APPENDIX 1

Russell Road Arterial Drainage Scheme Report

David Wills and Associates
Consulting Engineers
14 Hatherley Parade,
WINTHROP WA 6150
ABN: 84 442 721 346

CITY OF COCKBURN

SOUTHERN SUBURBS DISTRICT STRUCTURE PLANNING AREA

RUSSELL ROAD ARTERIAL DRAIN SCHEME

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1. INTRODUCTION

This report has been prepared to assist the City of Cockburn to resolve technical issues associated with the provision of a stormwater drainage system to service the City of Cockburn's proposed Southern Suburbs District Structure Planning Area, which covers the localities of Success, Atwell, Wattleup, Hammond Park and Banjup.

Over 10 years ago, the Water Corporation agreed to provide a stormwater Main Drainage outfall to service the agreed catchment to facilitate subdivisional development. The City of Cockburn was to assume responsibility for the coordination of the design and operate the drainage systems upstream of the proposed Water Corporation's Russell Road Buffer Lake in Success.

This report addresses the philosophy and design requirements of the major "Arterial Drains" which are required to enable the subdivisional development of the area covered by the Southern Suburbs District Structure Plan. The adoption of this report will result in an ordered, unified drainage system which will effectively serve the entire catchment but can be constructed in fragmented portions as the subdivisions occur on various fronts. This will facilitate the subdivisional process in the area.

Discussions with various Sections of the Water and Rivers Commission and the Water Corporation have been undertaken in preparing this report. Endorsement of the design approach and implementation of water sensitive design objectives of the drainage system has been gained. To gain formal approval of the suggested Arterial drainage system, the report requires acceptance by the City of Cockburn which is then forwarded to the Minister for the Environment via various Committees for the final Approval so the report can be adopted into the Structure Planning of the area by the City of Cockburn.

2. BACKGROUND

To facilitate the urban development east of the Beeliar Regional Park, which incorporates Thomsons Lake and Kogolup Lakes, the Water Corporation agreed to construct the Southern Lakes Main Drainage scheme. After considerable negotiation with various government departments, the final agreed Main Drainage system was to consist of three major "buffer lakes" (used for stripping nutrients from the stormwater and compensating flows to reduce the peak discharge from the system) and a gravity pipe system to convey stormwater discharge from the proposed future urban area adjacent to Thomsons Lake to the degraded Yangebup Lake to the north. From Yangebup Lake, stormwater in excess of specified operating and environmental criteria was to be then pumped into Cockburn Sound via a large diameter pressure main.

Additional drainage pump stations to control the rise in the water levels in various lake systems adjacent to the urban area were also required to be constructed to assist in meeting environmental criteria set out in the Southern Lakes Main Drainage Strategy Environmental Management Plan which was approved by the Department of Environmental Protection in 1988.

The Water Corporation has committed to extending the Southern Lakes Main Drain to the third and most southern buffer lake at Russell Road when the urban development requires the facility.

Stormwater disposal for the initial stages of subdivisional development within the Russell road catchment will use on site infiltration to the groundwater. The timing of the construction of the Water Corporation infrastructure will depend upon the rate of development of the area and interim strategies that can be employed to ensure the required level of service can be provided by the Water Corporation.

Upstream of the Russell Road buffer lake, the integrated major (Arterial) drainage system is to be under the control of the City of Cockburn. To facilitate the design of the Arterial Drainage system, the Drainage Planning Section of the Water Corporation prepared a conceptual drainage system for the total drainage catchment and modelled it using a computer model. The results help set the preliminary sizing of the pipe network and detention basins, which provided an indication of the pipe and channel flows and required storage volumes for various recurrent interval storms.

A draft report of the computer modelling of the proposed Russell Road Arterial Drainage strategy was completed in April 2001 by the Water Corporation. The date of the formal release of this report is unknown. Sections of the report detailing the conceptual drainage system were provided by the Drainage Planning Section of the Water Corporation and was used to assist in preparing this report.

The Water Corporation's conceptual arterial drainage system was based upon the premise that the Annual Average Maximum Groundwater Level (AAMGL) was to be maintained to values set in the Southern Lakes Main Drainage Strategy Environmental Management Plan. The AAMGL values follow the shape of the Water and Rivers Maximum Groundwater values detailed in the Groundwater Atlas, but are approximately 0.6m lower.

As the two of the three catchments of the Southern Lakes Main Drainage system have commenced to be developed (Bartram Road and Hird Road), the AAMGL values have been used to set invert levels of the major drainage pipeline and Low Water Levels (LWL) of detention basins. These values were to be used to set the proposed Invert Levels of the Russell Road Buffer Lake and upstream drainage and detention basin system.

The Bartram Road catchment, immediately north of the study area, has the largest of the three buffer lakes to be constructed by the Water Corporation. This lake has been operating for over 10 years. Due to the close proximity of the AAMGL to the ground surface in the Bartram catchment, significant areas of fill have been required to enable the area to be drained.

The Hird Road catchment is the most northern catchment area and has a relatively small buffer lake. This is due to a greater proportion of the catchment which is located well above the regional groundwater level, on site infiltration systems to dispose of the excess stormwater was used. The buffer lake is located at the downstream (western) end of the catchment to cater for the surrounding low lying development area.

This report is prepared to assist with the integration of the essential major drainage courses and detention basins into the Southern Suburbs District Structure plans. The philosophical approach of the design of the drainage system and disposal of the excess stormwater is an

alternative approach to that used in the two catchments to the north. The Waters and Rivers Commission has commended the proposed design approach of this report in their letter of approval dated March 19, 2003 (WRC Ref: 8303).

3. REVIEW OF THE GROUNDWATER LEVELS IN THE STUDY AREA

To validate the AAMGL to be adopted for the District Planning, a series of Water and Rivers monitoring bores and Water Corporation production bores for the area were reviewed. Records to at least October 2000 were reviewed to capture the peak groundwater level for the 2000 winter. The winter of 2001 and 2002 were abnormally dry with the 2001 winter estimated to be greater than a 1 in 50 year drought event. The incorporation of these values would lower the AAMGL values and cause spurious results.

To ensure a degree of reliability, monitoring bores had to have a sufficiently long record to get meaningful results. Bores of +10 years record was used, except for the bore JE23C located on Gaebler Road between Lyon Road and Beenyup Road, which only had a record from approximately August 1994. This bore was used to help gain an understanding of the trends in the south east corner of the catchment where there was a lack of data.

The location of the bores used in the study relative to Southern Suburbs Districts Planning Area is detailed at Appendix A.

3.1 AVERAGE MAXIMUM GROUNDWATER LEVELS FOR THE STRUCTURE PLANNING AREA

The five year average of the maximum recorded groundwater levels (1996 to 2000) has been calculated and tabulated in Table 1. below. To determine trends in the variation in the Regional Groundwater levels, the ten year average (1991 to 2000) and the 15 year average (1986 to 2000) values were also calculated.

Table 1: **5-*year, 10-year and 15-year Annual Average <u>Maximum</u> Groundwater Levels in boreholes near the Study Area.***

Borehole Reference	Ground Level (AHD)	GWL from GW Atlas (AHD)	Maximum Water Level			Ave. GWL below GW Atlas		
			5 Year Average	10 Year Average	15 Year Average	5 Year Average	10 Year Average	15 Year Average
TM13C	18.7	17.8	14.51	15.02	15.15	-3.29	-2.79	-2.65
JM37	22.1	20.1	19.33	19.49	19.53	-0.77	-0.61	-0.57
JE12A	37.1	20.4	19.27	19.49	19.58	-1.13	-0.91	-0.82
JM33	29.2	23.5	22.25	22.48	22.56	-1.25	-1.03	-0.94
JE11A(E)	29.2	24.4	22.85	23.00	23.11	-1.55	-1.40	-1.29
JM28	21.7	21.3	20.41	20.57	20.61	-0.89	-0.73	-0.69
TM16C	19.9	20.2	18.59	18.68		-1.61	-1.53	
JE23C #	29.0	26.2	24.19			-2.01		
JM49	28.0	25.8	23.76	23.79	23.74	-2.04	-2.01	-2.06

- 7 years record only

For comparison, the estimated maximum Groundwater Level (GWL) shown in the Water and Rivers Commission Groundwater Atlas is also given. Significant variations can be seen.

Different methods of analysing the data gave similar gradual reductions in the regional groundwater. The 10 year Average Maximum Groundwater Level and the 15 year Average Maximum Groundwater Level are very similar and therefore further discussions will only be based on the 10 year Average Maximum Groundwater level values.

From Table 1, it can be seen that on average, the 5 years Average Maximum Groundwater Levels are approximately 1.0 to 1.4m below the groundwater levels given in the Water and Rivers Commission Groundwater Atlas. Although not as great, the 10 year Average Maximum Groundwater Levels are still an average of approximately 0.9m to 1.0m below the Groundwater Atlas values.

There are several major influences which significantly impact on the groundwater levels on a regional basis over the District Planning Area:

1. Over the last 20 years, the average rainfall for Perth has been slowly reducing. The more extreme weather conditions over the last 5 to 7 years have depressed the average further. This is reflected in the tabulated results.

2. The Water Corporation installed a series of groundwater extraction bores (Jandakot Groundwater Scheme Stage 2) for the Perth water supply in the late 1980's. Within the Structure Planning Area, there are 6 bores located in Lyon Road. The bores have contributed to the lowering of the groundwater level below the values given in the Groundwater Atlas.

   As part of the Water Corporation Operating License for the groundwater extraction, the Waters and Rivers Commission have placed conditions on the operating criteria for the production bores. To reduce the environmental impact on the adjacent significant wetlands, some of the production bores have been operated less frequently to prevent operating criteria from being violated.

3. The Peel Main Drain is located south of Rowley Road. This major drainage system was constructed in the 1930's to facilitate the development of the surrounding water-logged land for agricultural purposes. The system discharges into the Serpentine River.

   The open drain acts as a major stabilising influence of the groundwater levels over the southern end of the District Scheme Area as it prevented any sustained rise in the groundwater level. This is demonstrated by the very uniform averages of the maximum groundwater levels over the series of years from the Monitoring Bore JM49.

Based upon the actual observed groundwater levels, the 5 year Average Maximum Groundwater Levels within the Southern Suburbs District Structure Planning Area have been prepared. (Appendix B: Drawing 02006 – C1). These values are significantly lower than the original Southern Lakes Drainage Management Plan groundwater contours but reflect the current groundwater regime in the area over a period of time.

3.2 AVERAGE MINIMUM GROUNDWATER LEVEL FOR THE STRUCTURE PLANNING AREA

The minimum average groundwater level for a 5, 10 and 15 year period have also been calculated from the regional bores and recorded at Table 2 below. This study was performed to gain an indication of the seasonal groundwater fluctuation in the study area.

The natural changes in groundwater levels have a significant impact upon the design and operation of detention basins and open channels within the proposed future urban area. See Section 5 for details and implications.

Table 2: ***5-year, 10-year and 15-year Annual Average Minimum Groundwater Levels in boreholes near the Study Area.***

Borehole Reference	Ground Level (AHD)	GWL from GW Atlas (AHD)	Minimum Water Level			Ave Yearly GW fluctuation		
			5 Year Average	10 Year Average	15 Year Average	5 Year Average	10 Year Average	15 Year Average
TM13C	18.7	17.8	14.00	14.22	14.34	0.51	0.79	0.81
JM37	22.1	20.1	18.50	18.63	18.62	0.83	0.86	0.91
JE12A	37.1	20.4	18.72	18.94	19.03	0.55	0.55	0.55
JM33	29.2	23.5	21.32	21.53	21.56	0.93	0.94	1.00
JE11A(E)	29.2	24.4	21.76	21.92	22.01	1.09	1.08	1.11
JM28	21.7	21.3	19.41	19.52	19.53	1.00	1.05	1.08
TM16C	19.9	20.2	17.63	17.71		0.96	0.97	
JE23C #	29.0	26.2	23.42			0.77		
JM49	28.0	25.8	23.24	23.28	23.31	0.51	0.51	0.43

- 7 years record only

The fluctuation between the maximum and minimum average groundwater levels for the various return periods appear to be fairly uniform and an average of approximately 0.8 metres, but can be greater than 1.0m in some locations. The fluctuation in water levels will make the construction of natural permanent water features difficult.

The 5 year Average Minimum Groundwater Levels for the structure plan area is at Appendix C for information (Drawing 02006 – C2).

3.3 OTHER IMPACTS ON THE REGIONAL GROUNDWATER LEVEL

Water Authority groundwater modelling of the Jandakot Stage 2 Water Supply area in 1993 indicates that the groundwater level of the operating system could be below the 5 year Average Maximum Groundwater level calculated above. Due to licensing conditions imposed by the Water and Rivers Commission, operating conditions and environmental concerns, these values have been amended. Some of the production bores near significant wetlands, including the Beenyup Road Swamp within the Structure Planning Area, have had the extraction quantities restricted in recent years after the series of relatively dry winters to reduce the impact on the wetland.

Discussions were held with the Groundwater Source Branches of the Water Corporation and the Waters and Rivers Commission to determine the optimal groundwater levels in the scheme planning area.

The Water Corporation did not have major concerns about the impact that the proposed drainage system would have on the groundwater resource. The bore operations are dictated by licensing conditions set and monitored by the Water and Rivers Commission.

The Waters and Rivers Commission required that the significant wetlands south of Gibbs Road and east of Lyon Road – Beenyup Road Swamp - have a minimum groundwater level regime to ensure the continued viability of the wetland and surrounding area and have set a series of groundwater level objectives to meet the Environmental Licensing conditions.

These values include the "Preferred Summer Minimum Groundwater Level" of 24.00m AHD and an "Absolute Summer Minimum Groundwater Level" of 23.60m AHD. Since the summer of 1997/98, the Preferred Summer level has been breached each year and the groundwater level was within 0.05m of breaching the Absolute Level in May/June, 2002. These low levels have influenced the operation of the Water Corporation production bores.

The average maximum groundwater level at Beenyup Road Swamp in the 7 years of records from September 1996 to November 2002, is 24.74m AHD. The lowest maximum groundwater level of 24.35m AHD was recorded in 2002, indicating that the Absolute Summer Minimum Value may be breached in the summer of 2002/03.

To assist in ensuring that the Absolute Summer Minimum Groundwater level for the Beenyup Road Swamp is not breached in the future, the proposed drainage strategy will assist in raising the groundwater level whist protecting the urban development from flooding. This can be achieved by nominating the level of the subsoil drains adjacent to the wetland. During periods when the groundwater is below the subsoil, stormwater is recharged back into the ground. When the groundwater rises, the subsoil prevents the continued rise to ensure the houses are protected.

The criteria for this area was used to set the maximum groundwater levels for the total scheme area and is a compromised between competing factors. If the subsoil levels are set too low, groundwater resources currently available for environmental and extraction for the production of Perth potable water supply will be lost as it be drained away too quickly.

If the levels are set too high, the regional groundwater would reach this level very infrequently, but significant additional capital expenditure to fill the land and construct shallow detention basins and drains. This will be of benefit to neither the environment nor the Community.

The setting of the groundwater level for the Southern Suburbs Districts Structure Plan has resulted in the development of revised concept in the drainage strategy for the area. In discussions with the Waters and Rivers Commission, the water level of the Beenyup Road Swamp will be set at 25.3m AHD, after which the groundwater will flow to the Local Authority stormwater drains. This will control the further rise of the groundwater level.

Based upon this environmental consideration, the balance of the Structure Plan west of Beenyup Road Swamp will have groundwater levels set that will sustain these

requirements. Below the groundwater level set by the subsoil and drainage system, the resistance of the groundwater flowing through the soil will slow the outflow of the groundwater and sustain the groundwater in the Swamp for a longer period of time to provide a greater water store in the aquifer.

The required groundwater level at Beenyup Road Swamp was used to set the groundwater levels for the entire District Structure Plan.

4. CONTROLLED GROUNDWATER LEVELS

The concept to be employed in this Drainage Strategy is to set "**Controlled Groundwater Levels**" to meet the objectives detailed above and install infrastructure to meet these objectives. The Controlled Groundwater Levels have been set as a conciliation between the requirements of the Environment, groundwater extraction by the Water Corporation and private organisations and subdivisional development to optimise the water resource in a synergetic relationship.

The Controlled Groundwater Level will supersede the concept and objectives formerly known as the AAMGL in this catchment. This is because infrastructure will be constructed to control the groundwater levels to agreed values on a regional basis, rather than construct the infrastructure to reflect an agreed groundwater regime.

4.1 PHILOSOPHICAL APPROACH

A series of "groundwater collection points" that will also act as detention basins are proposed to control the rise of the groundwater table within the Russell Road Arterial Drainage catchment. During a wet winter, the regional groundwater table will rise and the Controlled Groundwater Level will be reached, which will be set as the level of the subsoil drains and the outflow pipe from the detention basins. As the groundwater table continues to rise, the outflow will increase and assist in controlling the further rise in the groundwater. The subsoil drains set to the Controlled Groundwater Level are required beyond the basin within the drainage catchment area defined by the area where the finished lot level and Controlled Groundwater Level is less than, or equal to, 3.0m.

In a dry winter, the regional groundwater level may be some distance below the invert level of the outflow pipes. During short duration, low intensity storms, the stormwater runoff will be recharged to the groundwater via the subsoil drains or flow to the detention basin and infiltrate back into the groundwater.

For the higher intensity storms, the dead storage below the outflow pipe will fill and some of the stormwater runoff will discharge into the Arterial drainage system for short durations. A majority of the stormwater runoff will be encouraged to recharged into the groundwater. This design approach has been adopted to maximise the infiltration into the groundwater to maximise the benefits to the environment and groundwater users.

The approach will also result in reduced construction costs of the Local Authority drainage networks as only the stormwater runoff from the catchment area directly connected to the detention basins will be conveyed from the catchment area. See Section 5.

4.2 CONTROLLED GROUNDWATER LEVEL FOR SOUTHERN SUBURBS DISTRICT STRUCTURE AREA

The Controlled Groundwater Levels for the Russell Road Arterial Drainage Catchment have been determined after discussions with the Waters and Rivers Commission. These levels are approximately 1.0m to 2.5m below the Maximum Groundwater Level in the Groundwater Atlas. The value is a compromise between the 1 in 5 year Annual Average Maximum Groundwater Level from 1996 to 2000 and the needs to sustain the groundwater level in the vicinity of the Beenyup Road Swamp to a minimum value of 25.3m AHD.

The Controlled Groundwater Level for the Southern Suburbs District Structure Plan catchment is detailed at Appendix D and should be used in setting all infrastructure required to control the groundwater levels within the Structure Area (Drawing 02006-C3).

The Controlled Groundwater Level is to supersede the values set in the Southern Lakes Main Drainage Strategy Environmental Management Plan (EMP). The values have been developed for the area south of Gibbs Road and the area adjacent to the Russell Road Buffer Lake. North of Bartram Road, the EMP AAMGL values have been used. Between these two points, the Control Groundwater Levels have been merged to meet operating requirements in the Russell Road catchment.

Due to existing infrastructure and development, the Control Groundwater Levels between Bartram Road and Gibbs Road may have to be amended after consultation with the Consulting Engineers of the major land developments in the Bartram Road catchment.

The connection point into the Russell Road Buffer Lake has already been determined by the Water Corporation and is set at an IL of 18.80m AHD.

If lower Controlled Groundwater Levels are used across the study area, the available gradient for the flow of the stormwater drainage across the catchment is greatly reduced. Pipe diameters would become too large and the available grades to would be too flat to achieve frequent scouring velocity in the pipes.

5. ARTERIAL DRAIN CONCEPTUAL DESIGN

Careful design considerations will be required to integrate the stormwater drainage systems into the Structure Plan whilst maintaining a benefit to the environment and all Developers within the catchment.

The catchment boundary of the Russell Road buffer lake and the area contributing to the Arterial Drainage System is assumed to be the Water Corporations Declared Drainage System. South of this point, the land can be developed using either on site soakage, if the degree of separation between the groundwater level and finished lot level is adequate, or discharge to the Water Corporation's Peel Main Drain in the Serpentine Drainage area. The catchment and sub catchment boundaries for the Arterial Drain are shown at Appendix E (Drawing 02006-C4). The catchment boundaries were adjusted to reflect the subdivisional requirements at March 2003.

Due to the lack of grade available across the site, and the need to control the rise of the groundwater level effectively, it is suggested that a series of open drains and/or subsoil drainage pipes be constructed in a north/south direction and ultimately be connected to the Russell Road buffer lake.

The proposed Arterial Drain for the Southern Suburbs Districts Structure Area is detailed at Appendix F (Drawing 02006 – C5). Four detention basins (Groundwater Collection Points) are proposed to service the catchment which supersedes the Water Corporation's previous concept of installing up to 9 detention basins.

The concept design for the sewerage system within the Structure Plan has also been reviewed to identify areas where minimum lot fill levels are controlled by the sewer system rather than the Controlled Groundwater Level. From the preliminary design undertaken, the propose drainage system will not impose additional major constraints or fill requirements above the Water Corporation conceptual sewer design for the area.

The design requirements of the Arterial drain are detailed below:

5.1 **MAJOR GROUNDWATER COLLECTION POINTS** (Detention Basins)

The suggested Groundwater Control Points for the Southern Suburbs District Structure Area are as follows:

5.1.1 **Russell Road Buffer Lake** (Operated by the Water Corporation)

The location of the proposed nutrient stripping and detention basin identified by the Water Corporation shall be retained. The storage capacity of the basin and invert level of the pipe system to the Bartram buffer lake will be retained to the values suggested in the Water Corporation Arterial Drainage concept. Minor modifications in the proposed design may be required.

As the catchment area directly connected into the drainage system has been reduced from approximately 670 ha to 140 ha, 20.9% of the original area, the discharge from the basin can be reduced. To maintain sufficient flow in the Water Corporation drainage system the 1 in 10 year peak outflow from the Russell Road Buffer lake has only been reduced 25% from 667 l/sec to approximately 500 l/sec. This increase discharge per impervious hectare has resulted in a reduction in the storage requirements at each the detention basins.

5.1.2 **Freeway Swale Channel** (Operated by Local Authority)

This control point is to be a linear open channel (swale) adjacent to the major high voltage Western Power power lines and extend between Russell Road and Gaebler Road. The swale is to be constructed to act as a major groundwater control for the total drainage system. The adoption of this large, strategically placed linear open drain will provide substantial storage, which will assist in reducing the size of detention basins located elsewhere within the catchment.

The Swale channel is approximately 1.2 km long and is recommended to be located within, or to the west of the Western Power Easement. The Freeway Swale Channel is an

opportunity to create a landscaped buffer between the power lines and the urban development.

It may be possible to negotiate partial use of the Western Power Reserve to facilitate the construction of this drainage system. If use of portion of the Western Power land becomes difficult due to operational constraints, the Freeway Swale Channel may be separated into two smaller sections with a piped drain through the higher land to connect the two parts.

The swale channel should be landscaped with 1 in 6 to 1 in 8 side slopes on the public access side. Due to land restriction, it may be prudent to prevent public access to the eastern side closest to the Western Power easement and design this side of the channel with a bank gradient of approximately 1 in 2, with heavy vegetational planting on the banks.

The outlet from the Swale channel will ultimately connect to the Russell Road Buffer Lake via a series of either open channels and/or pipe drains, depending on the subdivision layouts.

It is proposed to construct the landscaped Swale Drain with negligible fall across the full length of the drain (less than 0.1m between the incoming pipe at the southern end of the swale drain to the outgoing pipe. During major storm events, the flow velocity within the swale will be very low and the main function of this control point will be to contain the storm event. The very flat grade will also facilitate infiltration along the basin's entire length.

The invert of the swale shall be 0.5 to 0.8 metres below the outgoing pipe for the full length of the channel. This additional depth is to assist in recharging the groundwater when the regional groundwater is below the outlet pipe by increasing the infiltration area. During periods of high regional groundwater level, the additional depth of the channel will assist in attracting groundwater to the swale as it will reduce the flow resistance through the soil which will improve the effectiveness controlling the regional groundwater level.

The Freeway drainage system has been designed so a majority of the catchment in the vicinity of Russell Road will drain to the Bartram Road catchment. The existing MRWA nutrient stripping / detention basins located on the south eastern side of the intersection of the Freeway and Gibbs Road can be connected to the Freeway Swale Channel if required.

5.1.3 **Lyon Road Groundwater Collection Point** (Operated by the Local Authority)

This groundwater collection point will be used to service the catchment east of the Lyon Road. To facilitate construction, lots fronting Lyon road will drain onto Lyon Road and the area will be part of the Freeway Swale Drain catchment.

The pipe under the Freeway to create an outlet to the Swale Drain will have to be thrust bored or micro-tunnelled. It will be required to carry the 1 in 5 year ARI peak discharge from the Lyon Groundwater Collection Point plus the balance of the Freeway Swale Drain catchment area.

It is assumed that only the subdivided area in the vicinity of Lyon and Gaebler Roads will be served by this basin. Originally, the drainage concept was to include the area in the proximity of Lyon Road and Gibbs Road into the basin, but the area of “Bush Forever”

would make this option too expensive to construct. Instead, portion of the area south of Gibbs Road shall dispose of stormwater runoff by soakage. The area north of Gibbs Road flows into the Bartram Road catchment.

5.1.4 Gaebler Road Groundwater Collection Point (Operated by a Local Authority)

A major ridge running east/west separates the Gaebler Road Groundwater Control Point from the Russell Road Buffer Lake and creates a natural catchment in the south of the Structure Area.

A pipe system to convey the basin outflow must be constructed to ultimately connect into Russell Road Buffer Lake so the groundwater can be accurately controlled in the vicinity of the Gaebler Road Groundwater Collection Point. The pipe route between Gaebler Road and the Russell Road buffer lake will need to be developed in consultation with the land owners to achieve the most direct route to limit the length of the pipeline.

The actual location of the basin, and the extent of the catchment connected to it can be resolved between the effected landowners. If the basin is moved to far to the west, there will be insufficient fall to enable the basin to discharge to the Russell Road Buffer Lake. Areas west of the basin could be filled as it will not be possible be served the area with subsoil drains as they would be required to flow uphill. The basin location and connecting system will require careful considerations.

A system using only on site infiltration for this catchment would defeat the concept of externally controlling the rise in the groundwater. An outflow to control the possible rise in groundwater in this area must be constructed.

The only possible option would be to pipe the groundwater collected in the detention basin westward into the Harry Wearing Nature Reserve to a point where the groundwater would not affect the drainage system. However, all surface and sub-surface flows would discharge into the reserve, which would create potential possible contamination. This option is not supported and it is highly unlikely that CALM approval could be obtained. See Section 5.2.1 below.

5.2 GROUNDWATER COLLECTION POINT (DETENTION BASIN) DESIGN CRITERIA

The design approach of the Groundwater Collection Points (detention basin) is to ensure that they "leak" to maximise the recharge into the regional groundwater system. The philosophy of using “bank” storage to minimise the peak discharge from the basin and assist in recharging the groundwater has not been included in the design parameters provided.

5.2.1 Groundwater Collection Point Overflow

The major pollution load that occurs within a drainage system is for the frequent, small duration storms which mobilise various sources of pollution and washes them into the drainage network.

In storm events greater than 1 in 5 year Average Recurrence Intervals (ARI) and of any duration, the total volumetric runoff constitutes a very small portion of the total yield from a catchment. However, the storage volume required to control the storm event in excess of 1 in 5 years, requires large areas of land to be designated for stormwater drainage purposes that is rarely used. Therefore, it is proposed that each groundwater collection point shall be designed only to contain a 1 in 5 year ARI storm event as a minimum requirement.

Due to the high quality of the stormwater in the larger storms events, the flows generated from storms in excess of a 1 in 5 year ARI will be allowed to overflow into adjacent wetland or conservation area. The only exception will be the Freeway Swale Channel which is land locked and will be required to contain a 1 in 100 year storm event with 300mm freeboard. The only possible alternative would be to recontour the land within the Western Power Easement to create additional storage at a higher level.

The overflow areas would be as follows:

The Russell Road Buffer Lake into Thomsons Lake
The Lyon Road basin into Beenyup Road Swamp
The Gaebler Road basin into the conservation wetland south of Gaebler Road and east of Frankland Avenue

Discharges from the Russell Road Buffer Lake and Gaebler Road will ultimately flow into Thomsons Lake and influence the water level within the Lake. As part of the total drainage strategy for the South Jandakot Branch Drain, the Water Corporation has installed a pump at Thomsons Lake to control the rise of groundwater. During a series of very wet winters when the discharge overflow points were to overflow frequently, the impact on Thomsons Lake will be minor. Water quality will be high and contribute to raising the level of the lake. If the lake was to rise above the desired control level, the excess stormwater will be pumped back into the South Jandakot Branch Drain at a relatively low flow rate which then flows to Yangebup Lake, and ultimately pumped to the ocean. The overflow system will maximise recharge into the lake system rather than the stormwater being quickly bypassed to Yangebup Lake and pumping into the ocean.

5.2.2 Groundwater Collection Point (Detention basin) Design Criteria

The entire drainage system, including the Groundwater Collection Point basin, will have to consider the 1 in 100 year storm event and ensure minimum freeboard requirements are met. It is proposed that the following design criteria be used to develop the design for the Russell Road Arterial Drain and Groundwater Collection Points:

1. All Lots shall be finished to an **absolute** minimum of 1.5 metres above the Controlled Groundwater Level.

2. Each Lot shall dispose of stormwater runoff within the lot using soakwells.

3. Roads and Public Open Space shall be depressed below the lot levels in accordance with good design and stormwater drainage principles. The 1 in 100 year top water flood level shall be a minimum of 0.3 metres below the lowest lot level, unless otherwise set by the Local Authority.

4. The outflow pipe from the Groundwater Collection Point basin shall be set to the Controlled Groundwater Level of the area.

5. The invert level of the Groundwater Collection Point basin shall be a minimum of 500 mm below the invert level of the outgoing pipe. The further over excavation of the basin to encourage the interception of the local groundwater at the basin is recommended. This area may tend to become swampy and will provide an opportunity to plant the area with suitable vegetation to assist with nutrient removal.

   For each basin, the area below the Controlled Groundwater Level shall be 10.0 square meters per impervious hectare connected to the basin, with a minimum area of 60 square meters being provided.

   Alternatively, a series of suitably interconnected soakwells of 1.5m diameter (minimum) which extend a minimum of 1.5 metres below the Controlled Groundwater Level could be used. If soakwells are installed, they shall be provided at the rate of six (6) 1.5m diameter soakwell per impervious hectare connected into the basin. Larger liners may be used with four (4) 1.8m soakwells being required.

   If soakwells are used, the top can be located a maximum of 0.5 m above the Control Groundwater Level and the area filled to create a dry area. The soakwell lids can be grated to allow excess stormwater to discharge into the storage area from the pipe system. The final design will be subject to City of Cockburn approval.

6. Subsoil drains shall be constructed within the Detention Basin catchment to assist in controlling the rise of the groundwater and set to the Controlled Groundwater Level. The subsoil area, and hence catchment of the basin, shall extend where the separation between the Controlled Groundwater Levels and Lot Levels is less than, or equal to, 3.0m.

   In subsoil areas down gradient of the Groundwater Collection Point, the subsoil drains are to be connected to the pipework conveying the stormwater to the next downstream Groundwater Collection Point. It is important to achieve a network of subsoil drains in the vicinity of the basins to control the rise of the groundwater.

7. The 1 in 5 year ARI storage capacity would be contained in a formalised area or swales within playing fields or POS. The top water level (TWL) would be set to ensure flooding of adjacent subdivided lots does not occur.

8. The allowed peak outflow for a 1 in 5 year ARI storm event from each basin as shown on the Proposed Arterial Drainage Scheme Infrastructure plan (02006 – C5 at Appendix F). At the time of the final detailed design, the outflow is to be checked using suitable hydraulic models to determine the peak discharge from a detention basin for a 1 in 100 year ARI storm event.

   The peak 1 in 100 year discharge into the drainage outlet system shall not be greater than 1.40 times the peak 1 in 5 year ARI value given in the design criteria. Additional flows into the overflow discharge area is allowed and the value will be

dependant only of the local drainage hydraulics. There is no maximum discharged value into the overflow area.

9. The outflow from the Detention Basin is the maximum value and may be reduced to suit engineering requirements, The minimum peak outflow from the basin for a 1 in 5 year ARI storm event shall be no less than of 6.0 l/sec per impervious hectare of catchment flow into the basin.

10. The runoff coefficient of 0.25 shall be applied to the catchments directly connected to the Groundwater Collection Point basins.

11. The actual storage volumes to be provided in the storm events greater than 1 in 5 year ARI shall be determined during the detailed design phase. The volume will be dependant upon the location and method to be used to discharge the excess stormwater into the agreed location. This shall be confirmed by the Local Authority before completing the design.

12. The location of the detention basins is indicative only. The final position will be dependant upon the subdivisional layout. The catchment area may be amended to suite, and the basin split into two smaller, interconnected basins if required.

13. Due to the fluctuation between the maximum and minimum groundwater levels in the area of approximately 0.8 metres, the integration of large bodies of open water into landscaping of public open space is relatively difficult. To address this large variation of groundwater level, lined lakes have been suggested to be incorporated into existing and proposed future developments. The benefit of a lined lake, other than short term aesthetics, cannot be justified. This option will **NOT** be supported as it is contrary to the principles of good stormwater drainage practices for the following reasons:

    a) The lined lake will not allow groundwater recharge, a central tenant of the Arterial Drainage concept.

    b) There will be a nutrient build-up within the lined lake system as there is no flushing effect.

    c) If there is a rapid rise in the groundwater level without suitable inflows to the lake, the liner can float and destroy the drainage system with a resulting high cost of repair to the Community.

    d) The use of groundwater resources to fill a lake which will then evaporate, is not an environmentally sound management practice for a resource which has an increasing environmental value. There is also little Community benefit.

    e) The long term operation cost (power and replacement of the pumps) to maintain groundwater in the lined lake is high and without benefit to the Community.

    f) The Local Authority, and hence the Community, will be responsible for long term operating and maintenance of the lake, and the future

replacement costs of the lake liner. Locating a failure in a liner demonstrated by a fall in water level within the lake is very difficult, expensive and time consuming.

To remove the Public expectation of a large body of water integrated into a subdivision, Developers could assist in the Community education programme to explain that regional fluctuations of the groundwater level is a natural phenomenon and part of an ecologically sensitive drainage system. Small artificial lake areas above the groundwater cannot be sustained without negative environmental impacts. The philosophy of the stormwater drainage scheme design for the Southern Districts Regional Structural Plan could be explained to potential purchasers to enable an appreciation of the benefits the system has to the environment.

5.3 LOT FILL LEVEL AND CONTRIBUTION CATCHMENT AREAS TO THE GROUNDWATER COLLECTION POINTS

The philosophy behind the drainage strategy for this region is to maximise infiltration into the groundwater. Therefore, for areas that have a minimum of 3.0 metres separation between the final Lot level and the Controlled Groundwater Level, disposal of stormwater shall be by infiltration.

With the use of a stormwater infiltration systems for a portion of the total subdivision catchment, significant environmental benefits can be gained, which include:

1. The area directly connected to the Groundwater Collection Point (detention basin) is reduced which minimises area for the basin.

2. By infiltrating the excess stormwater into the groundwater, the water quality is naturally improved and helps maximise the groundwater recharge in the area. Materials to bind phosphorous may be required to line the basin to assist in improving the stormwater quality.

3. Runoff from a major storm event infiltrated into a remote sump is delayed for between 1 and 30 days before it is intercepted by a subsoil drainage system or Groundwater Collection Point to be conveyed to the Russell Road Buffer Lake. If the regional groundwater level is low, this recharged stormwater is not removed from the catchment by the drainage system.

   If the total catchment was connected to the compensation basin, the recharge to the groundwater would be greatly reduced. The time available for the excess stormwater to infiltrate is much less as the detention basin would limit the degree of attenuation of the peak of the storm events and a greater proportion of the total volume of stormwater runoff would enter the Water Corporation Main Drainage system, rather than recharge the groundwater.

Swale areas or traditional fenced sumps can be used in the infiltration areas. The design of these devices shall comply with the following design criteria:

1. The infiltration rate shall be determined by investigation, or agreed value with the City of Cockburn. A clogging factor of 0.5 (i.e., half the observed value) shall be

used on the collected field results. The infiltration capacity of the base and sides shall be allowed, with an allowance for reducing head.

2. The 1 in 100 year top water level shall be set a minimum of 300 mm below the minimum Lot level.

3. A flow path shall be provided to ensure flooding does not occur during an extreme event. If the area can overflow into an adjacent detention basin, the effect shall be considered in the design of the drainage system.

   If a catchment area is land locked, an outflow pipe shall be installed and the pipe invert level shall be set at the TWL of the 1 in 100 year storm event. The pipe shall be provided to convey the excess water to a suitable emergency discharge point and shall be designed to discharge the design infiltration rate of the basin or 20 litres per second, whichever is greater.

   Alternatively, 600mm of freeboard to the lowest lot level, or twice the required 1 in 100 year storage volume with 200mm of freeboard can be provided.

5.4 DESIGN OF CONNECTIONS BETWEEN THE GROUNDWATER COLLECTION POINTS

For all drainage systems within the Southern Districts Structure Planning Area, suitable litter and silt traps shall be constructed within the drainage system before discharging to a sump or detention basin. The philosophical approach should be to minimise the number of traps to reduce capital cost to the Developer and continuing ongoing maintenance costs to the Local Authority, whilst ensuring a high degree of trapping efficiency of the water borne debris and some nutrient removal.

It is suggested that one trap serves a catchment area of between two to six gross hectares of residential area. POS and Regional Open Space are excluded. This is preferred to constructing silt traps on each road side gully.

If there is a major catchment with a large central (Arterial) drain with numerous lateral connections, it is recommended that the lateral drains are trapped before discharging to the central drain. This is to reduce capital costs and the scale of the trap required on the main central drainage system. This philosophical approach will also increase the effectiveness of the trap.

Open channels are to be used were possible to assist in controlling the groundwater rise. They should be generally oriented north / south to be approximately parallel with the Controlled Groundwater Levels to control the rise in the groundwater.

The use of landscaped swale channels are strongly supported to assist in nutrient removal and sound drainage management techniques.

Piped sections could be used to convey flows in an east/west direction with the fall of the groundwater gradients to minimise the possible impact of lowering the adjacent groundwater levels. If open channels are used in an east/west orientation, suitable drop

structures shall be used to reflect the Regional Controlled Groundwater Level. Culverts across roads, or similar, can also be used to create the required fall.

In the vicinity of the Beenyup Road Swamp / Lyon Road, the groundwater contours run parallel to the direction of flow to the Lyon Road Groundwater Collection points. To enable the system to function, additional fill may be required, or the drainage system be constructed using a different approach. Subsoil drains would be set to the Groundwater Control Levels. However, the stormwater pipe drains could be constructed to be water tight and the invert level located below the Groundwater Control Level. Thus the groundwater is prevented from rising above the subsoil drains, but the main conveyancing system will not over drain the regional groundwater.

6. FUNDING OF THE CONSTRUCTION OF THE ARTERIAL DRAINAGE SYSTEM

Funding for the proposed integrated Arterial Drainage system and Groundwater Collection Points within the Southern Suburbs District Structure Planning Area will be by contributions from ALL Developers within the Russell Road Branch Drain catchment area. With the proposed drainage system, the cost will be reduced from the concept design suggested by the DMP & EMP and hydraulically analysed by the Water Corporation.

The total integrated drainage system is required to control the rise of the groundwater. All Developers within the catchment will benefit from the construction of the Arterial Drainage system. Without the system, groundwater could rise uncontrolled and create significant additional development costs to all Developers.

The use of on site infiltration to dispose of stormwater in suitable locations is encouraged. However, it must be stressed that these areas will still be required to contribute to a regional Arterial Drainage scheme to control the rise in groundwater level for the whole catchment.

The area contributing to the drainages costs should be all land owners with lots within both the Southern Suburbs District Structure Planning Area and the Water Corporation Declared Main Drainage catchment boundaries. The total area is approximately 518 ha, excluding the freeway reserve.

7. RECOMMENDATIONS

To facilitate the proposed Local Authority Russell Road Arterial Drainage system for the Southern Suburbs District Structural Plan Area, the following recommendations are made:

- The groundwater levels for the total catchment area are set to ensure the viability of the Beenyup Road Swamp. The values are a reduction on the groundwater levels set in the original EMP for the area and are a compromise between environmental and development needs.

- Subsoil drains be placed at the required Controlled Groundwater Level to prevent the rise of the groundwater during periods of high rainfall.

- A series of Groundwater Control Points (detention basins) are to be used in association with the subsoil drainage system to provide a drainage system which meet sound water resources management principles.

- The Structure Plan for the area be developed to encourage the use of linear public open space/swale drains running in a north/south direction to control the rise of the groundwater level. This will assist in reducing the areas of detention basins within the District Structure Planning area and effectively control the rise of the groundwater within the area.

- Areas with sufficient separation between the lot fill level and Controlled Groundwater Level shall dispose of the stormwater by infiltration. In some areas that are not contiguous to a proposed detention basin, additional fill shall be placed to achieve the required separation so infiltration systems can be used to dispose of the stormwater runoff.

- As the proposed drainage system will benefit ALL land owners, the cost of the Arterial Drain shall be borne by all land Owners within both the Southern Suburbs District Structure Planning Area and the Water Corporation Declared Main Drainage catchment boundaries.

Before this report can be formally incorporated into the Southern Suburbs District Structure Plan, if will require submission and endorsement by the Technical Review Committee before gaining approval from the Minister for the Environment.

DAVID WILLS AIT(Civil) GradDipB MIE Aust CP Eng
David Wills and Associates

Appendix A

GROUNDWATER OBSERVATION BORE LOCATION

Appendix B

5 YEARS AVERAGE MAXIMUM GROUNDWATER LEVELS:

Drawing 02006-C1

LEGEND

- SOUTHERN SUBURBS DISTRICT STRUCTURE PLANNING AREA
- DRAINAGE CATCHMENT BOUNDARY
- 25.0 — WATER AND RIVERS GROUNDWATER ATLAS CONTOURS
- 18 — 5 YEAR AVERAGE MAXIMUM GROUNDWATER CONTOURS

BARTRAM ROAD
BEENYUP ROAD
LYON ROAD
KWINANA FREEWAY
HAMMOND ROAD
GIBBS ROAD
RUSSELL ROAD
BARFIELD ROAD
FRANKLAND AVENUE
GAEBLER ROAD
WATTLEUP ROAD
ROWLEY ROAD

metres
150 0 150 300 450 m
1:7500
scales quoted apply to original drawing scale A1

REV	DATE	DESCRIPTION
A	10/12/02	Issued for Approval

GRID: LOCAL DATUM: AHD

David Wills and Associates
Consulting Engineers
Office: Unit 7/16 Roxby Lane WILLETTON WA 6155
Mail: 14 Hotherley Parade WINTHROP WA 6158
phone - (08) 9259 4261
fax - (08) 9457 7922
mobile - 0417 778 875
e-mail - dwills@iinet.net.au
ABN - 84 442 721 344

CLIENT: City of Cockburn

PROJECT: Russell Road Arterial Drainage Scheme

DRAWING TITLE: 5 Year Average Maximum Groundwater Contours: 1996 to 2000

SCALE: AS SHOWN ORIGINAL DRAWING SIZE A1

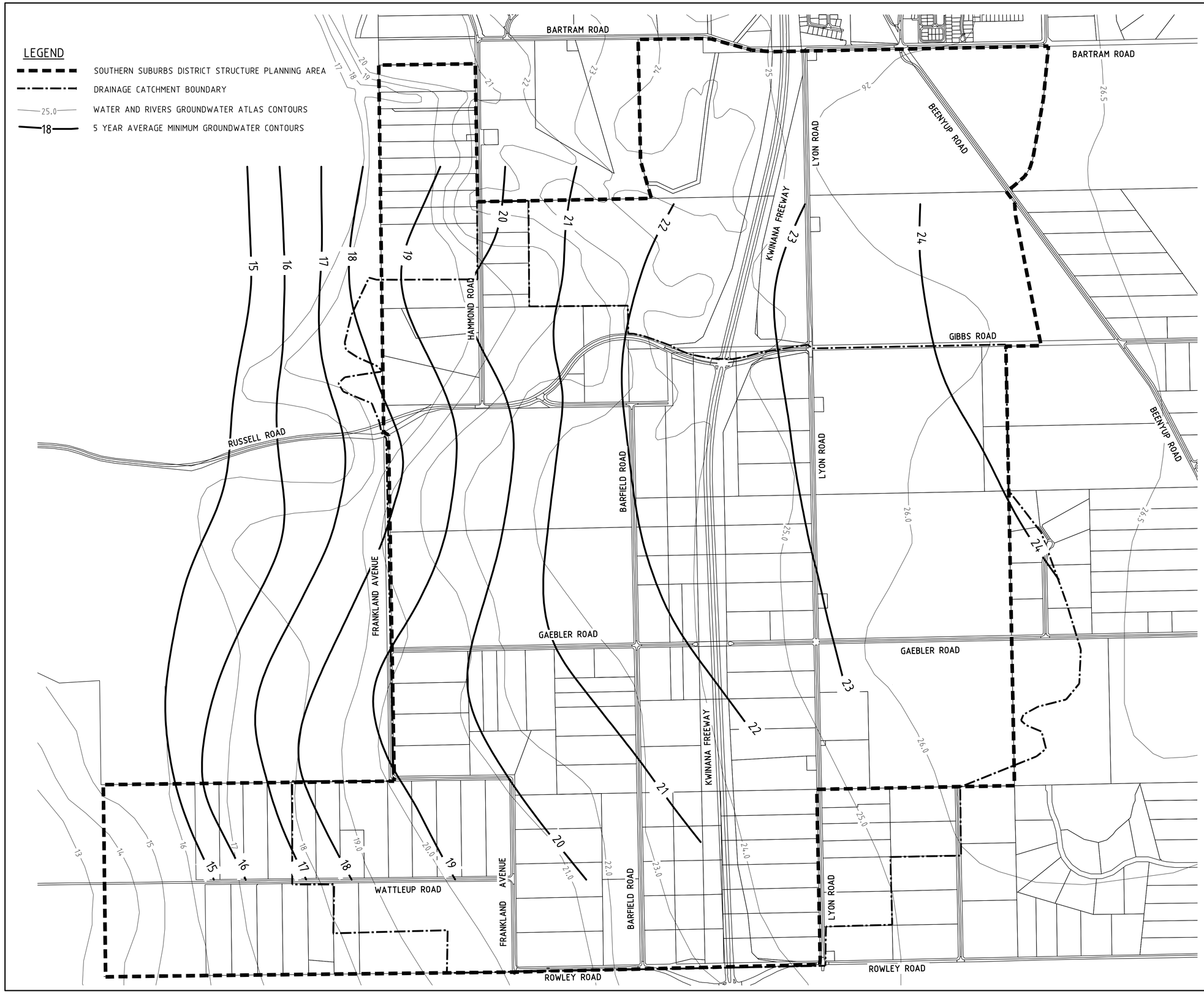
DESIGNED:	DATE:	AUTHORISED	DATE:
DJW	10/12/02	.....	.../.../...
DRAWN:	DATE:	David Wills	
SH	10/12/02	AIT(Civil) GradDipB MEAust CPEng	

JOB NUMBER	DWG No.	REV No.
02006	C1	A

Appendix C

5 YEARS AVERAGE MINIMUM GROUNDWATER LEVELS:

Drawing 02006-C2



metres
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1:7500
scales quoted apply to original drawing scale A1

REV	DATE	DESCRIPTION
A	18/12/02	Issued for Approval

GRID: LOCAL DATUM: AHD

David Wills and Associates
Consulting Engineers
Office Unit 1/16 Roxby Lane MILLETTON WA 6155
Mail 14 Hatherley Parade WINTHROP WA 6150
phone - (08) 9259 6241
fax - (08) 9457 7922
mobile - 0417 778 675
e-mail - dwills@iinet.net.au
ABN - 64 442 721 364

CLIENT: City of Cockburn

PROJECT: Russell Road Arterial Drainage Scheme

DRAWING TITLE: 5 Year Average Minimum Groundwater Contours: 1996 to 2000

SCALE: AS SHOWN ORIGINAL DRAWING SIZE A1

DESIGNED:	DATE:	AUTHORISED	DATE:
DJW	10/12/02	.....	.../.../...
DRAWN:	DATE:	David Wills AIT(Civil) GradDipB MEAust CPEng	
RMH	10/12/02		

JOB NUMBER:	DWG No:	REV No:
02006	C2	A

Appendix D

CONTROLLED GROUNDWATER LEVELS:

Drawing 02006-C3

LEGEND

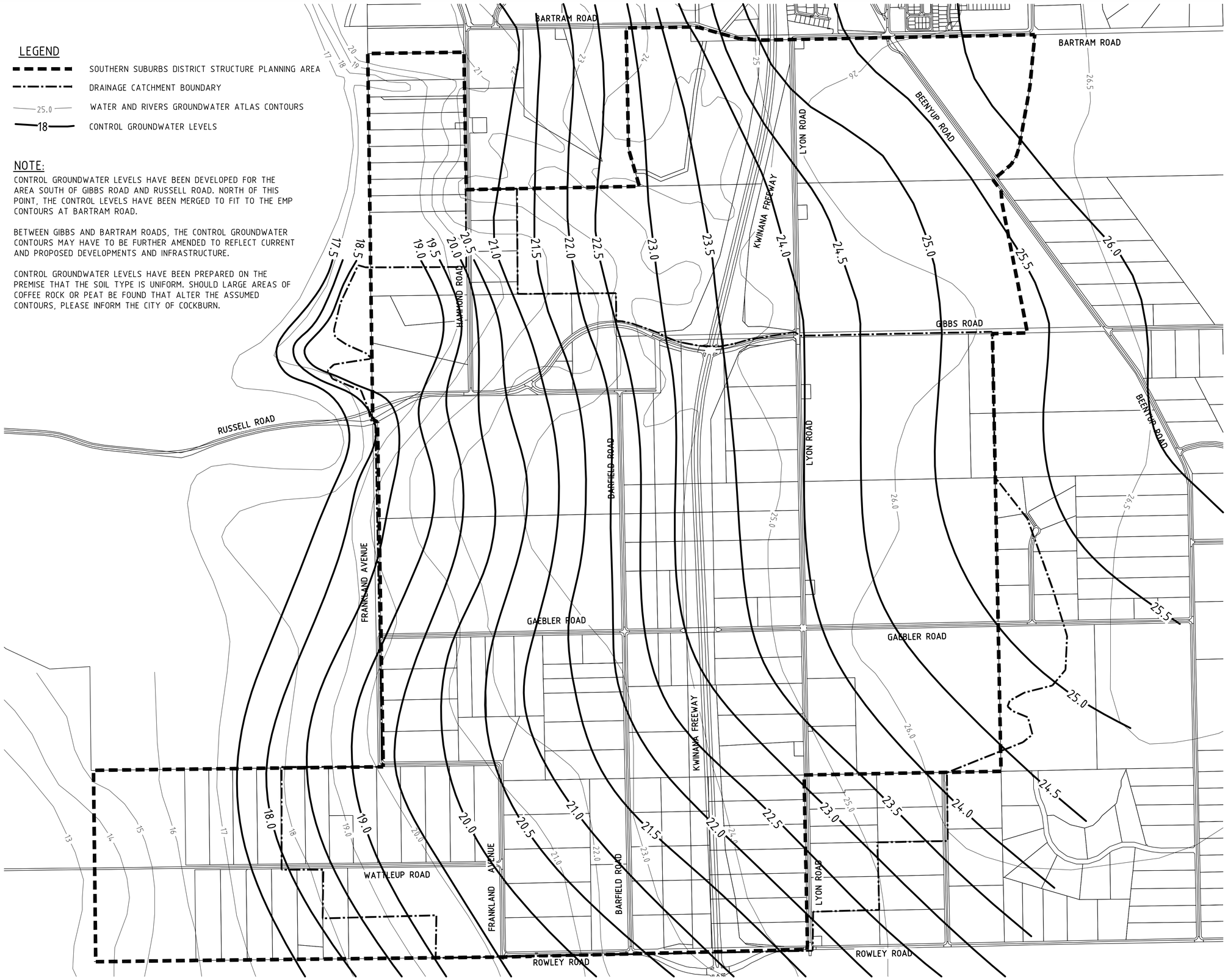
- SOUTHERN SUBURBS DISTRICT STRUCTURE PLANNING AREA
- DRAINAGE CATCHMENT BOUNDARY
- 25.0 — WATER AND RIVERS GROUNDWATER ATLAS CONTOURS
- 18 — CONTROL GROUNDWATER LEVELS

NOTE:

CONTROL GROUNDWATER LEVELS HAVE BEEN DEVELOPED FOR THE AREA SOUTH OF GIBBS ROAD AND RUSSELL ROAD. NORTH OF THIS POINT, THE CONTROL LEVELS HAVE BEEN MERGED TO FIT TO THE EMP CONTOURS AT BARTRAM ROAD.

BETWEEN GIBBS AND BARTRAM ROADS, THE CONTROL GROUNDWATER CONTOURS MAY HAVE TO BE FURTHER AMENDED TO REFLECT CURRENT AND PROPOSED DEVELOPMENTS AND INFRASTRUCTURE.

CONTROL GROUNDWATER LEVELS HAVE BEEN PREPARED ON THE PREMISE THAT THE SOIL TYPE IS UNIFORM. SHOULD LARGE AREAS OF COFFEE ROCK OR PEAT BE FOUND THAT ALTER THE ASSUMED CONTOURS, PLEASE INFORM THE CITY OF COCKBURN.



metres

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1:7500

scales quoted apply to original drawing scale A1

REV.	DATE	DESCRIPTION
A	18/12/02	Issued for Approval

GRID: LOCAL DATUM: AHD

David Wills and Associates
Consulting Engineers
Office Unit 1/16 Roxby Lane WILLETTON WA 6155
Mail 14 Hatherley Parade WINTHROP WA 6150
phone - (08) 9259 6261
fax - (08) 9457 7922
mobile - 0417 778 875
e-mail - dwills@iinet.net.au
ABN - 84 442 721 344

CLIENT: City of Cockburn

PROJECT: Russell Road Arterial Drainage Scheme

DRAWING TITLE: Control Groundwater Levels

SCALE: AS SHOWN ORIGINAL DRAWING SIZE A1

DESIGNED:	DATE:	AUTHORISED	DATE:
DJW	10/12/02	.....	../../..
DRAWN:	DATE:	David Wills	
RMH	10/12/02	AIT(Civil) GradDipB MIEAust CPEng	

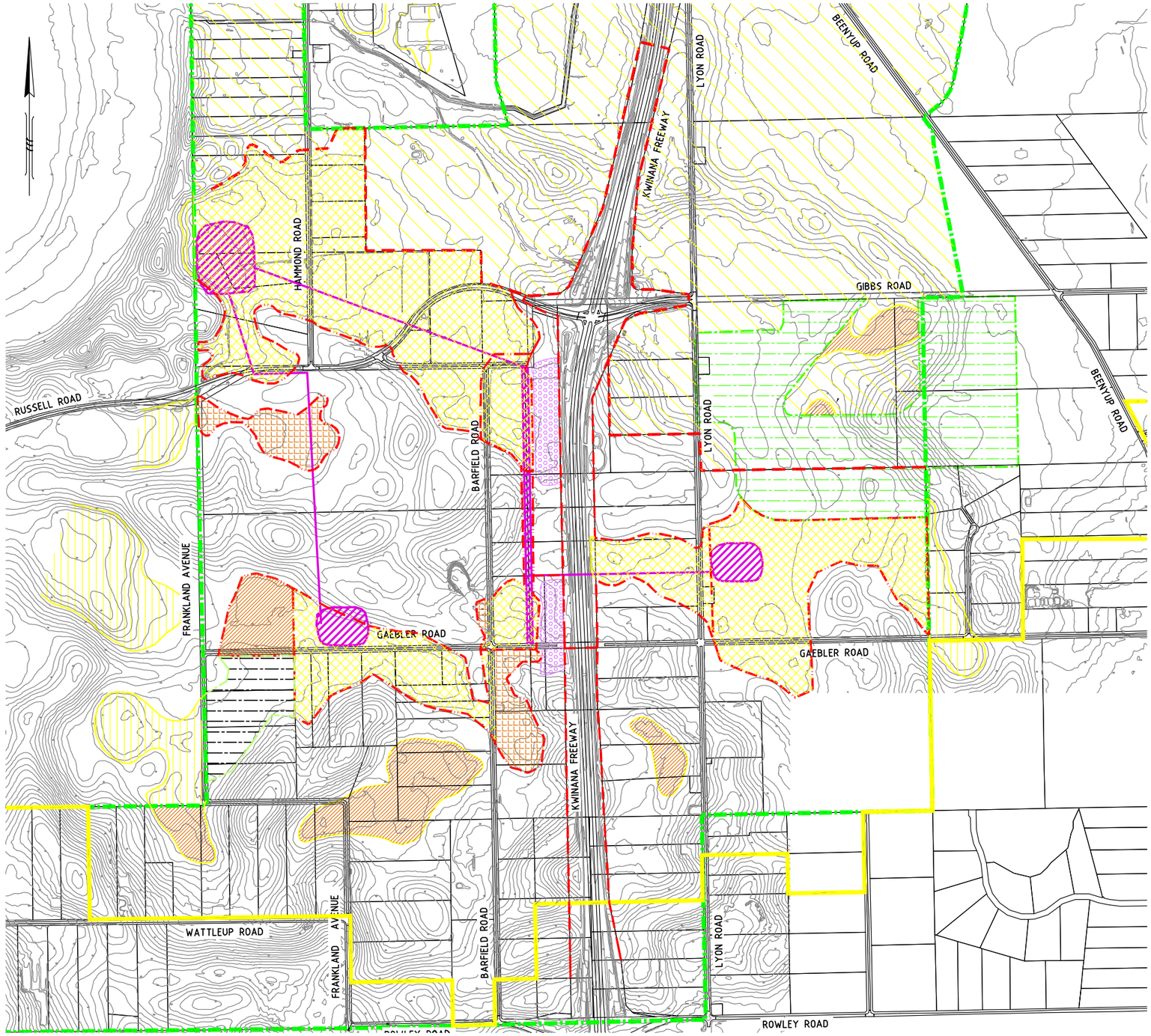
JOB NUMBER:	DWG No:	REV No:
02006	C3	A

Appendix E

PROPOSED SOUTHERN SUBURBS DISTRICT STRUCTURE AREA:

Proposed Russell Road Arterial Drainage Scheme Catchments

Drawing 02006 – C4



LEGEND

- SOUTHERN SUBURBS DISTRICT STRUCTURE PLANNING AREA
- DECLARED WATER CORPORATION DRAINAGE BOUNDARY
- RUSSELL ROAD ARTERIAL DRAIN CATCHMENT BOUNDARY
- PROPOSED DRAINAGE SYSTEM
- BASIN SUB CATCHMENT
- NATURAL SURFACE CONTOURS
- EXISTING AREA WITHIN 3m OF CONTROL LEVEL AND SHOULD BE CONNECTED TO A GROUNDWATER CONTROL POINT. SEE NOTE 2.
- BUSH FOREVER / WETLAND SITE.
- MINIMUM AREAS TO BE FILLED TO CREATE 3m SEPARATION TO CONTROL GROUNDWATER LEVEL AND DISPOSE STORMWATER BY RUNOFF INFILTRATION.
- EXISTING AREA HAS LESS THAN A 3m SEPARATION TO CONTROLLED GROUNDWATER LEVEL. SUGGEST AREA IS FILLED AND DISPOSE STORMWATER RUNOFF BY ON SITE INFILTRATION.
- EXISTING AREA WITHIN 3m OF CONTROL GROUNDWATER LEVEL. NOT TO BE FILLED AS MAJOR POWER LINES EXIST IN THIS LOCATION.
- BARTRAM ROAD ARTERIAL DRAIN CATCHMENT.
- AREAS BEYOND RUSSELL ROAD ARTERIAL DRAINAGE SYSTEM WHERE SEPARATION BETWEEN EXISTING GROUND LEVELS AND CONTROLLED GROUNDWATER LEVELS IS LESS THEN 3m.
- GROUNDWATER CONTROL POINT (DETENTION BASIN).

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH 02006 - C5 TO GIVE DETAILS OF THE STORMWATER DRAINAGE SYSTEM.
2. A GROUNDWATER COLLECTION POINT MUST BE CONSTRUCTED IN THE VICINITY OF THE LOCATION SHOWN. THE SIZE AND EXTENT OF THE CATCHMENT CAN BE AMENDED TO SUIT THE RECONTOURED EARTHWORKS FOR THE SITE.

   SUB-SOIL DRAINS MUST BE CONSTRUCTED IN ALL AREAS WHERE SEPARATION BETWEEN THE FINISHED LOT LEVELS AND CONTROLLED GROUNDWATER IS LESS THAN 3m. THE SUBSOIL DRAINS SHALL BE CONNECTED TO THE GROUNDWATER COLLECTION POINT.
3. UNLESS INDICATED OTHERWISE, THE BALANCE OF THE RUSSELL ROAD ARTERIAL DRAINAGE CATCHMENT CAN DISPOSE OF STORMWATER RUNOFF BY INFILTRATION IF THE SEPARATION BETWEEN FINAL LOT LEVELS AND CONTROLLED GROUNDWATER LEVEL IS GREATER THEN 3.0m.

meter's
150 0 150 300 450 m

scales quoted apply to 1:7500 A1
original drawing scale

REV	DATE	DESCRIPTION
B	28/11/03	Catchments Redefined
A	23/11/03	Separation From dwg. 4A

GRID: LOCAL | DATUM: AHD

David Wills and Associates
Consulting Engineers
Office Unit 1/14 Rosby Lane WILLETTON WA 6155
Mail 14 Hatherley Parade WINTHROP WA 6150
phone - 08 9351 6241
fax - 08 9457 7922
mobile - 0417 778 875
e-mail - dwills@iinet.net.au
ABN - 26 443 721 344

CLIENT: City of Cockburn

PROJECT: Southern Suburbs District Structure Area

DRAWING TITLE: Proposed Russell Road Arterial Drainage Scheme Catchments

SCALE: 1:7500 | ORIGINAL DRAWING SIZE A1

DESIGNED:	DATE:	AUTHORISED	DATE:
DJW	11/12/02	.....	../../..
DRAWN:	DATE:	David Wills	
RMH	11/12/02	AITCivil GradDipB MIEAust CPEng	

JOB NUMBER:	DWG No	REV No
02006	C4	B

Appendix F

SOUTHERN SUBURBS DISTRICT STRUCTURE AREA:

Proposed Russell Road Arterial Drainage Infrastructure

Drawing 02006 – C5

BARTRAM ROAD

BARTRAM ROAD

PIPELINE / OPEN CHANNEL
U/S I.L. = 22.70
D/S I.L. = 18.80

RUSSELL ROAD BUFFER LAKE.
TOTAL CATCHMENT AREA=72.0Ha (APPROX).
1 IN 5 YEAR ARI PEAK DISCHARGE=170l/sec.
SUM 1 IN 5 YEAR ARI PEAK
DISCHARGE=385l/sec.
1 IN 5 YEAR ARI STORAGE 4900m³

PIPELINE / OPEN CHANNEL
U/S I.L. = 20.50
D/S I.L. = 18.80

FREEWAY SWALE CHANNEL.
TOTAL CATCHMENT AREA=19.5Ha (APPROX).
1 IN 5 YEAR ARI PEAK DISCHARGE=55l/sec.
SUM OF 1 IN 5 YEAR ARI PEAK DISCHARGE=145l/sec
1 IN 5 YEAR ARI STORAGE=1320m³
1 IN 100 YEAR STORM SHALL BE CONTAINED WITHIN
THE SWALE - VOLUME=2550m³

GAEBLER ROAD GROUNDWATER CONTROL POINT.
TOTAL CATCHMENT AREA=24.0Ha (APPROX).
1 IN 5 YEAR ARI PEAK DISCHARGE=70l/sec.
1 IN 5 YEAR ARI STORAGE=1510m³
STORMS GREATER THAN 1 IN 5 YEAR ARI TO
DISCHARGE INTO WETLANDS SOUTH OF GAEBLER
ROAD.

KWINANA FREEWAY CATCHMENT.
EXISTING DETENTION BASINS SOUTH EAST
OF FREEWAY AND GIBBS ROAD CAN BE
CONNECTED TO THE FREEWAY SWALE
CHANNEL IF REQUIRED.

PIPE OUTLET
U/S I.L. = 24.00
D/S I.L. = 22.80

LYON ROAD GROUNDWATER CONTROL POINT.
TOTAL CATCHMENT AREA=30.9Ha (APPROX).
1 IN 5 YEAR ARI PEAK DISCHARGE=90l/sec.
1 IN 5 YEAR ARI STORAGE=2050m³
STORMS GREATER THAN 1 IN 5 YEAR ARI TO
DISCHARGE INTO BEENYUP ROAD SWAMP.

BEENYUP ROAD SWAMP

LYON ROAD

BEENYUP ROAD

KWINANA FREEWAY

HAMMOND ROAD

RUSSELL ROAD

BARFIELD ROAD

GIBBS ROAD

FRANKLAND AVENUE

GAEBLER ROAD

WATTLEUP ROAD

ROWLEY ROAD

WP EASEMENT

17.5 18.0 18.5 19.0 19.5 20.0 20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5 25.0 25.5

LEGEND

- GROUNDWATER CONTROL CONTOUR
- SOUTHERN SUBURBS DISTRICT STRUCTURE PLANNING AREA
- RUSSELL RD BD. CATCHMENT CONTROL GROUNDWATER LEVELS
- BASIN SUB CATCHMENT
- RUSSELL ROAD BUFFER LAKE CATCHMENT
- GABLER ROAD GROUNDWATER CONTROL POINT CATCHMENT
- LYON ROAD GROUNDWATER CONTROL POINT CATCHMENT
- FREEWAY SWALE GROUNDWATER CONTROL POINT CATCHMENT

NOTES

1. STORMS GREATER THAN A 1 IN 5 YEAR AIR MAY DISCHARGE EXCESS STORMWATER INTO A DESIGNATED ADJACENT AREA, SUBJECT TO SUITABLE DRAINAGE FREEBOARD BEING MAINTAINED.
2. LOCATION OF GROUNDWATER CONTROL POINT (DETENTION BASIN) IS INDICATIVE ONLY AND SHALL BE INTEGRATED INTO THE SUBDIVISIONAL LAYOUT.
3. THE CATCHMENT AREAS WILL BE REQUIRED TO BE REFINED AS DETAILED DESIGN IS PERFORMED. THE CATCHMENT AREA FOR EACH GROUNDWATER CONTROL POINT CAN VARY, BUT THE PEAK OUTFLOW CANNOT BE INCREASED.
4. DETENTION BASIN OUTFLOW VALUE IS THE PEAK DISCHARGE FOR A 1 in 5 YEAR ARI STORM EVENT AND CANNOT BE EXCEEDED.
5. THE STORAGE VOLUMES ARE INDICATIVE ONLY AND ARE TO BE ADJUSTED IN THE DETAILED DESIGN PHASE. THE DETENTION BASIN DESIGN VALUES DO NOT INCLUDE ALLOWANCES FOR "BANK STORAGE" OR INFILTRATION.
6. THE PEAK 1 IN 5 YEAR ARI DISCHARGE CAN BE REDUCED TO A MINIMUM OF 6 l/sec PER IMPERVIOUS HECTARE. STORAGE VOLUMES SHALL BE INCREASED ACCORDINGLY.
7. THE 1 IN 100 YEAR ARI PEAK DISCHARGE FROM A DETENTION BASIN IN TO THE ARTERIAL DRAINAGE SYSTEM SHALL NOT BE GREATER THAN 1.4 TIMES THE 1 IN 5 YEAR ARI VALUE. OVERFLOW INTO THE DESIGNATED ADJACENT AREA IS IN ADDITION TO OUTFLOW AND IS LIMITED ONLY BY THE SYSTEM HYDRAULICS.
8. 1 IN 100 YEAR STORAGE VOLUME WILL BE DEPENDENT UPON THE RATE OF OVERFLOW AND THE RISE IN WATER LEVEL IN THE BASIN. THE VALUE SHALL BE DETERMINED IN THE DETAILED DESIGN PHASE.
9. THE ROUTE OF THE PROPOSED DRAINAGE SYSTEM IS INDICATIVE ONLY AND SHALL BE INTEGRATED INTO THE SUBDIVISIONAL LAYOUT DURING THE DETAILED DESIGN PHASE.
10. THE SUGGESTED INVERTS OF THE DRAINAGE SYSTEM SHALL BE RETAINED UNLESS OTHERWISE APPROVED BY THE CITY OF COCKBURN.

metres
150 0 150 300 450 m
1:7500

scales quoted apply to original drawing scale

A1

REV	DATE	DESCRIPTION
A	28/04/13	Issued for Approval

GRID: LOCAL DATUM: AHD

David Wills and Associates Consulting Engineers
Office Unit 1/14 Rosby Lane WILLETTON WA 6155
Mail 14 Hatherley Parade WINTHROP WA 6150
phone - (08) 9329 4241
fax - (08) 9457 7922
mobile - 0417 778 875
e-mail - dwills@iinet.net.au
ABN - 44 442 721 564

CLIENT: City of Cockburn

PROJECT: Southern Suburbs District Structure Area

DRAWING TITLE: Proposed Rusell Road Arterial Drainage Infrastructure

SCALE: ORIGINAL DRAWING SIZE A1

DESIGNED:	DATE:	AUTHORISED	DATE:
DJW	28/04/13	.....	...../...../...
DRAWN: J Ergic	DATE: 28/04/13	David Wills AITC(Civil) GradDipB MEAust CPEng	

JOB NUMBER:	DWG No:	REV No:
02006	C5	A