



Stormwater Drainage for Proposed Buildings Design Guidelines

Introduction

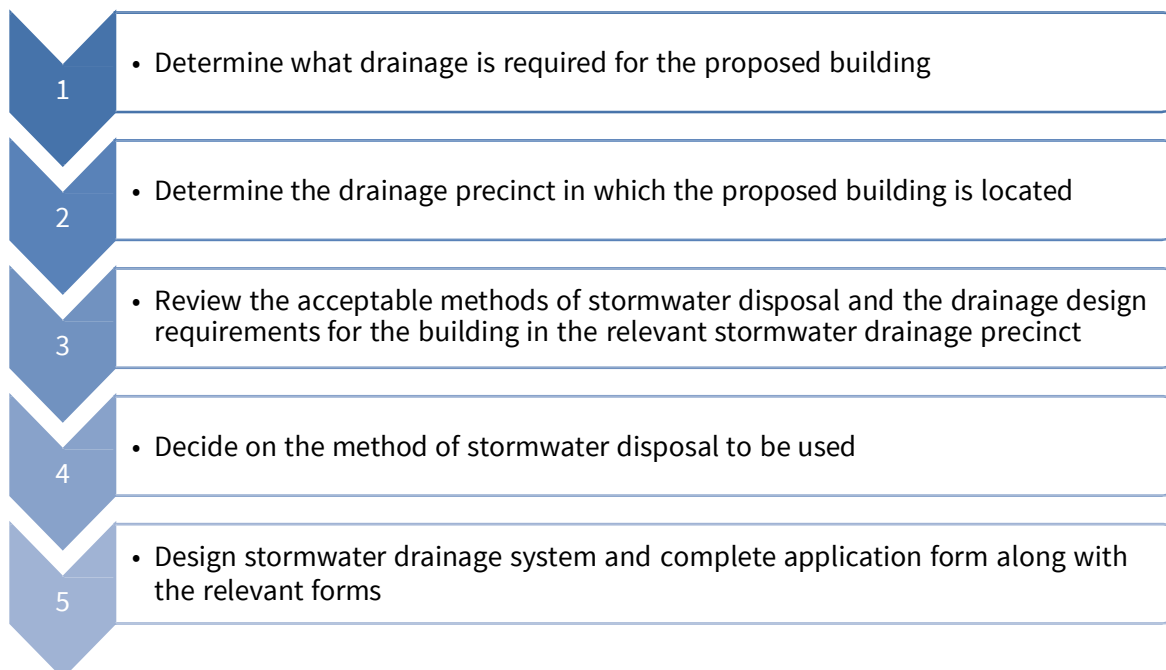
The City of South Perth is experiencing urban developments of increasing density. Blocks of land that may once have housed a single dwelling are now being used to house several dwellings or larger residential buildings. Consequently the impervious area of these blocks of land is continually increasing which results in an increase in stormwater run-off from the properties into the City-owned stormwater drainage network. This additional run-off puts a strain on existing City-owned drainage infrastructure and, if left unchecked, will require the City to undertake expensive replacement and improvement works.

The quality of stormwater discharged into the Swan and Canning Rivers and the groundwater is also now a source of some concern and efforts must be made to improve the quality of this water to the best of the City's abilities. A number of factors including geological conditions, depth of water table, and level of development all vary throughout the boundaries of the City of South Perth. This document is expected provide staff, residents and developers with clear guidelines that will:

- Limit the effects of high density urban development on drainage infrastructure
- Improve the quality of stormwater entering the lakes, river system and groundwater
- Ensure that the most appropriate form of stormwater disposal is utilised in each area.

Process

The Design Guidelines cover the following five essential steps:



Non-Compliant Requirements

When drainage works are undertaken on private property, if the adjacent verge area and infrastructure is damaged, it shall be the land owner’s responsibility to reinstate them to their original condition or better. If the City finds that the verge area and/or infrastructure has been damaged pertaining to the works, the City will give 21 days’ notice to the land owner for the rectification works to be completed. If the rectification works have not been completed or the standard of works are not to the City’s satisfaction, the City will complete the works and the land owner will be charged for all the cost pertaining to the works. If there are insufficient funds from the infrastructure bond, the City will invoice the land owner from the remaining balance of the costs.

Table of Contents

- Contents..... 2
- Industry Standards & City of South Perth Policies 3
- Appendix A - Stormwater Drainage Precinct Plan 4
- Appendix B - Stormwater Drainage Precinct Requirements..... 5
- Mill Point Drainage Precinct Requirements 5
- Hurlingham, Western Foreshore & Salter Point Drainage Precinct Requirements..... 7
- Como, Manning & South Perth Drainage Precinct Requirements..... 9
- Waterford Drainage Precinct Requirements 11
- Appendix C - Standard Conditions of Approval for Methods of Stormwater Disposal12
- Standard Conditions of Approval for Soakwells.....13
- Standard Conditions of Approval for Stormwater Re-Use14
- Appendix D: Other Information - Rainfall Intensity Design Chart 15
- Appendix D: Other Information – Standard Trapped Manhole Details..... 16

Industry Standards

All stormwater drainage for new buildings requiring calculations to be submitted shall be designed in accordance with the following industry standards:

- Australian Rainfall and Runoff (Institute of Engineers Australia, 1997 or 2019)
- Stormwater Drainage Design in Small Urban Catchments (J. Argue, ARRB Special Report No.34)
- A Manual for Managing Urban Stormwater Quality in Western Australia (Water & Rivers Commission, 1998)
- Local Government Guidelines for Subdivisional Development (Institute of Municipal Engineering Australia WA Division Inc. 1998)

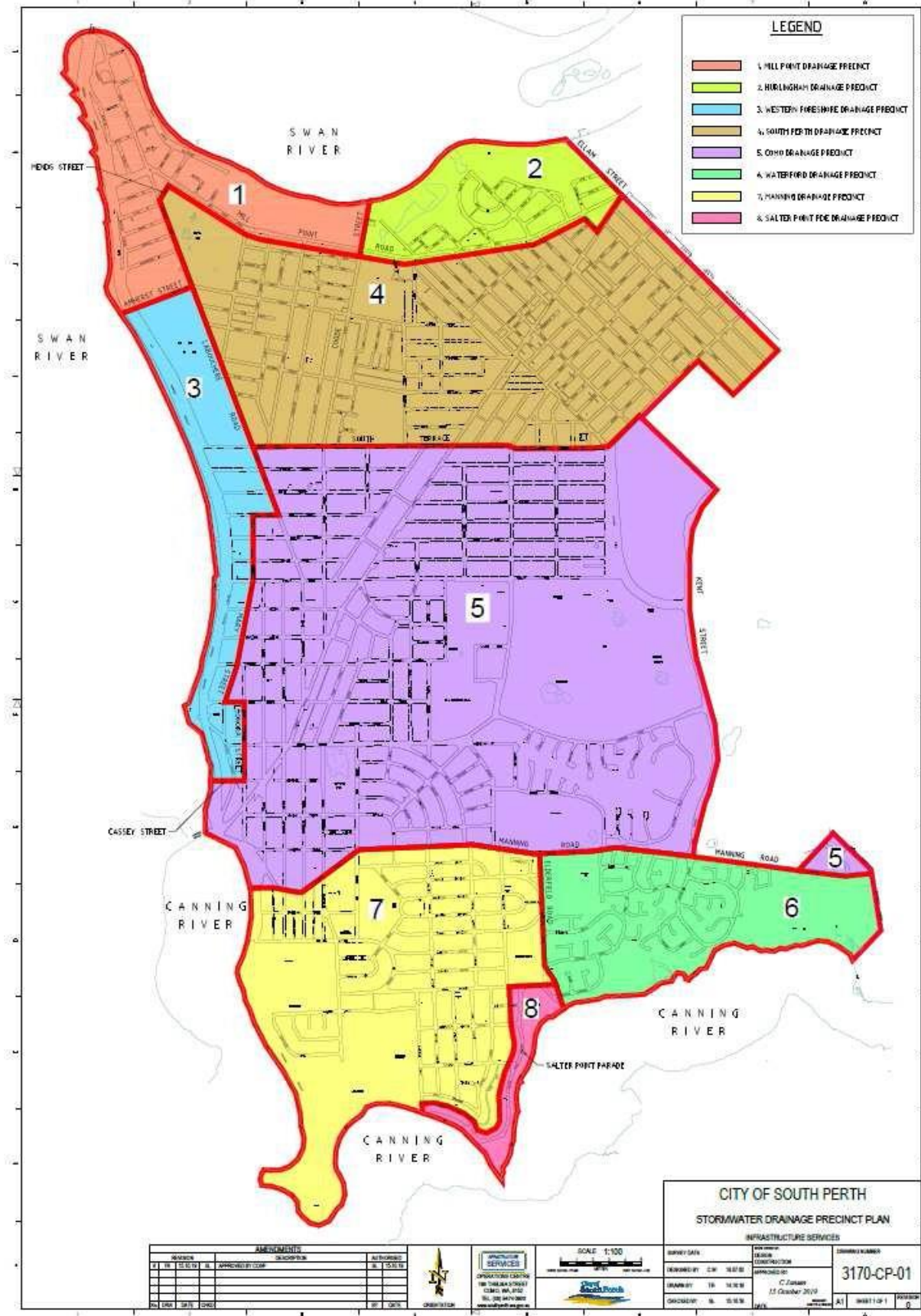
Other documentation with information and conditions that should be considered during the design process are:

- Utility Providers Code of Practice for Western Australia
- Perth Groundwater Atlas (Water & Rivers Commission)
- Building Code of Australia
- AS 3500.3.1-1998: National plumbing and drainage - Stormwater drainage - Performance requirements
- AS/NZS 3500.3.2:1998: National plumbing and drainage - Stormwater drainage - Acceptable solutions
- AS/NZS 3500.3.2-1998/Amdt 1-1998: National plumbing and drainage - Stormwater drainage - Acceptable solutions

City of South Perth Policies & Legislation

- Local Government Act 1995
- P353 Crossings/Crossovers
- P210 Street Verges
- P206 Urban Forest
- P354 Stormwater Drainage Requirements for Proposed Buildings
- P501 Paths – Provision and Construction

Appendix A. Stormwater Drainage Precinct Plan



Appendix B. Stormwater Drainage Precinct Requirements

MILL POINT PRECINCT REQUIREMENTS

(Stormwater Drainage Precinct 1)

All stormwater drainage for proposed buildings in the Mill Point Drainage Precinct should be designed in accordance with the requirements of Policy M354 - Stormwater Drainage Requirements for Proposed Buildings. The ability to store stormwater run-off from the design event on site for re-use is encouraged.

Within this precinct if re-use is not incorporated as part of the stormwater design, with few exceptions stormwater disposal will be via a controlled discharge to the street system through an approved Private Drainage Connection (PDC).

New buildings will not be permitted to use soakwells for their stormwater drainage requirements unless the structure is a minor addition and there is no existing approved PDC on the property. Soakwells may be considered for new buildings located at the extremities of the Precinct and/or where the base of the soakwell can be installed at least 0.5m above the average annual maximum groundwater level.

The general principle for stormwater disposal within the City is that all stormwater falling on the site, irrespective of the storm intensity and/or the duration of the event, is to be collected on site and contained on site and disposed through an approved disposal method. Contemporary building design practice has gutters and downpipes being designed for the very intense 1:100 year storm event with the relatively short time of concentration of 6 minutes. The short time of concentration is inappropriate for the design of drainage detention systems with controlled discharge, as invariably the long duration but less intense rain event results in the greatest volumetric demand. While it may be appropriate to assign a 1:10 year storm event for the sizing and provision of in ground drainage structures the designer must ensure that the general principle is satisfied.

For the purpose of this Management Practice an impervious area includes all surfaces other than a highly mulched/well maintained garden bed. For the purpose of this Management Practice includes all surfaces other than a highly mulched/well maintained garden bed. Within this precinct building heights are very likely to exceed three storeys in height and where the building height is greater than three storeys the Impervious Area Serviced or effective area is to be the plan area plus 50% of the largest vertical wall face.

Irrespective of the event duration the overall design shall ensure that all stormwater falling on the site is contained and controlled on site and not directed towards the road reserve. The designer must consider and incorporate as appropriate the Principles of Water Sensitive Urban Design (WSUD) as outlined below.

WUSD has, amongst others, the objective to:

- Ensure Water Sensitive Urban Design best management practices are implemented for all new development proposals and City operations to maximise the use of captured lot (roof) rainfall and grey water to reduce the reliance on external resources;

- Ensure stormwater within the urban environment is retained and treated as close to source as possible; and
- Reduce nuisance flooding and adverse drainage impacts.

A private drainage connection (PDC) from a new building into the City's existing stormwater drainage network shall be considered on application to Infrastructure Assets & Design if the developer adheres to the Standard Conditions of Approval for Private Drainage Connections and any other site specific requirements. In general the discharge to the City owned stormwater drainage system is limited to a rate of one litre per second (1 li/sec) for each 500 square metres of impervious area serviced or the flow expected from that site prior to any form of development whichever is the lesser. The designer is required to provide sufficient storage on site to cater for the short duration high intensity storm event with a controlled discharge to the street system, although the designer will need to satisfy themselves that the longer duration but less intense event can still be accommodated within the proposed onsite storage. The design should also provide sufficient freeboard (nominally 300mm) to building floor levels to accommodate the 1:100 storm event. The alternative is to increase the storage capacity of the collection tanks to meet this target.

The design, if it was to incorporate a larger sized diameter pipe for ease of cleaning etc., would only be acceptable with a flow limiting device within the pipe. An "orifice plate" would be an acceptable means within a larger diameter pipe to control flow to the prescribed amount. The discharge pipe is to be fitted with a simple reflux or non-return valve.

If a developer requests that a PDC be made where insufficient City owned stormwater drainage infrastructure currently exists then the cost of providing the required infrastructure shall be borne by the developer.

Adequate subsoil drainage shall be provided where required for all new buildings and linked to the City's stormwater network via a Private Drainage Connection.

A hydraulic design plan shall be submitted with the appropriate certified statement signed by an appropriately qualified Practising Engineer stating that the stormwater design meets the design requirements unless the building is a minor addition.

Stormwater drainage from a property abutting a watercourse shall not discharge directly into that watercourse.

HURLINGHAM, WESTERN FORESHORE & SALTER POINT PRECINCT REQUIREMENTS

(Stormwater Drainage Precincts 2, 3 & 8)

All stormwater drainage for proposed buildings in the Hurlingham, Western Foreshore and Salter Point drainage precincts shall be designed in accordance with the requirements of Policy M354 - Stormwater Drainage Requirements for Proposed Buildings.

The ability to store stormwater runoff from the design event on site for re-use is encouraged.

Within the listed precincts if re-use is not incorporated as part of the stormwater design, with few exceptions stormwater disposal will be via a controlled discharge to the street system through an approved Private Drainage Connection (PDC).

New buildings will not be permitted to use soakwells for their stormwater drainage requirements unless the structure is a minor addition and there is no existing approved PDC on the property. Soakwells may be considered for new buildings located at the extremities of the Precinct and/or where the base of the soakwell can be installed at least 0.5m above the average annual maximum groundwater level.

The general principle for stormwater disposal within the City is that all stormwater falling on the site, irrespective of the storm intensity and/or the duration of the event, is to be collected on site and contained on site and disposed through an approved disposal method. Contemporary building design practice has gutters and downpipes being designed for the very intense 1:100 year storm event with the relatively short time of concentration of 6 minutes. The short time of concentration is inappropriate for the design of drainage detention systems with controlled discharge, as invariably the long duration but less intense rain event results in the greatest volumetric demand. While it may be appropriate to assign a 1:10 year storm event for the sizing and provision of in ground drainage structures the designer must ensure that the general principle is satisfied.

Drainage runoff shall be calculated using 100% run-off from all impervious surfaces on the development using a time of concentration of 6 minutes,

For the purpose of this Management Practice an impervious area includes all surfaces other than a highly mulched/well maintained garden bed. It is unlikely that within the listed precincts building heights would exceed three storeys in height however where the building height is greater than three storeys the impervious area serviced or effective area is to be the plan area plus 50% of the largest vertical wall face.

Irrespective of the event duration the overall design shall ensure that all stormwater falling on the site is contained and controlled on site and not directed towards the road reserve. The designer must consider and incorporate as appropriate the principles of Water Sensitive Urban Design (WSUD) as outlined below.

WUSD has, amongst others, the objective to:

- Ensure Water Sensitive Urban Design best management practices are implemented for all new development proposals and City operations to maximise the use of captured lot (roof) rainfall and grey water to reduce the reliance on external resources

- Ensure stormwater within the urban environment is retained and treated as close to source as possible
- Reduce nuisance flooding and adverse drainage impacts.

A private drainage connection (PDC) from a new building into the City's existing stormwater drainage network shall be considered on application to Infrastructure Assets & Design if the developer adheres to the Standard Conditions of Approval for Private Drainage Connections and any other site specific requirements. In general the discharge to the City owned stormwater drainage system is limited to a rate of one litre per second (1 li/sec) for each 500 square metres of impervious area serviced or the flow expected from that site prior to any form of development whichever is the lesser. The designer is required to provide sufficient storage on site to cater for the short duration high intensity storm event with a controlled discharge to the street system, although the designer will need to satisfy themselves that the longer duration but less intense event can still be accommodated within the proposed onsite storage.

The design, if it was to incorporate a larger sized diameter pipe for ease of cleaning etc., would only be acceptable with a flow limiting device within the pipe. An orifice plate would be an acceptable means within a larger diameter pipe to control flow to the prescribed amount. The discharge pipe is to be fitted with a simple reflux or non-return valve.

A hydraulic design plan shall be submitted with the appropriate certified statement signed by an appropriately qualified Practising Engineer stating that the stormwater design meets the design requirements unless the building is a minor addition.

COMO, MANNING AND SOUTH PERTH PRECINCT REQUIREMENTS

(Stormwater Drainage Precincts 4, 5 & 7)

All stormwater drainage for proposed buildings in the Como, Manning & South Perth drainage precincts shall be designed in accordance with the requirements of Policy M354 - Stormwater Drainage Requirements for Proposed Buildings.

The ability to store stormwater runoff from the design event on site for re-use is encouraged.

Where stormwater re-use is not incorporated as part of the stormwater design then new buildings shall preferably utilise soakwells for their stormwater drainage requirements.

The general principle for stormwater disposal within the City is that all stormwater falling on the site, irrespective of the storm intensity and/or the duration of the event, is to be collected on site and contained on site and disposed through an approved disposal method. Contemporary building design practice has gutters and downpipes being designed for the very intense 1:100 year storm event with the relatively short time of concentration of 6 minutes. The short time of concentration is inappropriate for the design of drainage detention systems with controlled discharge as invariably the long duration but less intense rain event results in the greatest volumetric demand. While it may be appropriate to assign a 1:10 year storm event for the sizing and provision of in ground drainage structures the designer must ensure that the general principle is satisfied.

The designer is required to verify the adequacy of the soakwells for the alternate long duration but less intense storm event. Irrespective of the design, the designer is to ensure that all stormwater falling on the site is retained on the site and away from the building. The designer must consider and incorporate as appropriate the Principles of Water Sensitive Urban Design (WSUD) as outlined below.

WUSD has, amongst others, the objective to:

- Ensure Water Sensitive Urban Design best management practices are implemented for all new development proposals and City operations to maximise the use of captured lot (roof) rainfall and grey water to reduce the reliance on external resources
- Ensure stormwater within the urban environment is retained and treated as close to source as possible
- Reduce nuisance flooding and adverse drainage impacts.

For the purpose of these Design Guidelines, an impervious area includes all surfaces other than a highly mulched/well maintained garden bed. It is unlikely that within the listed precincts building heights would exceed three storeys in height however where the building height is greater than three storeys the impervious area serviced or effective area is to be the plan area plus 50% of the largest vertical wall face.

Unless otherwise demonstrated soakwell volume required (m^3) for Type 1 residential buildings or minor additions would be not less than 0.02 times the Impervious Area Serviced (m^2).

Private Drainage Connections (PDC's) shall only be considered for new buildings where:

- soakwells are not a feasible option due to a high water table; and
- the existing City owned drainage infrastructure is available for connection;

A hydraulic design plan shall be submitted with the appropriate certified statement signed by an

appropriately qualified Practicing Engineer stating that the stormwater design meets the design requirements, unless the development in question is a Type 1 residential building or a minor addition.

Stormwater drainage from a property abutting a watercourse shall not discharge directly into that watercourse. If a developer requests that a PDC be made where insufficient City owned stormwater drainage infrastructure currently exists then the cost of providing the required infrastructure shall be borne by the developer.

Adequate subsoil drainage shall be provided where required on all new buildings and linked to the City's stormwater network via a Private Drainage Connection.

A hydraulic design plan shall be submitted with the appropriate certified statement signed by an appropriately qualified Practicing Engineer stating that the stormwater design meets the design requirements unless the building is a Minor Addition. Unless otherwise demonstrated soakwell volume required (m³) for minor additions where there is no existing PDC on the property would be not less than 0.02 times the impervious area serviced (m²).

Stormwater drainage from a property abutting a watercourse shall not discharge directly into that watercourse.

WATERFORD PRECINCT REQUIREMENTS

(Stormwater Drainage Precinct 6)

All stormwater drainage for proposed buildings in the Waterford Drainage Precinct should be designed in accordance with the requirements of Policy P354 - Stormwater Drainage Requirements for Proposed Buildings. The ability to store stormwater runoff on site for re-use is encouraged.

Within this precinct if re-use is not incorporated as part of the stormwater design, with few exceptions stormwater disposal will be via a controlled discharge to the street system through an approved Private Drainage Connection (PDC).

The general principle for stormwater disposal within the City is that all stormwater falling on the site, irrespective of the storm intensity and/or the duration of the event, is to be collected on site and contained on site and disposed through an approved disposal method. Contemporary building design practice has gutters and downpipes being designed for the very intense 1:100 year storm event with the relatively short time of concentration of 6 minutes. The short time of concentration is inappropriate for the design of drainage detention systems with controlled discharge, as invariably the long duration but less intense rain event results in the greatest volumetric demand. While it may be appropriate to assign a 1:10 year storm event for the sizing and provision of in ground drainage structures the designer must ensure that the general principle is satisfied.

Irrespective of the event duration the overall design shall ensure that all stormwater falling on the site is contained and controlled on site and not directed towards the road reserve.

For minor additions and Type 1 residential buildings the developer shall adhere to the Standard Conditions of Approval for Private Drainage Connections with the exceptions of points 11 & 12 and any other site specific requirements.

For Type 2 Residential Buildings the developer shall adhere to the Standard Conditions of Approval for Private Drainage Connections and any other site specific requirements.

Where a developer requests that a PDC be made where insufficient City owned stormwater drainage infrastructure currently exists then the cost of providing the required infrastructure shall be borne by the developer.

Stormwater drainage from a property abutting a watercourse shall not discharge directly into that watercourse.

A hydraulic design plan shall be submitted with the appropriate certified statement signed by an appropriately qualified Practising Engineer stating that the stormwater design meets the design requirements unless the building is a minor addition.

Within Cygnia Cove, soakwells may be considered for new buildings located at the extremities of the Precinct and/or where the base of the soakwell can be installed at least 0.5m above the average annual maximum groundwater level.

Within Cygnia Cove, if the conditions relating to soak wells cannot be satisfied and a PDC is required, then the Application for a PDC shall be processed as if it were located within the Waterford Drainage Precinct.

Appendix C. Standard Conditions of Approval for Methods of Stormwater Disposal

Any Private Drainage Connection (PDC) from a new or existing building into the City of South Perth's stormwater drainage network shall only be considered if the following conditions are met:

1. A trapped manhole incorporating a gross pollutant trap shall be installed, inside and close to the property boundary, to prevent impurities including sand, grit, litter and oil based contaminants from discharging from the property into the City's stormwater drainage network
2. Trapped manholes shall be constructed to a standard equal to or exceeding the manhole shown in COSP Drawing No. STD-302
3. The cost of providing any required drainage easements shall be borne by the applicant
4. Unless authorised by the Manager Assets & Design the connection works outside the private property boundary may only be undertaken by the City of South Perth and the cost of the connection will be a direct charge to the owner
5. The owner or any person other than a person authorised by the City of South Perth shall not alter or interfere at any time with the City's stormwater drainage system
6. The City reserves the right at any time to disconnect or remove any private drainage connection if the owner does not adequately maintain or keep clean any pipes or drains that are connected to the City's stormwater drainage system
7. The cost of any maintenance and cleaning of the system and trapped manhole on the property shall be borne by the owner of the property
8. The City of South Perth shall not accept any claims for damage of any description that may arise due to back flooding or blockage of the City of South Perth stormwater drainage system
9. An 'As Constructed' drawing of the stormwater drainage system shall be submitted to the City of South Perth on completion of the connection works
10. Water from sources other than rain or groundwater, e.g. swimming pools, shall not be discharged into the City's stormwater drainage network
11. The flow into the City's stormwater network through the Private Drainage Connection shall be limited to a rate of one litre per second (1 li/sec) for each 500 square metres of impervious surface or the maximum flow that would have originated from the vacant block of land prior to the original development whichever is the lesser
12. Stormwater plans and calculations signed by an appropriately qualified person, with a statement that the stormwater design meets the design requirements, are provided with the application. Pipe design shall be based on the Rational Method, assuming a full pipe flow not under head. Drainage runoff shall be calculated using 100% run-off from all impervious surfaces on the development using a time of concentration of 6 minutes. Irrespective of the event duration the overall design shall ensure that all stormwater falling on the site is contained and controlled on site and not directed towards the road reserve
13. The owner agrees to advise subsequent owners of the property of the above conditions.

STANDARD CONDITIONS OF APPROVAL FOR SOAKWELLS

Developments in drainage precincts that allow for stormwater drainage to be disposed of by the use of soakwells, as specified in the Stormwater Drainage Precinct Plan, shall be required to meet the following conditions:

1. All downpipes shall be connected to soakwells directly through a piped gravity fed system
2. Downpipes from structures shall not discharge over surface areas
3. The base of soakwells shall be constructed to a level greater than 500mm above the historical maximum ground water level as specified in the Perth Groundwater Atlas (Water and Rivers Commission)
4. Soakwells shall be located on the development site and constructed in such a way that regular and routine maintenance of the system can be undertaken
5. The depth of any soakwell shall be no greater than twice its' diameter (to a maximum depth of 2.4m)
6. Soakwells shall be located as far away from any building foundation as possible and never closer than 1.5 times the soakwell depth
7. The owner of the property shall adequately maintain or keep clean any pipes or soakwells on their property
8. Soakwells used in trafficable areas shall be covered with a trafficable lid and shall be capable of supporting the load from a large delivery vehicle
9. An 'As Constructed' drawing of the stormwater drainage system shall be submitted to the City of South Perth on completion of the connection works
10. The owner agrees to advise any subsequent owner of the property of the above conditions.

STANDARD CONDITIONS OF APPROVAL FOR STORMWATER RE-USE

Designs incorporating stormwater storage for re-use is encouraged as a preferred method for stormwater disposal and detention in all drainage precincts. Stormwater re-use systems shall be utilised as either a complete treatment or as a treatment to be used in conjunction with other methods of stormwater disposal. Any proposed stormwater re-use system shall only be considered if the following conditions are met:

1. Potable water collected on site shall be treated to the required level as specified by the relevant Western Australian and National Standards
2. Water used for domestic purposes shall be collected only from roof runoff
3. Water collected from paved surfaces shall only be re-used for irrigation or other approved purposes
4. Overflow systems shall be incorporated into any stormwater re-use system and shall be designed in line with the requirements of the specified stormwater drainage precinct
5. The design for the overall stormwater drainage and re-use system shall be submitted for approval with a Certified Statement, signed by an appropriately qualified Chartered Professional engineer of the Institution of Engineers, Australia
6. On completion of the installation of the stormwater re-use system, an 'As Constructed' drawing of the stormwater drainage system shall be submitted to the City of South Perth
7. The owner agrees to advise any subsequent owner(s) of the property of the above conditions.

Appendix D. Other Information

RAINFALL INTENSITY DESIGN CHART

Duration	Average Recurrence Interval (Years)							
	1	2	5	10	20	50	100	500
5m	59.35	78.17	102.62	119.02	142.65	177.59	207.44	290.89
6	55.19	72.60	95.01	110.00	131.62	163.54	190.77	266.70
7	51.74	67.99	88.74	102.57	122.56	152.02	177.10	246.93
8	48.82	64.08	83.44	96.31	114.92	142.32	165.62	230.37
9	46.30	60.72	78.88	90.92	108.37	134.01	155.79	216.21
10	44.09	57.77	74.90	86.23	102.66	126.78	147.25	203.94
11	42.13	55.16	71.38	82.08	97.63	120.42	139.74	193.17
12	40.38	52.83	68.24	78.39	93.15	114.76	133.07	183.63
13	38.81	50.73	65.42	75.08	89.13	109.70	127.10	175.09
14	37.38	48.83	62.87	72.08	85.50	105.13	121.71	167.41
15	36.07	47.10	60.55	69.36	82.21	100.97	116.82	160.45
16	34.88	45.51	58.42	66.87	79.19	97.18	112.37	154.11
17	33.77	44.04	56.47	64.58	76.43	93.71	108.28	148.31
18	32.75	42.69	54.66	62.46	73.87	90.50	104.52	142.97
20	30.93	40.26	51.43	58.69	69.32	84.79	97.81	133.48
25	27.27	35.43	45.02	51.21	60.32	73.53	84.62	114.87
30	24.52	31.80	40.22	45.63	53.62	65.17	74.85	101.16
35	22.36	28.95	36.47	41.28	48.41	58.70	67.29	90.59
40	20.61	26.64	33.45	37.79	44.23	53.51	61.25	82.18
45	19.15	24.73	30.96	34.90	40.79	49.25	56.29	75.30
50	17.93	23.11	28.86	32.48	37.90	45.68	52.15	69.56
55	16.87	21.73	27.06	30.42	35.44	42.65	48.63	64.70
60	15.96	20.53	25.51	28.63	33.32	40.03	45.60	60.53
75	13.85	17.80	22.06	24.72	28.73	34.47	39.21	51.92
90	12.32	15.82	19.56	21.89	25.42	30.45	34.60	45.73
2.0h	10.21	13.09	16.14	18.03	20.89	24.97	28.34	37.32
3	7.82	10.00	12.27	13.67	15.80	18.82	21.32	27.94
4	6.46	8.25	10.09	11.22	12.94	15.39	17.40	22.73
5	5.57	7.11	8.67	9.62	11.09	13.16	14.87	19.37
6	4.94	6.30	7.66	8.49	9.78	11.59	13.07	17.00
8	4.09	5.20	6.31	6.98	8.02	9.48	10.68	13.84
10	3.53	4.49	5.43	5.99	6.87	8.12	9.13	11.80
12	3.13	3.98	4.80	5.29	6.06	7.15	8.04	10.36
14	2.83	3.60	4.36	4.82	5.53	6.54	7.36	9.52
16	2.59	3.30	4.01	4.44	5.11	6.05	6.82	8.85
18	2.40	3.06	3.72	4.13	4.76	5.64	6.37	8.29
20	2.24	2.86	3.49	3.87	4.46	5.30	5.99	7.82
22	2.10	2.68	3.28	3.65	4.21	5.01	5.67	7.41
24	1.98	2.53	3.11	3.46	4.00	4.76	5.39	7.06
36	1.50	1.93	2.39	2.67	3.10	3.72	4.23	5.59
48	1.22	1.57	1.96	2.21	2.57	3.10	3.53	4.71
60	1.03	1.33	1.67	1.89	2.21	2.67	3.05	4.09
72	0.89	1.16	1.46	1.65	1.94	2.35	2.69	3.62

This information has been obtained from Main Roads Western Australia for use as guidance only regarding Average Recurrence Intervals for rainfall in the Perth Metropolitan area. The City of South Perth and Main Roads WA accepts no responsibility for its accuracy and encourages designers to utilise the hydrometeorology services of the Bureau of Meteorology to determine Average Recurrence Intervals for the development being considered.

PRIVATE DRAINAGE CONNECTION & TRAPPED MAHOLE LAYOUTS

