the cost of the external reticulation works.

Denis Cumerlato from Sydney Water has stated via email on 19 March 2007 that; Sydney Water has completed a preliminary investigation and advises that there is sufficient capacity within both the NSOOS and Quakers Hill sewerage system for the Precinct.

2.2 Water

The Precinct is located within the Prospect Hill Elevated water supply system. A number of existing water mains are located within or adjacent current road reserves throughout the Precinct. Refer attached SKC003 in Appendix A. These mains include trunk mains from Prospect Reservoir which service the areas of Blacktown; north of the Great Western Highway.

Water Infrastructure in the area consists of:

- 500mm diameter CICL main running along the southern side Honeman Close which crosses at Reservoir Road and continues along the western side of Boiler Close crossing at the Western Motorway;
- 375mm diameter CICL main running along the northern side Honeman Close which crosses at Reservoir Road and continues along the eastern side of Boiler Close connecting into the 500mm main before crossing at the Western Motorway;
- 150mm diameter uPVC main running along the eastern side of Reservoir Road connecting into the 500mm main at the intersection of Honeman and Boiler Close;
- 900mm diameter SCL main running along the western side of Reservoir Road which crosses at Honeman Close and continues along the western side of boiler close adjacent the road reserve crossing at the Western Motorway.

Trunk water infrastructure traversing the Precinct was provided as part of the Boral development and as such the Precinct is subject to a recovery charge of $57,750/Ha + CPI. Reticulation mains would need to be provided by the developer.

DSP charges area applicable and will be levied by Sydney Water based on Pure Net Hectare (which approximately equates to developable area). The DSP charges for the Precinct are additional to the cost of the external reticulation works.

Denis Cumerlato from Sydney Water has stated via email on 16 March 2007 that; There is sufficient capacity within the Prospect Hill Elevated water supply system to service the Precinct.

2.3 Gas

Gas supply is available to the Precinct via two lines:

1. 63mm Residential/Light commercial - Polyethylene line (210kPa) to the west of the Precinct running along the southern side of the Great Western Highway adjacent the entrance of the RTA crash lab. Refer attached SKC004 in Appendix A.
2. 75mm Residential/Light commercial - Nylon line (210kPa) running along Flushcombe Road currently servicing landowners within the Precinct. Refer attached SKC004 in Appendix A.

Neil Hilton from Alinta has stated via email on 19 March 2007 that; It is anticipated that there will be minimal consumption of gas in the Precinct and the supply is considered adequate.

2.4 Electrical

2.4.1 Electrical Supply

There are two existing zone substations which are the most viable options to service the Precinct, these are:

1. Arndell Park Zone Substation - Located on the corner of Holbeche Road and Walters Road. Integral Energy has advised that the Zone Substation is currently at capacity.
2. Prospect Zone Substation - Located on the corner of Great Western Highway and Blacktown Road. Integral Energy has advised that the Zone Substation is currently at capacity.

Integral Energy has confirmed that a new Zone Substation is proposed to be built to the west of the Precinct (West Huntingwood Zone Substation) which has the potential to offset a portion of the Arndell Park Zone Substations load. Transferring a portion of Arndell Park Zone Substations load to the West Huntingwood Zone Substation will free up the capacity of Arndell Park Zone Substation and enable future connection to the Precinct. Integral Energy has advised there will be an associated lead-in time of approximately 5 years.

In the interim, Integral Energy has advised that although the Arndell Park Zone Substation is at capacity they may accept a minor increase in demand as long as they determine the risk to be manageable. This would be a short term arrangement until the new Zone Substation is operational.

The developer will be required to fund connection from the Precinct to the Arndell Park Zone Substation. The connection to the Precinct will be via 2km of underground feeder and will cost $1,000per/meter. Refer attached SKC005 in Appendix A.

It is expected that the ultimate supply to the precinct will be via three 11kV feeders from Arndell Park Zone Substation. It is estimated that the development will require a supply of up to 11 MVA. During the initial stages of development the first developer will be required to supply the conduits for the three feeders and cabling for at least one. The remaining feeder cables will be pulled through as required. The developer who funds the initial outlay will be able to recoup some of the costs as the other developments come online.

There are however, timing issues involved with obtaining supply from Arndell Park and these are inclusive of, but not limited to:

- The firm capacity of Arndell Park Zone Substation will be exceeded by 2008;
- The establishment of the proposed West Huntingwood Zone Substation is required to allow any further demand to be supplied from Arndell Park Zone Substation;
- The West Huntingwood Zone Substation requires the reconstruction and duplication of a 33kV feeder to 132kV.

Craig Willebrand from Integral Energy has stated via email on 24 April 2007 that; Currently the central and western portions of the development are supplied from Arndell Park Zone Substation and the eastern portion of the precinct is supplied from Prospect Zone Substation. These feeders may allow a limited nominal supply for building supplies as an interim measure.

2.4.2 Electrical Infrastructure and Easements

Electrical Infrastructure in the area consists of:

- A number of 11kV above ground lines traversing the local street network;
- 33kV above ground transmission line that traverse the Precinct adjacent Honeman Close and Boiler Close. This is the major supply line from Blacktown Transmission Substation to Doonside Zone Substation;
- Parallel 132kV above ground transmission lines that that run through the southern side of the Precinct along the Western Motorway. This forms part of the distribution network between major transmission Substations.

Integral Energy indicated their preference is to have the aboveground transmission lines that traverse the Precinct adjacent Honeman Close redirected along the Great Western Highway.

It has been highlighted that the 33kV transmission line as described above will require augmentation and a possible new route through the East Huntingwood Precinct. Integral Energy would like to work closely with developers/landholders to secure a route which will allow the establishment of the West Huntingwood Zone Substation and ultimately the capacity to supply the entire development.

There are two parallel easements for the existing132kV above ground transmission lines that run through the southern side of the Precinct along the Western Motorway. These easements are of varying width approximately 30m to 35m. As part of the proposed development, no structures shall be erected within the easement area. Truck loading dock will be possible within the easement depending upon the type of materials. In general a 9m vertical clearance from the transmission line is required.

2.5 Telecommunications

The Precinct is currently serviced by the Blacktown Exchange service area.

Telecommunications Infrastructure in the area consists of:

- Optical fibre currently runs through the Precinct along the eastern side of Flushcombe Road and along the northern side of Augusta Street. Optical fibre is also present along Reservoir Road terminating shortly after entering the Precinct boundary. Refer attached SKC006 in Appendix A;
- Local cable currently services businesses within the Precinct along Flushcombe Road, Augusta Street, Reservoir Road, Honeman Close and Boiler Close;
- A Telstra Mobiles Hut is located on the northern side of Augusta Street. It is recommended that the Hut remains in its current location and that vehicular access is maintained.

Telstra has advised that there is sufficient capacity to service the Precinct.

3 Road Network

The Precinct is situated between two major arterial roads; Great Western Highway and the Western Motorway, providing good links to the regional road network.

The traffic study is the subject of a separate report prepared by Traffix: ***Huntingwood East Estate SEPP59 Precinct Plan - Traffic Assessment version 5, dated August 2007***.

3.1 Regional Road Network

Based on ***Huntingwood East Estate SEPP59 Precinct Plan - Traffic Assessment version 5, dated August 2007***Access to the Precinct will be via:

- Existing - Reservoir Road off the Great Western Highway. This intersection will likely require upgrade.
- Existing - Reservoir Road off the Western Motorway. This intersection will likely require upgrade.
- Existing - Flushcombe Road off the Great Western Highway. This intersection will likely require upgrade.
- Existing - Flushcombe Road off the Western Motorway. This intersection will likely require upgrade.
- Proposed - Road Reserve No. 1 (bisecting Augusta Street) off the Great Western Highway. This intersection will likely require signalisation.
- Proposed - Midway between Reservoir Road and Flushcombe Road off the Great Western Highway. This intersection will likely require signalisation.
- Proposed - Honeman Close off the Great Western Highway. This intersection will likely require signalisation.

3.2 Local Road Network

Final confirmation of internal road network is subject to future Development Applications.

Road cross sections are based on Blacktown Development Control Plan 2006. Refer attached SKC007 in Appendix A.

Road Type	Total Road Reserve	Carriage-way	Parking	Footpath (both sides)
Industrial (Other)	20.5m	8.5m	2.5m	1.2m
Industrial (Collector)	23.0m	10.5m	2.5m	1.2m

Table 5.1 - Standard road widths. (*Blacktown Development Control Plan, 2006 - Part A)*

Current road reserves are indicated in SKC008 Appendix A. Additional access points to the Precinct from the Great Western Highway are proposed. Reference should be made to the ***Huntingwood East Estate SEPP59 Precinct Plan - Traffic Assessment version 5, dated August 2007*** prepared by Traffix.

4 Stormwater Management

4.1 The Site

The Precinct is bounded by the Great Western Highway to the North, the Western Motorway to the south and Prospect Highway to the East. Two internal roads; Flushcombe and Reservoir run North-South and divide the Precinct into three parcels of land. Grades within the Precinct vary from 4% to 8% with some relatively steep areas of up to 13%. There are a number of natural depression and gullies traversing the Precinct, which drain the Precinct and the external catchments.

4.2 Site Analysis

4.2.1 Catchment Description

External Catchments

Draining to the Precinct are six external catchments as represented in the catchment plan. Refer attached SKC009 in Appendix A. The external catchments generally drain from south to north crossing the Western Motorway trough a series of culverts discharging into the Precinct.

A ridgeline running south to north crossing the Precinct between Reservoir Road and Flushcombe Road divides the catchment areas into two main groups:

- Hawkesbury River Catchments draining north-west; and
- Parramatta River Catchments draining north-east

Internal Catchments

The Precinct has five outlet locations crossing the Great Western Highway. Draining to these outlet structures are the external catchments and five internal catchment areas. Refer attached SKC009 in Appendix A.

Catchments 1 to 4 drain under the Great Western Highway to the Parramatta River catchment and Catchment 5 drains under the Great Western Highway to the Hawkesbury Rive. Catchments 1 to 5 are described below:

- Catchment 1 in the North-East corner of the Precinct has an area of approximately 3.7 hectares. The catchment is bordered by the Great Western Motorway, Prospect Highway and Catchment 2 to the South-West .The catchment drains to a culvert under the Great Western Highway.

- Catchment 2 in the East of the Precinct has an area of approximately 18.1 hectares. The catchment is bordered by the Great Western Highway, Catchment 1 to the North-East, Prospect Highway and the M4. An external catchment area of approximately 28.6 hectares drains from the Southern side of the Western Motorway via two culverts into Catchment 2. The catchment subsequently is drained via a natural gully to a culvert under the Great Western Highway.
- Catchment 3 in the centre of the Precinct has an area of approximately 13.9 hectares. The catchment is bordered by the Great Western Highway, Catchment 2 to the East, the Western Motorway and Catchment 4 to the West. An external catchment area of approximately 24.1 hectares drains from the Southern side of the Western Motorway via a culvert into Catchment 3. The catchment subsequently is drained via a natural gully to a culvert under the Great Western Highway.
- Catchment 4 in the centre of the Precinct has an area of approximately 17.6 hectares. The catchment is bordered by the Great Western Highway, Catchment 3 to the East, the Western Motorway and Catchment 5 to the West. An external catchment area of approximately 3.1 hectares drains from the Southern side of the Western Motorway via a culvert into Catchment 4. The catchment subsequently is drained via a natural gully to a culvert under the Great Western Highway.
- Catchment 5 in the west of the Precinct has an area of approximately 42.5 hectares. The catchment is bordered by the Great Western Highway, Catchment 4 to the East, the Western Motorway and Industrial land to the West. An external catchment area of approximately 36.1 hectares drains from the Southern side of the Western Motorway via two culverts into Catchment 5. The catchment subsequently is drained via a natural gully to a culvert under the Great Western Highway.

4.2.2 Flooding

Indicative flood widths for the 100 year Average Recurrence Interval (ARI) event under existing conditions were obtained from previous a hydraulic study for the Precinct as part of the ***Eastern Creek and Prospect Corridor Excluded Lands Study-Area 5***, prepared by GHD to the Department of Planning in 1993.

Additional information about flooding extents within the Precinct has been compiled from the following sources:

a) Flood extent information for catchment C5.1 draining to the culvert located in the western side of the Precinct, under the driveway of the RTA Crashlab site. This information was based on the Flood Risk Map for the area provided by Blacktown Council.

b) Further hydrologic and hydraulic analysis undertaken as part of this study for the culverts draining catchments C4.1, C3.1 and C2.1 of the Precinct. Based on information from Blacktown Council, these culverts were identified as been subject to modification in outlet size to restrict the discharged flow during peak events to alleviate flooding of downstream areas.

The flood extents resulting from these restricted culverts were determined using DRAINS model to simulate the 100 year ARI event for pre-development conditions. These culverts were modelled as detention basins using survey and site inspection information. The pre-development DRAINS model was calibrated using the rural rational method as described in AR&R. More details of the modelling assumptions are presented in Appendix B.

Areas subject to 100 year ARI flooding within the Precinct are presented in the Flood Extent Plan SKC011 in Appendix A

4.2.3 Creek corridors and overland flowpaths

The local subcatchments drain through the Precinct via natural creeks and overland flowpaths. The major overland flowpaths within the Precinct are presented in the Flood Extent Plan SKC011 in Appendix A. The creek corridors were identified and assessed based on their ecological values as part of the biodiversity study for the Precinct.

4.3 Water Sensitive Urban Design for the Precinct

4.3.1 Objectives

The proposed stormwater management plan for the Precinct aims to achieve the following objectives:

Environmental

- Provision of a safe, efficient and sustainable urban water management system through appropriately designed, functional stormwater facilities.
- Minimise impacts on water quality (oils, hydrocarbons, nutrients, sediment and gross pollutants) during and following construction activities.
- Control the runoff discharge peaks and velocities to emulate the pre-developed status at the outlet to the Precinct.
- Maintenance of existing downstream peak flow rates.

Urban Amenity

- Minimise impacts of flooding on people and property within the development through design of an appropriate drainage system incorporating both piped and overland flow path components.
- Integrate of landscaped areas with the stormwater management system.

Engineering

- Minimise the volume of stormwater runoff from the developed site through a reduction of impervious areas and implementation of stormwater retention and detention measures.
- Provide a stable drainage path through the Precinct.

Economics

- Provide a cost effective, functional site drainage system that optimises performance, provides maximum value for expenditure, and keeps on-going maintenance requirements to a minimum.
- Water Sensitive Urban Design (WSUD) principles are used in this study to mitigate the potential impacts of urban development in this precinct.

4.3.2 Stormwater Management Plan for the Precinct

WSUD principles were used in this study to identify the required measures to mitigate the potential impacts of urban development in this precinct. The overall WSUD strategy for the Precinct aims to meet the following targets:

- Attenuate flows to a maximum of the pre-development or rural flow rates, which ever is the lesser. This shall be addressed over a range of storms from the 2 year ARI to the 100 year ARI.
- Pollutant reduction rates of:
  - 70% for gross pollutants
  - 80% for coarse sediments
  - 50% for suspended solids (TSS)
  - 45% for total phosphorus and total nitrogen (TP & TN)

  These retention criteria are specified in Blacktown Council's Stormwater Quality Control Policy

This study included an investigation into the potential Locations for detention basins and constructed wetlands so as to meet the above mentioned performance targets. A conservative approach was adopted to size these detention basins and constructed wetlands in order to provide an idea of the expected size and area of these measures. The following assumptions were made:

- The constructed wetlands were combined with the detention basins in a single integrated structure to minimise land take.
- Sizing for flood control was made based on the Upper Parramatta River Catchment OSD policy, which is to allocate 455 m3/ha to control both the 1.5 year ARI and the 100 year ARI design storms.
- The detention basin configuration was based on Blacktown Council guidelines of maximum 1.2 m depth of detention storage and 1:6 batters for ease of maintenance of grassed cover.
- Sizing for the constructed wetlands was based on current best management practice and their pollutant retention performance was assessed using MUSIC modelling (details provided in Appendix B).

Typical cross section of the combined detention basin/constructed wetland structure is shown in Plan SKC013, while indicative locations for these structures are shown in the Stormwater Management Plan SKC012. Potential areas and sizes of these structures based on the above assumptions are presented in Appendix B. It should be noted that the estimated areas are conservative and could be reduced based on detailed design and discussion with Council during the subsequent stages of the Precinct's development.

4.3.3 Controls

General

a) Development Applications must be accompanied by a site specific Stormwater Management Plan, where appropriate, designed to:

   i. be consistent with the Huntingwood East Precinct Stormwater Management Report;

   ii. be consistent with Blacktown City Council stormwater requirements;

   iii. include appropriate water quantity and quality control systems, accompanied by a management plan in accordance with Council and manufacturer's specifications;

   iv. implement effective source controls of stormwater pollution and discharge;

v. manage flooding and water quality impacts on site to ensure that there are no adverse downstream impacts;

vi. ensure all permanent structures and devices are at source and off-line of any open watercourse;

vii. implement sediment control measures, stormwater quality improvement devices or other innovative technology to minimise water pollution; and

viii. incorporate bank stabilisation, revegetation, energy dissipating structures and upstream detention basins to minimise erosion of waterways.

b) Natural materials and channel forms, rather than engineered forms are to be used where possible.

c) Applicants are required to show how WSUD principles have been included in the design of the stormwater system for the Precinct.

d) WSUD techniques (such as vegetated swales, filter strips and bio-retention systems) are to be incorporated into the conventional drainage system to treat rainfall events up to the 3 month ARI.

e) Stormwater management and drainage works are to be constructed in accordance with Council's drainage standards and other relevant guidelines and standards, including:

i. ***Managing Urban Stormwater: Strategic Framework (Draft),*** Environment

ii. Protection Authority (March 1998);

iii. ***Managing Urban Stormwater: Treatment Techniques,*** Environment Protection Authority (November 1997);

iv. ***Managing Urban Stormwater: Council Handbook (Draft),*** Environment

v. Protection Authority (1997);

vi. ***Managing Urban Stormwater: Soils and Construction,*** Department of Housing (August 1998);

vii. ***Water Sensitive Urban Design Guidelines – Technical Guidelines for Western Sydney***, Upper Parramatta River Catchment Trust and URS (May 2004); and

viii. ***Stormwater Quality Control Policy***, Blacktown City Council (June 2005).

f) Adequate provision must be given to the implementation of a surface and roofwater runoff collection and disposal system. All stormwater must be reticulated to the Precinct stormwater system or a suitable location approved by Council.

g) Where a site falls away from the street frontage, the Development Application must include information establishing that the written agreement of all relevant downstream property owners to drain water over their property has been obtained. Such agreement must state that downstream property owners have no objection to the discharge of stormwater through their properties to reach Council's drainage system nor do they have objection to the creation of necessary easements over the pipelines. If an easement is necessary over downstream properties this must be created prior to the release of the Subdivision Certificate or Occupation Certificate.

Major Drainage System

a) The major drainage system shall be designed to safely convey stormwater flows under normal operating conditions for the critical 100 year ARI flood event. In the event of blockage of pits and/or pipes, or for storm events greater than the design event, adequate overland flowpaths shall be provided on the roads or landscaped areas to ensure safety and control damage to property.

b) The effects of failure during extreme storm events shall be assessed and adequate provision shall be made for evacuation of personnel up to the critical PMF event.

c) Where the major drainage system is not located within road reserves, drainage easements/ reserves shall be created across the area occupied by infrastructure and include an easement to allow access for maintenance purposes.

d) New development shall not adversely impact the performance of existing drainage structures within the area.

e) All major drainage and stormwater detention basins shall be constructed within land dedicated for stormwater use.

f) During the maintenance period, performance monitoring of major drainage, basins and stormwater quality control (WSUD) structures must be undertaken in order to demonstrate satisfactory performance. The monitoring shall be in line with design parameters. Council will not accept handover of any device until it is demonstrated to be working efficiently.

g) The drainage system shall provide for detention structures in appropriate locations to minimise any adverse affect on existing downstream drainage paths.

h) The frequency of bank-full flows shall not increase as a result of the development. Flows are to be attenuated to a maximum of the pre-development or rural flow rates, which ever is the lesser. This shall be addressed over a range of storms from the 2-year ARI to the 100 year ARI.

i) The major drainage system for the development shall generally follow the natural drainage system.

j) Design of drainage works shall include a minimum freeboard of 0.5m to the 100 year ARI critical water level.

Minor Drainage System

a. The minor drainage system shall have the capacity to convey stormwater flows under normal operating conditions for the ARI specified in Council's Drainage Design Standard and shall link to the major drainage system.

b. The minor drainage system shall be designed to:

   i. enable the safe passage of vehicles and pedestrians;

   ii. prevent ponding for a prolonged period; and

   iii. prevent damage to property such as buildings and landscaped areas.

c) The minor drainage system will need to be either piped or in bioretention / grass swales, and will ideally be located within the road reserves. Where this is not possible, drainage easements shall be provided.

d) Road drainage shall:

   i. provide water quality treatment to achieve objectives outlined in Council's current 'Stormwater Water Quality Control Policy' and 'Engineering Guide for Development'; and

   ii. incorporate drainage systems and other infrastructure to allow treated runoff from development sites to be transferred to the major drainage system as necessary.

Detention Basins and Constructed Wetlands

a) Detention basins shall be located on or adjacent to the natural drainage system and meet the requirements of Council and relevant State Government agencies.

b) Suitable numerical modelling shall be undertaken for the detailed design of detention storages to ensure an acceptable level of hazard downstream for all storm events up to and including the PMP/PMF.

c) Wetlands shall be located adjacent to existing drainage channels. They should be located off line to ensure that they are not damaged during floods and that trapped material is not resuspended.

d) Bioretention basins, detention basins and wetlands shall:

i. include appropriate safety features, especially with regard to edge treatments;

ii. be designed to prevent induced salinity; and

iii. be sized to limit pollutant export loads to the levels specified in the water quality section of this Precinct Plan (below).

e) The detention basin shall be sized and designed to attenuate flows to a maximum of the pre-development or rural flow rates, which ever is the lesser. This shall be addressed over a range of storms from the 2 year ARI to the 100 year ARI. The effects of the PMF on the basin shall be assessed and measures prepared to avoid catastrophic failure.

Water Quality

a) To maintain stormwater quality to the required levels downstream, a “treatment train” approach shall be taken where various types of pollutants are removed by a number of water quality devices acting in series. This system allows for flexibility of the individual on-lot development with the co-ordinated Precinct approach for the road system and regional drainage treatment.

b) The precinct water quality treatment strategy is required to provide a water quality control mechanism to Council’s satisfaction. This could include an individual device or combination of devices to ensure that the appropriate water quality standard is achieved. Pollutants generated from within the Precinct shall be treated on site.

c) Best practice WSUD techniques are to be used for treating stormwater quality to the required standard and for the attenuation of flows to the predevelopment level.

d) The pollution retention criteria specified in Council’s Stormwater Quality Control Policy and Engineering Design Guidelines are required to be met on a Precinct scale.

e) An appropriate stormwater quality model (such as MUSIC) shall be used to demonstrate that the proposed stormwater quality control measures would meet the pollution retention criteria provided above.

Maintenance and Monitoring

1) Where development incorporates stormwater treatment devices, WSUD measures or revegetation/enhancement of watercourses, the developer will be responsible for the maintenance for 3 years beginning from practical completion. A maintenance plan prepared by a suitably qualified person shall be submitted to Council for approval.

2) Where wetlands and revegetation/ enhancement of watercourses has occurred, an appropriately qualified horticulturalist/ ecologist with experience in bush regeneration techniques and aquatic environments is to develop a wetland/watercourse and vegetation maintenance plan for Council's approval.

3) For stormwater treatment devices, WSUD measures and watercourses, a performance monitoring program is to be developed and implemented for the life of the maintenance period. This is to demonstrate that the stormwater treatment devices and WSUD measures are performing to the design criteria and that the watercourse is establishing and meeting the requirement for revegetation and enhancement.

4) Results from the maintenance and performance monitoring schedule are to be provided to Council on a 3 month basis. If it is demonstrated that the stormwater treatment devices and WSUD measures are not performing to design requirements and watercourses and riparian corridor enhancement is failing, appropriate alterations are to be undertaken prior to hand over to Council.

5 Conclusion

Services including water, sewer, gas, electrical and telecommunication will be available to the Precinct.

There appears to be no major access issues, but roadways are likely to need to be upgraded in accordance with Blacktown City Council requirements.

The site is constrained by minor flooding issues from Bungarribee Creek and Blacktown Creek.

The stormwater management system proposed for the Precinct complies with Council's requirements and UPRCT guidelines.

Appendix A

Drawings

SKC001 - Locality Plan

SKC002 - Concept Sewer Plan

SKC003 - Concept Water Plan

SKC004 - Concept Gas Plan

SKC005 - Concept Electricity Plan

SKC006 - Concept Telstra Plan

SKC007 - Road Cross Sections

SKC008 - Internal Road Reserves

SKC009 - Catchment Plan

SKC010 - Site Analysis

SKC011 - Flood Extent

SKC012 - Stormwater Management Plan

SKC013 - Typical Cross Sections

Appendix B

Hydrology, Hydraulic and Water Quality

Hydrology

Model Data and Parameters

Orthophoto maps and survey plan provided by Whelans Operations Pty Ltd were used to determine catchment properties such as slope, fraction impervious, length of flow path and times of concentration.

The model was based on the following rainfall loss characteristics.

Soil type ***= 3***

Antecedent rainfall (AMC) ***= 3 (rather wet)***

Depression storage

Paved areas	***= 1 mm***
Supplementary areas	***= 1 mm***
Grassed areas	***= 5 mm***

The rainfall intensities used in this analysis were obtained from an IFD table provided by Blacktown City Council.

Analysis

Prior to the DRAINS analysis a rural rational method (AR&R) was conducted to calculated existing peak flows from the site for the 1, 2, 5, 10, 20 and 100 year ARI. The flows obtained from the rational method were used to calibrate the DRAINS model.

Rainfall data for the 100 year ARI rainfall event for the 5, 10, 15, 20, 25, 30, 45, 60, 90 and 120-minute storm durations was entered into the model and used to check overland flow paths and ponding depth around the outlet culverts.

Included in the DRAINS model were the existing culverts which had been modified from their original condition with orifice plates to reduce peak flows from the site.

Results

The results where used to determine the flood extents within the site.

Detention basins

All 10 proposed basins were sized in accordance with the UPRCT on-site detention handbook which specifies an allowance of 455 m^3 per hectare for controlling the 1.5 year ARI and the 100 year ARI storm events.

The proposed basin volumes for each basin are summarized in table B.1.

Basin No.	volume (m^3)
1	1750.
2	3237
3	3329
4	2369
5	2511
6	2645
7	3098
8	3363
9	1334
10	4060

Table B.1 - Basin Volumes

Music Modelling

Water quality modelling has been undertaken using MUSIC to assess the effectiveness of the proposed scheme of water treatment devices. MUSIC is able to assess the behaviour of pollutants common to urban development including total suspended solids (TSS), total phosphorous (TP) and total nitrogen (TN).

In order to model the proposed wetland a typical section was adopted and is shown in the drawing SKC013 The inlet zone has been sized to cater for particles with settling speed of up to 0.007 m/s, and the extended detention provides volume for 25 mm of rainfall over the catchment. Table B.2 shows the assumed properties of the proposed wetlands.

	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6	Wetland 7	Wetland 8	Wetland 9	Wetland 10
Volume of Inlet bay (m^3)	195	425	433	278	300	312	457	437	130	535
Volume of exit bay (m^3)	109	220	228	155	165	176	209	230	80	283
Average Surface Area of wetland (m^2)	1100	2205	2275	1555	1660	1760	2100	2300	800	2830
Depth of wetland (m)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Table B.2 - Wetland Dimensions

With the proposed dimensions all basins performed above requirements for nutrient reductions as represented in the table B.3.

	% Reduction									
	Wetland 1	Wetland 2	Wetland 3	Wetland 4	Wetland 5	Wetland 6	Wetland 7	Wetland 8	Wetland 9	Wetland 10
TSS (kg/yr)	86.1	87.2	87.1	85.9	86.4	86.3	88.0	87.2	84.6	87.3
TP (kg/yr)	70.2	71.3	71.3	70.0	70.5	70.5	72.0	71.4	68.5	71.6
TN (kg/yr)	43	44.0	44.0	42.5	43.2	43.1	44.4	44.2	41.1	44.4
Gross Pollutants	100	100	100	100	100	100	100	100	100	100

Table B.3 - Total Reductions in Pollutants

Integrated Detention Basin & Wetland

The proposed WSUD strategy for the site involves an integrated system combining water quality control and flow detention. Table B.4 presents the total volume and land take associated with the integrated structure, which was calculated based on council guidance to use basin side slopes of 1 in 6. A 1 m wide walkway around the basin and external embankments is also included in the total area.

Basin / Wetland	Total volume (m^3)	Total land take (m^2)	Land take as % of catchment
1	2055.	4230	11.7%
2	3883	6331	8.9%
3	3990	6452	8.8%
4	2802	5176	9.9%
5	2976	5370	9.8%
6	3133	5550	9.6%
7	3765	6150	9.0%
8	4029	6494	8.9%
9	1543	3672	12.93%
10	4877	7374	8.3%

Table B.4 - Basin/Wetland Total Volume and Area

Appendix C

Correspondence

Sydney Water Correspondence [2 page(s)]

Alinta Correspondence [1 page(s)]

Integral Energy Correspondence [1 page(s)]

Sydney Water

From: DENNIS CUMERLATO [mailto:DENNIS.CUMERLATO@sydneywater.com.au]
Sent: Monday, 19 March 2007 1:33 PM
To: Greg Ives
Subject: RE: FW: Huntingwood - Sydney Water

Greg,

I have provided responses to your queries in red.

Regards

Dennis

>>> "Greg Ives" <Greg.Ives@hyderconsulting.com> 19/03/07 8:12 am >>>

Dennis,

Many thanks for the reply.

A few questions:

1. Is the recovery for water based on total site area or developable area. If the latter, can you confirm that developable area excludes roads and open space please. Only developable area is assessed.

2. Can you please advise what is involved in wastewater modelling? Do we make a formal request on behalf of the client? What timeframe is required? SW has now completed a preliminary investigations and advise that there is sufficient capacity within both the Quakers Hill and NSOOS sewerage system for the proposed development.

3. How relevant are the Past investigations? No longer relevant.

4. Are there any restrictions as to where we can connect to existing trunk water infrastructure? Not that I am aware. You can if you wish provide a concept desgin for review. Connection to trunk mains will only be permitted during low demand periods.

5. We will review our services search, but are you aware of anything in particular regarding the locations at which we can connect to existing sewer? At this time a connection point has not been specified. SW assessment has only considered carriers and not included reticulation mains.

Thanks

Greg Ives

From: DENNIS CUMERLATO [mailto:DENNIS.CUMERLATO@sydneywater.com.au]
Sent: Friday, 16 March 2007 10:49 AM
To: Greg Ives
Subject: Re: FW: Huntingwood - Sydney Water

Greg,

The advise that Sydney Water provides in relation to this proposed development is only an overview of existing infrastructure, capacity and future requirements. Further detailed investigation is required to determine the preferred servicing option.

Water - The site will be served from the Prospect Elevated water supply system and has sufficient capacity to service the site. Trunk water infrastructure traversing the site was provided as part of the Boral development and as such the site is subject to a recovery charge of $57750/ha+CPI. Reticulation mains would need to be provided by the developer.

Sewer - The site drains to two catchments. To the Quakers Hill sewerage system and the NSOOS sewerage system. Past investigations have indicated that there is capacity within the Quakers Hill sewerage system for lands that are within the catchment. To date lands that drain to the NSOOS catchment have not been assessed. Wastewater modelling of both system would be required to confirm and or determine any capacity issues / amplification required within the wastewater systems to service the proposed development.

Regards

Dennis

Alinta

From: Neale Hilton [mailto:Neale.Hilton@alinta.net.au]
Sent: Monday, 19 March 2007 11:24 AM
To: Greg Ives
Subject: Re: Huntingwood East

Greg,

Thanks for the detail regarding this proposal. Alinta has assesed the brief and can state the following.

A 75mm 210kPa gas main exists in Flushcombe Rd south of the Great Western Hwy. This can be extended and could be further utlised for residential and or light commercial applications.

A 63mm PE gas main operating at 210kPa exists in the Great Western Hwy adjacent to the entrance of the RTA crash lab. It also could be further utlised for residential and or light commercial applications.

No further gas mains are near the vicinity of the area.

We look forward to further investigation of this proposal.

Neale Hilton
Network Account Manager-Sydney
Alinta Asset Management
18A Rodborough Rd, Frenchs Forest NSW 2086 PO Box 6300 Frenchs Forest Delivery Centre NSW 1640
PH (02) 8977 6851 Fax (02) 8977 6831

Integral Energy

From: Craig Willebrand [mailto:Craig.Willebrand@integral.com.au]
Sent: Tuesday, 24 April 2007 2:01 PM
To: Greg Ives
Subject: East Huntingwood Precinct

Greg,

Thank you for your enquiry regarding the supply to the East Huntingwood industrial precinct. This enquiry has been registered under Customer Application Process (CAP) Number ENL, please quote this number for all future correspondence. The relevant staff have reviewed your enquiry and offer the following advice.

It is expected that the ultimate supply to the precinct will be via 3 x 11 kV cables originating from Arndell Park ZS. It is estimated that the development will require a supply of up to 11 MVA.

There are however, timing issues involved with obtaining supply from Arndell Park and these are inclusive of, but not limited to:

- The firm capacity of Arndell Park ZS will be exceeded by 2008
- The establishment of the proposed West Huntingwood ZS is required to allow any further demand to be supplied from Arndell Park ZS
- The West Huntingwood ZS requires the reconstruction and duplication of a 33 kV feeder to 132 kV.

Currently the central and western portions of the development are supplied from Arndell Park and the eastern portion of the precinct is supplied from Prospect ZS. These feeders may allow a limited nominal supply for building supplies as an interim measure.

It has been highlighted that the 132 kV works as described above will require augmentation and a possible new route through the East Huntingwood Precinct. Integral Energy would like to work closely with developers/landholders to secure a route which will allow the establishment of the West Huntingwood ZS and ultimately the capacity to supply the entire development.

If you require any further information, please contact me on the following numbers.

Regards,
Craig Willebrand
Engineering Officer
Major Projects
Integral Energy
(02) 9853 5189
0434 075 747

craig.willebrand@integral.com.au