### Chapter E14: Stormwater Management

#### Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2 OBJECTIVES</td>
<td>1</td>
</tr>
<tr>
<td>3 DEFINITIONS / TECHNICAL TERMS</td>
<td>1</td>
</tr>
<tr>
<td>4 AVERAGE RECURRENCE INTERVAL</td>
<td>5</td>
</tr>
<tr>
<td>4.1 Minor System</td>
<td>5</td>
</tr>
<tr>
<td>4.2 Major System</td>
<td>5</td>
</tr>
<tr>
<td>4.3 Trunk Drainage</td>
<td>5</td>
</tr>
<tr>
<td>5 PRELIMINARY LAYOUT OF PROPOSED STORMWATER SYSTEM</td>
<td>6</td>
</tr>
<tr>
<td>6 ESTIMATION OF MINOR SYSTEM FLOWRATES</td>
<td>6</td>
</tr>
<tr>
<td>6.1 Design rainfall intensities</td>
<td>6</td>
</tr>
<tr>
<td>6.2 Times of concentration</td>
<td>6</td>
</tr>
<tr>
<td>6.3 Runoff coefficient</td>
<td>7</td>
</tr>
<tr>
<td>6.4 Sub-Area Discharge</td>
<td>7</td>
</tr>
<tr>
<td>6.5 Estimation of flowrates by computer models</td>
<td>8</td>
</tr>
<tr>
<td>7 PIT INLET DESIGN</td>
<td>8</td>
</tr>
<tr>
<td>7.1 Pit Location</td>
<td>8</td>
</tr>
<tr>
<td>7.2 Inlets and their Capacities</td>
<td>8</td>
</tr>
<tr>
<td>8 MAJOR SYSTEM FLOWS</td>
<td>9</td>
</tr>
<tr>
<td>8.1 Definition</td>
<td>9</td>
</tr>
<tr>
<td>8.2 Safety</td>
<td>9</td>
</tr>
<tr>
<td>8.3 Continuity</td>
<td>9</td>
</tr>
<tr>
<td>8.4 Road Reserve Flow Capacity</td>
<td>9</td>
</tr>
<tr>
<td>9 HYDRAULIC DESIGN OF MINOR SYSTEM</td>
<td>10</td>
</tr>
<tr>
<td>10 TRUNK DRAINAGE</td>
<td>12</td>
</tr>
<tr>
<td>10.1 General</td>
<td>12</td>
</tr>
<tr>
<td>10.2 Estimation of Flowrate</td>
<td>12</td>
</tr>
<tr>
<td>10.3 Watercourses</td>
<td>12</td>
</tr>
<tr>
<td>11 MANAGEMENT OF STORMWATER FROM DEVELOPMENT</td>
<td>16</td>
</tr>
<tr>
<td>11.1 General</td>
<td>16</td>
</tr>
<tr>
<td>11.2 Development Sites Affected By Flooding</td>
<td>17</td>
</tr>
<tr>
<td>11.3 Disposal of stormwater from development sites</td>
<td>18</td>
</tr>
<tr>
<td>11.4 Conditions for Building over Common Stormwater Lines and Stormwater Easements</td>
<td>22</td>
</tr>
<tr>
<td>12 ON-SITE STORMWATER DETENTION</td>
<td>24</td>
</tr>
<tr>
<td>12.1 Application of On-Site Stormwater Detention</td>
<td>24</td>
</tr>
<tr>
<td>12.2 Design requirements</td>
<td>26</td>
</tr>
<tr>
<td>12.3 Alternative Systems</td>
<td>30</td>
</tr>
<tr>
<td>12.4 Implementation of OSD requirements</td>
<td>30</td>
</tr>
<tr>
<td>12.5 Development Approval Process</td>
<td>33</td>
</tr>
<tr>
<td>12.6 Record System</td>
<td>41</td>
</tr>
<tr>
<td>12.7 Inspections</td>
<td>42</td>
</tr>
<tr>
<td>13 INFORMATION REQUIREMENTS (TO BE SUBMITTED BY APPLICANT)</td>
<td>42</td>
</tr>
<tr>
<td>13.1 Development Application Stage (Where Construction Certificate is required)</td>
<td>42</td>
</tr>
<tr>
<td>13.2 Construction Certificate Stage</td>
<td>43</td>
</tr>
<tr>
<td>13.3 Prior to Final Occupation Stage</td>
<td>43</td>
</tr>
<tr>
<td>13.4 At Development Application Stage (Where No Construction Certificate Is Required)</td>
<td>44</td>
</tr>
<tr>
<td>13.5 Standard of Engineering Submission</td>
<td>45</td>
</tr>
<tr>
<td>13.6 Computer Programs</td>
<td>45</td>
</tr>
<tr>
<td>14 APPLICATION OF THIS CHAPTER</td>
<td>45</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

1. This chapter of the DCP outlines Council’s requirements for stormwater drainage design and on-site stormwater detention for all developments within the City of Wollongong LGA. All stormwater drainage design and on-site stormwater detention must be carried out in accordance with this chapter. Adherence to the requirements contained in this chapter of the DCP will help facilitate the expeditious processing of applications involving engineering related issues.

2. This chapter of the DCP should be read in conjunction with the Australian Rainfall and Runoff: National Code of Practice for Drainage, published by Institution of Engineers, Australia 1998 in addition to the Floodplain Management and Water Sensitive Urban Design chapters contained in Part E of this DCP.

3. This chapter of the DCP embraces the concept of the “Major/Minor” approach. The minor system is the gutter and underground pipe network that is designed to an Average Recurrence Interval, as indicated in Section 4.1. The major system refers to the overland flow paths/stormwater routes that are to be designed to convey major storm flows when the capacity of the minor system is exceeded.

2 OBJECTIVES

1. The main objectives of this chapter are to:

(a) Achieve a uniform standard of stormwater drainage design for all developments;

(b) Reduce peak flows from sites into Council’s stormwater drainage system;

(c) Reduce the probability of downstream flooding;

(d) Minimise the potential impacts of new development and redevelopment in areas affected by local overland stormwater run-off or flooding, such that no increase in stormwater peak flows occurs downstream;

(e) Minimise stormwater run-off volumes;

(f) Reduce peak run-off flows from urban developments by local detention basins and minimising impervious areas, wherever practicable;

(g) Minimise the drainage infrastructure cost of development; and

(h) Increase public convenience and public safety as well as protection of property.

3 DEFINITIONS / TECHNICAL TERMS

For the purposes of this chapter of the DCP, the following definitions / technical terms apply:

**Absorption Trench**
An excavation that has been filled with material or prefabricated void units that are conducive to the drainage of stormwater and which are designed to drain vertically or side-ways, into adjacent sub-surface in-situ void or fill material.

**AEP**
Annual Exceedence Probability: The probability of a rainfall or flood event of given magnitude being equalled or exceeded in any one year.
**Part E – General Controls – Environmental Controls**

**Chapter E14: Stormwater Management**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHD</td>
<td>Australian Height Datum: National reference datum for level.</td>
</tr>
<tr>
<td>Alluvium</td>
<td>Material eroded, transported and deposited by streams.</td>
</tr>
<tr>
<td>Antecedent</td>
<td>Pre-existing conditions (e.g. wetness of soils).</td>
</tr>
<tr>
<td>Areal</td>
<td>Variation over an area of a particular parameter.</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Recurrence Interval: The expected or average interval of time between exceedences of a rainfall or flood event of given magnitude.</td>
</tr>
<tr>
<td>Backwater Profile</td>
<td>Longitudinal profile of the water surface in a stream where the water surface is raised above its normal level by a natural or artificial obstruction.</td>
</tr>
<tr>
<td>Basement Carparking</td>
<td>A car parking area generally below ground level or above natural ground level but enclosed by bunding, where inundation of the surrounding areas may raise water levels above the entry level to the basement, resulting in rapid inundation of the basement to depths greater than 0.8 metres. Basement car parks are areas where the means of drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity. Car parks not at risk of inundation (i.e. their entrance is above the PMF) are not subject to the requirements of this Chapter.</td>
</tr>
<tr>
<td>Catchment</td>
<td>Area draining into a particular creek system, typically bounded by higher ground around its perimeter.</td>
</tr>
<tr>
<td>Conveyance</td>
<td>A measure of the carrying capacity of the channel section. Flow is directly proportional to conveyance for steady flow. From Manning’s equation, the proportionality factor is the square root of the energy slope.</td>
</tr>
<tr>
<td>Cover</td>
<td>Type and distribution of vegetation on catchment.</td>
</tr>
<tr>
<td>Critical Depth</td>
<td>If discharge is held constant and the water depth allowed to decrease, as in the case of water approaching a free overfall, velocity head will increase, pressure head will decrease, and total energy will decrease toward a minimum value where the rate of the decrease in the pressure head is just counterbalanced by the rate of increase in velocity head. This is the critical depth. More generally, the critical depth is the depth of flow that would produce the minimum total energy head, and it depends on cross section geometry and water discharge.</td>
</tr>
<tr>
<td>Critical Flow</td>
<td>The state of flow where the water depth is at the critical depth and when the inertial and gravitational forces are equal. When Froude $N^o = 1.0$.</td>
</tr>
<tr>
<td>Culvert</td>
<td>An enclosed conduit (typically pipe or box) that conveys stormwater below ground.</td>
</tr>
<tr>
<td>DECCW</td>
<td>Department of Environment, Climate Change and Water</td>
</tr>
<tr>
<td>DWE</td>
<td>Department of Water and Energy</td>
</tr>
<tr>
<td>Discharge</td>
<td>The flow rate of water.</td>
</tr>
</tbody>
</table>
| Escarpment | A cliff or steep slope, of some extent, generally separating two level or gently
sloping areas.

**Flood**
A relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.

**Freeboard**
The factor of safety expressed as the height above the design flood level. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, and other effects such as “greenhouse” and climate change.

**Froude No**
A measure of flow instability - below a value of one, flow is tranquil and smooth, above one, flow tends to be rough and undulating (as in rapids).

**Geotechnical**
Relating to Engineering and the materials of the earth crust.

**Gradient**
Slope or rate of fall of land/pipe/stream.

**Gully**
Narrow ravine, small valley.

**Headwall**
Wall constructed around inlet or outlet of a culvert.

**Hydrology**
A term given to the study of rainfall and runoff processes as relates to the derivation of flood discharges

**Hyetograph**
A graph of rainfall intensity against time.

**Hydrograph**
A graph of flood flow against time.

**Hydraulic**
A term given to the study of water flow, as relates to the evaluation of flow depths, levels and velocities.

**Ha**
Hectare. (Area = 10,000m²)

**IFD**
Intensity - Frequency – Duration Rainfall parameters used to describe rainfall at a particular location.

**Isohyets**
Lines joining points of equal rainfall

**FSL**
Flood Surface Level.

**FPL**
Flood Planning Level

**FPDM**

**Km**
Kilometre. (1 km distance = 1,000m)

**M**
Metre.

**M²**
Square Metre.

**M³/sec**
Cubic Metre per Second.
### Major/Minor Stormwater System
Refer under GENERAL.

### Manning’s n
A measure of channel or pipe roughness.

### Minor Development
Developments discharging less than 55L/S and discharging to kerb.

### Normal Depth
The depth that would exist if the flow were uniform.

### NWC
Natural Water Course: A small creek or channel in its natural condition.

### Orographic
Pertaining to changes in relief, i.e. mountains.

### Orthophoto
Aerial photograph with land contours, boundaries or reference grids added.

### Pluviograph
An instrument which records rainfall collected as a function of time.

### PMF
Probable Maximum Flood: Flood calculated to be the maximum ever likely to occur.

### PMP
Probable Maximum Precipitation: Rainfall calculated to be the maximum ever likely to occur.

### Receiving Waters
A river, lake or the ocean.

### RCP
Reinforced Concrete Pipe.

### Run-off
Stormwater running off a catchment during a storm on the catchment.

### Scour
Erosion of soil in the banks or bed of a creek, typically occurring in areas of high flow velocities and turbulence.

### Sec
Second.

### Siltation
The filling or rising up of the bed of a watercourse or channel by deposited silt.

### Spurs
Secondary ridges typically occurring at right angles to a main ridge line, formed by stream erosion of the slopes of the main ridge.

### Stormwater
Surface runoff generated from rainfall events.

### Stratigraphy
The sequence of layers in which soils/rocks have been deposited.

### Sub-critical Flow
The state of flow where the water depth is above the critical depth. Here, the influence of gravity forces dominates the influences of inertial forces, and flow, having a low velocity, is often described as tranquil.

### Surcharge Flow
Unable to enter a culvert or exiting from a pit as a result of inadequate capacity.

### Supercritical Flow
The state of flow where the water depth is below the critical depth, inertial forces dominate the gravitational forces, and the flow is described as rapid or shooting.

### Suitably Qualified Civil Engineer
A civil engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia.
Topography
The natural surface features of a region.

Transpiration Pit
An excavation which has been filled with material conducive to the drainage of stormwater and which is designed to drain sideways, into the atmosphere, via a retaining medium.

Trunk Drainage
A stormwater system serving catchments larger than 15 hectares.

Urbanisation
The change in land use from natural to developed state.

Watercourse
Small stream, creek.

Yr
Year.

4 AVERAGE RECURRENCE INTERVAL

4.1 Minor System
1. The design average recurrence interval to be adopted for the gutter and piped stormwater (minor) system must be as indicated below:

   a) Road Drainage (Longitudinal)
      i) For all land use types including rural residential, urban residential, commercial and industrial, the ARI must be 10 years. In new residential subdivisions where overflow paths are provided in accordance with Section 8 of this Chapter and are capable of safely discharging stormwater flows into receiving waters the ARI may be reduced to 5 years.

   b) Stormwater Within Development Sites
      i) For all land use types including rural residential, urban residential, commercial and industrial, the ARI must be 10 years. Refer to Section 12 of this chapter to for on-site detention requirements.

4.2 Major System
1. The major system, which includes “escape routes” or overland flow routes for flows in excess of the piped system capacity must be designed and/or checked for a 100 years ARI event.

4.3 Trunk Drainage
1. Trunk stormwater systems, which include open channels, large conduits and overland flow paths are to cater for storms up to the PMF event.

4.3.1 Road Culverts
1. Culverts under local/collector roads must be designed in combination with an overflow route.

2. Overtopping of roads may be permitted, provided the following criteria are adopted when designing road crossings:

   a) The road crossing must be designed such that the peak overtopping velocity and depth which is within safe limits and is of low hydraulic hazard (see NSW Government’s Floodplain Development Manual).

   b) The appropriate blockage factor in accordance with Section 10.3.2 of this chapter.
c) The road section must be able to withstand such overtopping without scour.

5 PRELIMINARY LAYOUT OF PROPOSED STORMWATER SYSTEM

1. The determination of stormwater paths will require a site survey to be carried out. Existing stormwater systems must be analysed using either reliable work-as-executed plans or alternatively, if these are not available, a field survey will be necessary.

2. Once the survey information is available, a proposed stormwater layout is plotted taking into account rainfall data applicable to the site, times of concentration, gutter and pit capacities.

3. An approximate procedure for locating pits is detailed in “Technical Note 2” in ARR and Section 7 of this chapter.

4. Catchment areas for each pit can then be defined once the pipe layout has been established. A site inspection should be carried out to determine the effect of features that could alter the assumed catchment boundaries and flow paths such as existing or proposed fencing, retaining walls or other structures.

5. Sub-area discharges can be calculated using the procedures detailed in Section 6. Major system flow paths should be identified at this stage and analysed using the procedures detailed in Section 8.

6 ESTIMATION OF MINOR SYSTEM FLOWRATES

6.1 Design rainfall intensities

1. Rainfall intensities adopted for design must be derived using the methods detailed in ARR for the appropriate duration and average recurrence interval.

6.2 Times of concentration

1. Overland flow times must be determined using the Kinematic Wave Equation as detailed in “Technical Note 3” of ARR. The time of concentration is made up of a number of components including pipe flow time and channel time.

2. Gutter flow times can be determined using the procedure detailed in “Technical Note 4” of ARR.

3. The value of the Retardance Coefficient “n*” used in the calculation of overland flow time must be the appropriate value listed in Table 1 below.

<table>
<thead>
<tr>
<th>Land Use Retardance Coefficients (n*)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Road/Paved Areas</td>
<td>0.01</td>
</tr>
<tr>
<td>Parkland – Grassed</td>
<td>0.17</td>
</tr>
<tr>
<td>Open Space (Natural Bushland)</td>
<td>0.30</td>
</tr>
</tbody>
</table>
### 6.3 Runoff coefficient

1. The runoff coefficient to be adopted for design must be determined from Figure 1 below.

2. The runoff coefficient must be estimated separately for each land use. Table 2 below gives specific values of percentage impervious area for various types of land uses.

![Figure 1: Determination of Runoff Coefficient](image)

#### Table 2: Percentage Impervious Area for Landuse type

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Percentage Impervious Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Residential Lots</td>
<td>60%</td>
</tr>
<tr>
<td>Half Width Road Reserve</td>
<td>95%</td>
</tr>
<tr>
<td>Medium Density Residential Lots</td>
<td>80%</td>
</tr>
<tr>
<td>Commercial Areas</td>
<td>100%</td>
</tr>
<tr>
<td>Industrial Areas</td>
<td>100%</td>
</tr>
<tr>
<td>Public Recreation Areas</td>
<td>25%</td>
</tr>
</tbody>
</table>

3. Actual percentages of impervious area may be used as long as they take into account the ultimate development of the site.

### 6.4 Sub-Area Discharge

1. The discharge at the outlet of each sub-area may be calculated using the Rational Method. A plan of the adopted sub-area/s must be submitted. A typical sub-catchment layout and calculations can be found in “Technical Note 6” of ARR.

\[
Q = \frac{C \times I \times A}{0.36}
\]

Where
- \( Q \) is the design flowrate (l/s)
- \( C \) is the runoff coefficient
I is the rainfall intensity (mm/hr)
A is the area of the sub-catchment (ha)

The calculations should be set out in tabular form similar to those shown in “Technical Note 6” of ARR.

2. **Partial Area Effects**

a) Partial area effects in some cases may result in larger discharges than when full catchment areas are used. This is mainly caused by catchment shape or variations in slopes and land use within a sub-catchment. In large developments, such as large industrial or high density residential developments, a partial area discharge must be checked against that obtained using the full area.

b) These calculations should be set out in tabular form similar to those shown in “Technical Note 6” of ARR.

### 6.5 **Estimation of flowrates by computer models**

1. The discharge at the outlet of each sub-area may also be calculated using computer models. When computer models are used, the input parameters and assumptions made must be clearly described and justified.

2. A hardcopy of the results as well as a summary table showing all relevant information must be submitted with the application.

### 7 **PIT INLET DESIGN**

#### 7.1 **Pit Location**

1. For the minor system ARI, kerb inlet pits must be located in the following positions:

   a) At the upstream tangent point of the kerb return (i.e. at an intersection).
   b) Where the gutter flow width exceeds 2.5 metres.
   c) Where the gutter flow depth exceeds the top of kerb.
   d) At each low point of the kerb and gutter. Where serious flooding could result if the main pit was 50% blocked then an auxiliary pit must be provided such that the combined system caters for the minor system flowrate without overtopping.
   e) Clear of driveways, accessways and pedestrian pram ramps.
   f) Where spacing between pits exceeds 80m.
   g) In line with common lot boundaries.
   h) Such that the depth of flow in the low side kerb and gutter does not exceed the crest level of driveways to properties below road level.

#### 7.2 **Inlets and their Capacities**

1. The capacity of any type of inlet involves determining the quantities and characteristics of the flow approaching the inlet.

2. The minimum blockage factors to be used in the analysis of sag pits and pits on grade are 50% and 80% respectively.
3. All new work must use combined galvanised grates with lintels. For slopes greater than 5%, deflectors shall be incorporated into the design.

8 MAJOR SYSTEM FLOWS

8.1 Definition
1. Major system flows are flows in excess of the minor system capacity. These major system flows shall be catered for by providing suitable escape routes such that they do not present a danger to life and property. These overland flow paths (ie. escape routes) shall have a capacity to carry major system flows up to the 100 year ARI.

2. The following overland flow paths may be used to act as major system flow routes:
   (a) Roadways including footpath;
   (b) Pathways; and
   (c) Parkland or open space.

8.2 Safety
1. In the design of these overland flow paths the actual flow depth must be taken into account when establishing an appropriate design value of \( V*D \). Reference should be made to the Floodplain Development Manual 2005 to determine safe values of \( V*D \).

2. Stormwater drainage designs must take account of the existing flood behaviour and at the very least ensure that it is not made worse by any proposed works.

8.3 Continuity
1. Consideration must be given to continuity of the overland flow path and as such where, for example, a roadway acting as an overland flow path discharges stormwater to a pathway, park, stormwater reserve, etc. the footpath must have a reverse crossfall to facilitate the overland flow. Other obstructions, such as fences, must not traverse these flow paths.

2. Consideration should also be given to low points near kerb returns. That is, the grading of the kerb return should be such that water flows around the return and away before it breaks over the top of the kerb at the low point.

8.4 Road Reserve Flow Capacity
1. Flow capacities of road carriageways having widths of 6 metres, 8 metres and 12 metres with varying longitudinal slopes can be found within Appendix 7 to this chapter. If the roadway alone does not provide the required capacity, the entire width of the road reserve may be used as the flood path subject to velocity and depth restrictions.

2. Technical Note 6, in ARR details a procedure for analysing major system flows. Alternatively, a computer model may be used, providing the input parameters and assumptions are clearly described and justified.

3. A hard copy of the results as well as a summary table showing all relevant information must be submitted with the application.
9 HYDRAULIC DESIGN OF MINOR SYSTEM

1. The hydraulic design of the minor system must be carried out using the hydraulic grade line method. The results can be determined either by manual calculations or by using a computer program. Where a computer model is used, the input parameters and assumptions shall be clearly described and justified.

2. A hard copy of the results as well as a summary table showing all relevant information must be submitted with the application. The following information must be taken into account:

   a) Pipe Friction

   Recommended pipe friction coefficients to be used are shown in Table 3.

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Manning's &quot;n&quot;</th>
<th>Colebrook-White &quot;k&quot; (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>0.012</td>
<td>0.6</td>
</tr>
<tr>
<td>Fibre Reinforced Concrete</td>
<td>0.01</td>
<td>0.15</td>
</tr>
<tr>
<td>UPVC</td>
<td>0.009</td>
<td>0.05</td>
</tr>
</tbody>
</table>

   b) Downstream Control Points

   For both the designing of a new system and the checking of an existing system, the following control points apply:

   i) For a submerged outlet discharging into tidal water, the level to adopt must be RL 1.28m AHD. This level is based on the 1 year ARI storm surge tide which is assumed to coincide with the runoff peak from the design recurrence interval storm on the catchment. The pipe invert must be above RL 0.00m AHD or above siltation level, whichever is higher.

   ii) For an outlet draining the local system and discharging into an open channel or body of water serving a catchment of comparable size to the local catchment, the tailwater in the channel immediately downstream of the outlet must be determined by using Manning's Equation to find the normal depth. This water level becomes the control point, unless there is an obvious downstream control that makes it necessary to perform a backwater analysis.

   iii) For an outlet draining the local system and discharging into an open channel serving a catchment much larger than the local catchment, the determination of the tailwater shall be based on a hydrograph analysis, which has considered phase differences between the two catchments.

   iv) For a free outlet, the control point is taken as the greater of tailwater depth or $d_c + \frac{D}{2}$ where $d_c =$ critical depth in pipe, and $D =$ diameter of pipe.

   v) If a new system connects to an existing system and there will be significantly increased discharges in the existing system, the existing system must be checked to assess its adequacy in carrying the increased discharge. This checking must extend down the system until either the increase in discharge becomes insignificant (less than 5%) or the outlet is reached.

   c) Pit Loss Factors

   Either the Missouri Charts or Hare Charts may be used in calculating hydraulic losses in pits. Benching in pits may be used to assist in reducing pit losses where desirable.

   d) Drop Pits

   Drop pits occur where there is a substantial difference between the invert of the inlet and obvert of the outlet. Usually, this results in the water losing all of its forward velocity and momentum. Very large
headlosses can be expected due to the need to accelerate the water from rest and due to the turbulence caused by the incoming water.

When the obvert of the outlet pipe is at or greater than Do/4 (Do = diameter of outlet pipe) below the invert of the upstream pipe, the inflow must be regarded as grate flow.

e) Pipe deflection and Mitre Bends

Pipe manufacturer’s allowable pipe deflection angles and mitre bends may be used for changes in direction in the horizontal plane only where the use of junction pits are not required. Appropriate headlosses are to be taken into account.

f) Pit Freeboard

A zero freeboard may be adopted.


g) Pipe Velocities

The maximum and minimum velocities for reinforced concrete pipes must be 8m/s and 0.6m/s respectively, or as recommended in the manufacturer’s specifications. For all other pipe types, refer to the manufacturer’s specifications.

h) Minimum/Maximum gradients for Pipes

The minimum and maximum gradients to be adopted for pipes must be in accordance with the relevant Australian Standards or as recommended in the manufacturer’s specifications.

i) Anchor Blocks

Where the grade of the pipe exceeds 15%, concrete anchor blocks must be provided as a minimum at every third collar or as recommended in the manufacturer’s specifications.

j) Pipe Class, Cover and Joints

The class of pipe used must be compatible with the loading it will be subjected to.

- The calculation of working loads and methods of installation of buried concrete pipes must be in accordance with AS3725 “Loads on Buried Concrete Pipes”.
- Cover over pipelines must comply with the relevant Australian Standards, but generally should not be less than 300mm in landscaped areas and 450mm in areas subjected to vehicle loads, with the exception of pipelines laid under the footpath which connect to a kerb.
- Rubber ring jointed concrete pipes must be used for all road stormwater applications. Pipelines shall have a minimum diameter of 375 mm when used for road drainage applications.

k) Hydraulic Design Calculations

Technical Note 9 of ARR details the recommended methods for hydraulic design calculations. Alternatively, a computer model may be used, providing the input parameters and assumptions are clearly described and justified.

A hard copy of the results as well as a summary table showing all relevant information must be submitted with the application.
10 TRUNK DRAINAGE

10.1 General

1. Trunk drainage carries runoff from local street drainage systems to receiving waters. Trunk drainage systems serve catchments larger than 15 hectares and can include the following elements:

a) Natural watercourses or artificial open channels. For the purpose of this document, the term “natural watercourse” is considered to be a defined path which stormwater follows and includes channels and any overbank flow path. The provision of channel lining or enclosure by pipes, etc. does not in any way diminish the fact that the flow path is a natural route for the stormwater. In areas of uncertainty, the Manager Infrastructure will determine its existence.

b) Culverts and road crossings exceeding 900 mm in diameter.

c) Naturally occurring ponds and lakes exceeding 1000 m³ capacity.

d) Transition and hydraulic structures.

e) Artificial detention/retention storages exceeding 1000 m³ capacity.

10.2 Estimation of Flowrate

1. An appropriate runoff routing model must be used to estimate design flowrates at suitable points along a trunk stormwater system. It is necessary to estimate runoffs using storm patterns of different durations to determine the critical storm. Such patterns are obtained from ARR. The model should reflect the existing conditions of the catchment.

2. The model chosen must be calibrated against a recorded storm event if available; otherwise the model must be compared with at least one other runoff routing model and/or the Probabilistic Rational Method. If calibration is to be made against the Probabilistic Rational Method, then once calibration is achieved, model parameters must be adjusted to take into account the extent of urbanisation.

3. The model eventually chosen must be justified for its adoption.

10.3 Watercourses

10.3.1 Hydraulic Design - Estimation Of Design Flood Level

1. Hydraulic design or analysis of watercourses shall proceed with the use of Flood Water Surface Profile (FWSP) calculations as appropriate. These calculations may be done manually or by the use of appropriate computer models. Any assumptions made in the hydraulic analysis/design are to be clearly stated and shown to be justified. The hydraulic design will need to integrate current riparian management and related environmental considerations and policies as appropriate.

2. The data required for the hydraulic design or analysis including channel cross sections, hydraulic properties (e.g. roughness), dimensions of controls, obstructions, etc, shall be obtained by the proponent. This data shall be documented clearly and reflect both the existing and proposed hydraulic characteristics of the creek channel and floodway. Unrealistic approximations are not to be made on this data and all assumptions should be documented.
3. A sufficient number of cross-sections selected at appropriate locations both within the site and extending sufficiently upstream and downstream of the site shall be analysed in order to reflect flood behaviour. This would normally require that the hydraulic calculations extend to a boundary condition at the hydraulic control downstream of the site.

4. In the hydraulic design of watercourses (which includes modified stream channels and floodway systems), a freeboard of 0.5 metres to habitable floor level shall be provided above the 100 year ARI flood water surface level within the floodway for the profile that has been amended for blockage (see Section 10.3.2). If modifications are required to the creek channel or floodplain to convey larger than natural flows or if the proposed involves activities with 40 metres of the top of the creek bank, then liaison with DWE regarding requirements for a Controlled Activity Approval under the Water Management Act 2000 is encouraged to be undertaken and integrated into the hydraulic design. This will ensure the hydraulic design appropriately integrates the final landform with geomorphic and riparian environment enhancement requirements. This will also reduce the number of iterations of hydraulic computations and reduce the overall timeframe and cost of the assessment process.

10.3.2 Conduit Blockage

1. General
   a) Historical evidence indicates a high probability of blocking of structures located along watercourses during major flooding. Evidence indicates that the debris source is catchment wide.

2. Blockage Criteria
   b) Based on a detailed evaluation of flood behaviour during the major floods of 17 August 1998 and 24 October 1999 the following blockage factors are to be applied to structures across all watercourses when calculating design flood levels
      i) 100% blockage for structures with a major diagonal opening width of <6m.
      ii) 25% bottom up blockage for structures with a major diagonal opening width of >6m
         For bridge structures involving piers or bracing, the major diagonal length is defined as the clear diagonal opening between piers/bracing, not the width of the channel at the cross-section.
      iii) 100% blockage for handrails over structures covered in (i) and for structures covered in (ii) when overtopping occurs.

   a) Flood Water Surface Profiles are to be developed upstream from each control structure to which blockage factors are applied. These profiles are to extend until the normal non-blocked profile is reached (ie afflux due to blockage is reduced to 0mm). Expected cross-catchment diversion flowpaths as a result of the afflux associated with blockage are to be identified. Where this is an issue, appropriate survey information at the structure and along the top of both banks will be required and is to be plotted against the computed Flood Water Surface Profiles until the afflux effect diminishes to zero.
   b) Where flow diversions are identified, account shall be taken of the future potential for installing measures to prevent the flow diversion occurring. (That is, a flood mitigation device may be installed to manage the diversion). The impact of such a device on the proposed development shall be considered and appropriate measures included in the design of the development.

4. Provision of Debris Control Structures
   c) Historical evidence indicates debris loading in major flooding is catchment wide. Evidence also suggests the blockage occurs in a cascading fashion down the catchment. Therefore the appropriate blockage factor indicated above is to be applied unless a catchment wide program for debris control is part of an adopted Floodplain Management Plan and has been fully implemented. Provision of localised upstream control measures (trash racks, settling basins etc) will not remove the blockage requirement for individual structures.
5. **Hydraulic Performance**
   
a) Hydraulic performance defined using the blockage factors outlined in 10.3.2(b) is to be used to evaluate flood behaviour at individual sites. Tailwater effects on the site due to blocked structures or other downstream constraints are to be considered in flood level derivation. This applies to both levels associated with the immediate watercourse as well as potential overland flow diversions from adjacent watercourses.

6. **Design of New Structures**
   
b) Design of new structures across watercourses is to be carried out in an iterative manner as indicated below:
   
i) Design is to consider the impacts of downstream structures and other downstream constraints and the associated tailwater effects.
   
ii) Structure is to be sized using conventional (non-blocked) design criteria.
   
iii) Dependent upon the classification of the road, the structure is to be sized to convey the ARI event.
   
iv) The appropriate blockage factor outlined in 10.3.2(b) is to be applied.
   
v) Adjusted surface profiles upstream and downstream of the new structure as a result of the blockages are to be calculated. Profiles are to extend until the afflux due to the blockage and the new structure is exhausted;
   
vi) Longitudinal plots should be provided for existing and proposed conditions for both the blocked and unblocked cases.
   
vi) Flows in the 100 year ARI event, in excess of the stated blockage percentage are to overflow the structure in a defined flowpath ensuring that this is consistent with the pre-structure flowpath. A check is to be made on an extreme event of 3 times the peak of the 100 year ARI event to ensure the flowpaths for rarer events remain the same.
   
vi) Flood Hazard considerations need to be identified, planned and managed on all overland flowpaths.
   
ix) Design is to make provision for the movement of both terrestrial and aquatic fauna under the road.
   
xi) Where the profile adjusted for blockage alters flow conditions such that:
   
   - Flood levels to existing or potential development areas are raised;
   
   - Additional overland flowpaths develop; and
   
   - Cross catchment diversions are created.
   
   c) Compensating measures are to be considered to be incorporated into the new structure design to ensure pre-structure conditions are not made worse.
   
d) Compensatory measures which themselves will require a full assessment may include:
   
i) Hydraulic measures to facilitate streamlined overtopping of the structure; stream re-entry points shall be determined and checked for adequacy against erosion. Erosion protection measures may be required;
   
ii) Additional hydraulic capacity of the total floodway upstream and downstream of the site (this option will need to checked against Council’s Riparian Corridor Management Study, DWE’s Controlled Activity Approval and other state policy requirements);
   
iii) Additional diagonal width of structure opening to minimise blockage potential; and
   
iv) Upstream levees to contain elevated flows.
e) Because of the scale of the debris source, localised debris control structures will not be allowed to justify overriding of this clause.

f) The appropriate blockage factor may be negated where a catchment wide program for debris control is part of an adopted Floodplain Management Plan and has been fully implemented.

7. Applicability

a) Section 10.3 applies to all watercourses including creeks, floodway and other trunk drainage systems within the City of Wollongong with the exception of the minor system as defined in the Introduction to this chapter DCP. It does not apply to pit blockage. This consideration is set out in Section 7.2.

b) It will be applied to all flood study models being developed under Council’s floodplain management program.

c) It is to be applied to all localised flood studies to support individual development proposals.

10.3.3 Ocean Levels

1. Flood surface profiles must be determined using the following criteria:

a) Adopting a 100 year ARI ocean level of RL 2.9m* AHD and a 10 year ARI fluvial flood.

b) Adopting an ocean level of RL 1.9m* AHD and a 100 year ARI fluvial flood.

2. The greater value of the above shall be adopted to determine the minimum habitable floor level. In the case of properties affected by flood levels in Lake Illawarra, flood surface profiles shall be determined using the following criteria:

a) Adopting a 100 year ARI Lake level of RL 2.3m AHD and a 100 year ARI fluvial flood.

b) Adopting a 1 year ARI Lake level of RL 1.57m AHD and a 1 year ARI fluvial flood.

c) The greater value of the above shall be adopted to determine the minimum habitable floor levels.

* A value of 0.4 metres has been included for the effects of climate change in the period up to the year 2050. For developments including essential community facilities, critical utilities and subdivisions creating more than 10 lots, a 100 year ARI ocean level of RL 3.4m AHD shall be adopted for item (i) and RL 2.4m AHD shall be adopted for item (ii). Certain commercial buildings will be required to adopt the higher flood levels. The Manager Infrastructure shall be the determining authority on when these higher flood levels are to be adopted.

10.3.4 Flow Velocities

1. Maximum flow velocities in channels and overland flow paths that are grass-lined must be restricted to 2m/s. Designs must ensure that flow is subcritical. Supercritical flow must be avoided, however, where this cannot be prevented as in the case of an existing open channel, fencing to the satisfaction of the Manager Infrastructure must be provided for the length of the open channel where supercritical flow occurs.

10.3.5 Scour Protection

1. Adequate scour protection must be designed for all discharge points into and out of the channel. It must also be provided at any point along the channel where there is a significant change in flow conditions.

10.3.6 Batter Slopes

1. Side slopes of grassed channels should be relatively flat. The desirable batter slope must not be greater than 1 vertical to 6 horizontal. However in difficult circumstances a 1 vertical to 4 horizontal may be considered.
10.3.7 Modifications to Watercourses

1. Modifications to natural watercourses are generally not permitted, as they adversely impact on a number of issues including:
   - Hydraulic function
   - Channel pattern and form
   - Long-term channel stability
   - Aesthetic appearance
   - Aquatic and bankside habitat diversity
   - Water quality

2. Any proposals involving modifications to watercourses will require the submission of a detailed hydraulic assessment as well as a thorough environmental impact assessment of the prepared watercourse modification. Modifications to watercourses will only be considered where no other alternative exists, such as when scour within the watercourse threatens the stability of a dwelling or other high value asset. The reduction of development potential as a result of not modifying a watercourse will not be considered justification for such modification.

Note: Lodgement of an Integrated Development Application will be required for any involving modified to a watercourse since the concurrence of the NSW Department Water and Energy will be required pursuant to the requirements of the Water management Act 2000.

11 MANAGEMENT OF STORMWATER FROM DEVELOPMENT

11.1 General

1. The guidelines contained within this Section must apply to all developments within the City of Wollongong.

2. The responsibility for the submission of satisfactory details as required in these guidelines must rest solely with the applicant.

3. Detailed plans showing the proposed method of stormwater disposal are to be submitted to Council with the Development Application, and are to be shown on the plans prepared in support of the Construction Certificate, as approval will not be granted for any work commencing on site until the stormwater disposal system has been approved.

4. The guidelines that follow are grouped into sub-sections, each dealing with separate issues. At the end of each sub-section, the information, which must be submitted to Council, is outlined.

5. Generally, all stormwater designs/investigations must be prepared in accordance with all relevant sections in this chapter. To prevent delays in assessment, the applicant should ensure that all necessary details included in this chapter are submitted.
11.2 Development Sites Affected By Flooding

11.2.1 Flood Studies
1. Flood studies must be prepared by suitably qualified civil engineers. The flood study must be prepared in accordance with the relevant sections of this Chapter. Both the 100 year ARI and PMF flood events must be adopted to assess the effects of flooding on the proposed development site and adjacent properties. In certain circumstances, it may be necessary to assess the effects from lesser storm events.

2. An investigation of the effects on the proposed development of upstream diversions caused by blockages and inappropriate development needs to be undertaken as part of the overall flood study.

3. Council will request a flood study to determine the effects of a proposed development on flooding or conversely, the effect of flooding on a proposed development. Flood studies will be required for any type of development where the development occurs in the floodplain or in areas of where overland flow is suspected. The hydraulic component of the analysis shall be undertaken in accordance with Section 10.3 of this chapter. Unless it can be demonstrated that it is not applicable, flood studies shall be prepared using a fully dynamic 1 or 2 dimensional computer model. The model chosen shall be calibrated against a recorded storm event if available. All input parameters and assumptions made must be clearly described and justified. A hard copy of the report, including all results, results summary table, and all the relevant information must be submitted with the application.

11.2.2 Other Stormwater Designs
1. The design of all stormwater drainage systems must be carried out by a suitably qualified civil engineer, with the exception of stormwater systems conveying 55 L/s or less in the 100 year ARI storm event.

11.2.3 Flood Planning Levels
1. Flood Planning Levels (FPL) for all development must be determined in accordance with the Floodplain Management chapter in Part E of this DCP and the NSW Government Floodplain Development Manual. The FPL is determined by the addition of a freeboard to the calculated 1 in 100 year ARI flood level. The freeboard to be adopted is as follows:

- For the Lake Illawarra floodplain 0.7 metres
- All other floodplains... 0.5 metres

11.2.4 Vehicle Parking Requirements
1. Parking area levels are to be set in accordance with requirements of the Floodplain Management chapter in Part E of this DCP.

2. Basement Car Parks are to be protected from inundation from 100 year ARI flood levels (or greater), ensuring all vehicular access, doors and ventilation points are a minimum of 0.2m above the 100 year ARI flood level.

11.2.5 Filling of Flood Liable Land
Refer to the Floodplain Management chapter in Part E of the DCP.
11.3 Disposal of stormwater from development sites

11.3.1 Control of Peak Discharge

1. A consequence of increasing urbanisation and intensification of development, without proper safeguards, is an increase in stormwater runoff. This increase can overload existing drainage systems, both major and minor, with resulting nuisance and potential damage to existing properties.

2. One of the methods adopted by Council to alleviate the problem is to require developers to include detention storage in developments.

3. Detention storage is the provision of depressed areas or specific storages in paved or landscaped areas that are provided with relatively small stormwater outlets, to detain a volume of water for a short duration, during more intense storms. This prevents or mitigates any increase in peak stormwater flow rates from development and delays the peak volume of runoff. Section 12 of this chapter outlines Council’s requirements for on-site stormwater detention.

11.3.2 Amplification of Council’s Stormwater Drains

1. The capacity of the stormwater system into which stormwater from the development discharges into, must be checked in accordance with Section 9(b)(v). If part of the stormwater system is found to not have the required capacity, then that part must be augmented/amplified to take the additional flow.

11.3.3 Discharge of Stormwater to a Watercourse

1. Stormwater may be discharged to a watercourse. The watercourse to which it is proposed to discharge stormwater must be well defined, having defined bed and banks. Depressions in landforms are not considered to be watercourses.

2. If there are no other means of disposal, and a defined watercourse is not in the immediate vicinity of the site, the disposal must be by a suitably designed and constructed pipeline to a point where the watercourse is clearly defined. Note: stormwater must not be discharged at the top of the bank of the watercourse.

11.3.4 Discharge of Stormwater to the Kerb

1. Where the total minor system discharge from a development site does not exceed 55 litres per second, it may be discharged into the street gutter under gravity by means of one or more pipes of 100mm diameter. A maximum of two 100mm diameter pipes will be permitted at each end of the site. A maximum of two 150mm x 100mm galvanised steel pipes may be used as an alternative if greater capacity is required, with the 150mm dimension being parallel with the road surface. In cases where this is impractical, Council may consider the use of flow converters. Note: charged stormwater lines will not be permitted.

11.3.5 Discharge of Stormwater to Council’s Drains

1. Where the total minor system discharge from a development site exceeds 55 litres per second, the disposal of all roof and surface discharge must be by means of a single pipeline connected directly into an existing Council stormwater pipeline.

2. Where no pipeline exists in the immediate vicinity of the development, disposal must be by a suitably designed and constructed pipeline to the nearest available Council gully pit. The minimum pipe size must be 375mm in diameter and must be of reinforced concrete. The reinforced concrete pipe must be located immediately behind the line of the back-of kerb in the carriageway of the street.
11.3.6 Discharge of Stormwater through Downstream Properties

1. Where a site proposing a new development falls away from the road reserve, an easement must be obtained through downstream or adjacent properties, to enable stormwater from the development site to drain in the same direction as it would in the pre-developed state. Therefore the submission of documentary evidence is required at the lodgement of the Development assessment which confirms that the downstream property owner agrees to the provision of a drainage easement through their property.

2. Where no building development exists within the site proposed to contain the easement, the minimum width of easement must be 1.0 metre. In sites which contain a building development and through which an easement is proposed, a minimum width of 0.9 metres may be used.

3. The minimum diameter of pipe to be placed within the easement is 150mm.

4. Evidence that the easement has been created must to be submitted to the Principal Certifying Authority prior to the issue of the Construction Certificate.

5. Some sites that fall away from the road still discharge some stormwater to the street. This may be due to some portion of the land draining to the street; an existing building that has piped stormwater flow draining to the street or existing raised landscape areas that drain to the street. In such cases, an equivalent stormwater flow rate, as that which occurs in the pre-development case will be permitted to drain to the street post-development.

6. In all cases, it must be clearly demonstrated that the post-developed flow rates and flow concentrations from the development site are not greater than the pre-development condition.

11.3.7 Discharge of Stormwater into Swales

1. In rural areas where no pipeline or kerb and gutter exists within the road reserve to which discharge is proposed, then discharge may be permitted within stormwater swales alongside the pavement. The swale shall be designed against scour and shall have a cross section adequate to convey the minor system flow rate.

11.3.8 Interallotment Drainage

1. Interallotment drainage must be provided to drain lots within proposed subdivisions where roof water and surface water from future development cannot be discharged directly into the street drainage system. Interallotment drainage must be provided in the form of a minimum 150mm diameter PVC Class SH single pipeline collecting runoff from properties through which the pipeline traverses and discharging to an appropriate point of discharge. Refer to 11.3.3 and 11.3.5.

2. Interallotment drainage shall be designed for a 10 year ARI event unless noted otherwise. The pipeline must generally be located parallel to and within 1 metre from the rear or side boundary inside the allotment to be serviced.

3. A minimum 1.0 metre wide easement shall be created over all interallotment drainage pipelines and reflected on the subdivision linen plan and 88B instrument.

11.3.9 Discharge of Stormwater Through Public Reserves

1. When a public reserve downstream of the development site must be traversed with a stormwater pipeline in order to reach an appropriate point of discharge, prior approval must be obtained from Council. If approval is granted, Council reserves the right to require the owner of the land benefiting from the existence of the stormwater facility to remove and relocate same at any time, subject to one month’s written notice by Council, with all associated costs being the responsibility of the owner of the benefiting land.
2. Where such a stormwater pipeline is proposed within Council owned, controlled or managed land, negotiations must be entered into with Council’s Property Division.

3. Alternatively, an absorption or transpiration pit may be used to capture and drain stormwater from development sites where they naturally drain to public reserves. Such pits must be constructed wholly within the development site and should not be used as storage to control peak discharge of stormwater from the development site. Development Application must be accompanied by an engineer’s certificate certifying that the proposed absorption pit will not adversely affect flood conditions in public reserves or on adjacent properties. In this case, the use of such pits will not be permitted. Refer to Section 11.3.12 for further details on absorption and transpiration pits.

11.3.10 Discharge of Stormwater to the Ocean
1. Individual stormwater outlets from a development site to the ocean are generally not permitted. Rather, proposed outlets are to be connected to existing outlet to minimise environmental and visual impacts. Evidence must be provided demonstrating that the sharing of common stormwater outlets from existing developments or public infrastructure (such as reserves and roads) has been exhausted, before the creation of a new separate outlet will be considered by Council. In the event that there is no alternative the applicant must provide details of the method of stormwater disposal at the ocean outfall/cliff face. In this regard the applicant must address the aesthetic qualities and environmental impacts of the method of stormwater disposal. Geotechnical considerations along the length of and at the point of discharge must also be taken into account. This may require stormwater from the development being piped and/or channelled to the foot of the outfall/cliff face with appropriate scour protection and energy dissipating elements incorporated into the design.

11.3.11 Pump Systems
1. Pump systems will not be permitted to discharge stormwater from sites grading away from the roadway, except for the specific purpose of draining underground/basement car parks. The water to be pumped from a basement car park shall be limited to sub-soil drainage, vehicle wash water and runoff from the driveway that drains towards the basement. Water to be extracted from the basement car park should be pumped to a pit inside the property boundary then gravity feed to street.

2. Drainage of stormwater runoff from roof and ground surfaces using submersible pumps is not permitted, with the exception of the above.

11.3.12 Absorption and Transpiration Disposal Systems
1. The objective of an absorption and transpiration system is to dispose of roof water from the subject dwelling to either an underground system or over the existing ground surface by replicating natural overland flows and without adversely impacting upon the subject or downslope properties/buildings.

2. An absorption disposal system or “soakaway” is the preferred method of disposing stormwater from a single dwelling only where site gradients do not allow for street gutter disposal or disposal via an interallotment drainage pipeline.

Note: Absorption disposal systems shall not to be used as storage facilities to control peak discharge of stormwater from development sites.

3. Also, absorption disposal systems should not be used for sites having steep gradients, low hydraulic soil conductivity or slope instability unless supported by further detailed engineering advice.
4. Further information on absorption disposal systems can be sourced from Council’s ‘Domestic Stormwater Drainage Systems’ fact sheet.

5. A transpiration disposal system or “level spreader” is an alternative method of disposing stormwater from a single dwelling only where site gradients do not allow for street gutter disposal or disposal via an interallotment drainage pipeline and where an absorption system is not otherwise considered suitable.

6. The location of an absorption or transpiration disposal system must be across the gradient of the site, and situated a minimum of 3 metres from property boundaries, 5 metres minimum distance from all buildings and 1 metre minimum from vehicular pavement areas. A zero setback from the downslope property boundary may be considered where the property is public reserve.

7. The design of any absorption or transpiration disposal system shall be undertaken in accordance with Council’s ‘Domestic Stormwater Drainage Systems’ fact sheet. The design of the chosen system, including all calculations and supporting documentation shall be submitted with the Development Application for the proposed development.

8. Absorption and transpiration disposal systems will not be permitted for developments, with the exception of single residential dwellings in older subdivisions and the provisions of section 11.3.9.

9. Absorption systems on unstable land must take into consideration the recommendations of a geotechnical report.

11.3.13 Minimum Pipe Size Connecting to Council’s Drains
1. Where connection must be made to Council’s underground stormwater system, the minimum pipe size crossing the footpath directly in front of the allotment must be 150mm in diameter.

11.3.14 Method of Connection to Council’s Drains
1. Where connection is to be made to Council’s underground stormwater system, the type of connection to be used must be as shown in Drawing 842 of Appendix 9.

2. Where pipes larger than 150mm in diameter are to be connected to Council’s stormwater system, a junction pit must be constructed. The lid of the junction pit must be level with the road surface. The cover over the junction pit must be of a type and of the same material as that surrounding the pit. The covers must be designed to withstand the appropriate vehicle loading.

11.3.15 Drainage Work in Footpath/Carriageway
1. Any drainage works proposed within the footpath or carriageway shall be undertaken by a Council approved contractor at the expense of the developer.

2. Prior to undertaking the works, the developer shall obtain a permit and arrange inspections with Council’s Regulation and Enforcement Division.

11.3.16 Services
1. The depth and location of all services (i.e. Stormwater, gas, water supply, sewer, electricity, telephone, traffic lights, etc.) which may affect the drainage design must be confirmed prior to the submission of final working drawings with the Construction Certificate application.
11.3.17 Flow from Adjacent Properties
1. No obstruction to the overland flow of stormwater runoff from adjacent properties is permitted. Allowance must be made for this overland flow component and adequately catered for on the subject property. In calculating this component, the entire catchment upstream of the subject property must be taken into account.

2. The diversion of this overland flow to the street, the rear of the subject property or in any other direction other than that in which it would naturally flow will not be permitted.

11.3.18 Sumps and Inlet Pits
1. Sumps and inlet pits must conform to the standards shown in Appendix 8. Alternatives to cast-in-situ concrete may be acceptable subject to approval from the Manager Infrastructure.

2. Heavy-duty cast iron or galvanised and lockable steel grates must be provided on all surface inlet pits in areas with vehicular traffic.

3. The base of pits must be graded or benched to the outlet pipe. Weepholes in the base of pits are not permitted unless written evidence is provided by a suitably qualified engineer justifying the suitability of the site for this system.

4. Paved areas and driveways falling towards Council’s footpath must be provided with a full driveway width grated box drain at the property boundary, draining into the internal system and of minimal internal dimension of 200mm wide x 100mm deep.

5. Where affected by proposed driveways, existing kerb inlet pits must be modified to suit. In this regard, the existing lintel must be removed and replaced with a vehicular crossing. A new grate must be installed and incorporated within the layback by a Council approved contractor at the developer’s expense.

6. Access to existing properties fronting the drainage works must be maintained at possible times during construction. It would be prudent to provide some form of notification to the affected properties prior to commencement of works. This is particularly the case if any disruption to access will be required as a consequence of the works.

11.4 Conditions for Building over Common Stormwater Lines and Stormwater Easements

11.4.1 General
1. This section provides Council’s requirements for the erection of buildings/structures over and adjacent to common stormwater line easements and common stormwater lines.

11.4.2 Definitions
(a) Common Stormwater Line (Interallotment Stormwater Line) Easement
An easement created over an allotment in favour of upstream allotments for the installation of drainage serving those allotments.

(b) Common Stormwater Line (Interallotment Stormwater Line)
A conduit provided to an allotment for the disposal of stormwater drainage.

(c) Owner
Means registered owner of a property or registered body corporate.
11.4.3 Common Stormwater Lines/Easements
Council requires the following conditions to be met in the construction of buildings over common stormwater lines/easements:

1. **Encroachments**
   (a) Generally, no structure of a permanent nature will be allowed on a common stormwater line or easement, except in special circumstances and subject to the approval of the Manager Infrastructure.
   (b) In such cases, written approval is required by all owners benefited by the common stormwater line on the upstream side of the proposed encroachment.
   (c) No encroachment will be permitted where that encroachment occurs within an overflow path.

2. **Loads on Conduit**
   (a) Any structural component of the building, plant or machinery and fixtures is to be so constructed so as not to impose any dead or live loads on the stormwater pipeline and to permit excavation of the line without affecting the structural stability of the building.
   (b) Where required by Council, the building is to be supported on stable foundations carried at least to the invert level of the pipeline.

3. **Design of Adjacent Footings**
   (a) The footings and floor slabs required by (b) above must be designed by a Structural Engineer and submitted to Council for approval.
   (b) No part of the structure, including footings, eaves and gutter overhang will be permitted to encroach into the drainage easement, except in special circumstances and subject to the approval of the Manager Infrastructure.

4. **Access Pits**
   (a) Access pits are to be provided at points immediately upstream and downstream of the building on the stormwater line and any intermediate pits as may be required.
   (b) Pits are to conform to Wollongong City Council Standards or an approved alternative.

5. **Obstruction of Free Flow**
   (a) No work shall be carried out which will or is likely to inhibit or obstruct the free flow of waters through the stormwater pipeline and/or overland flow path.

6. **Joints on Easement Boundary**
   (a) Where a reinforced concrete slab is provided for any purpose over the easement or pipeline, a construction joint shall be formed on the easement boundary.

11.4.4 Building Over or Adjacent to Council’s Easement

1. **General**
   (a) Building over Council stormwater easements is generally prohibited. However Council may consider the construction of extremely light structures such as carports, pergolas, or other like minor structures over easements, subject to the approval of the Manager Infrastructure.
Part E – General Controls – Environmental Controls

Chapter E14: Stormwater Management

(b) In the event that access to the easement/pipeline is required, the cost of removal and restoration of any structures over the easement will be borne by the property owner.

(c) No construction over Council stormwater easements will be permitted where the easement contains an overflow path.

2. **Footings Close to an Easement**

(a) Where it is proposed to construct footings or foundations in the vicinity of a stormwater easement, Council may impose such conditions, as it considers necessary to protect the structural stability of the existing or proposed stormwater infrastructure.

(b) The walls of any structure adjoining the easement boundary must be designed by a suitably qualified Engineer to withstand all forces should the easement be excavated to existing pipe invert level. This may require foundations to be designed such that they are set to a minimum of 300mm below pipe invert level or founded on sound rock.

(c) There must be no loss of support of the land contained within the drainage easement as a result of excavation within the site.

(d) No part of the structure, including footings, eaves and gutter overhang will be permitted to encroach into the easement to drain water / drainage easement.

3. **Concrete Slabs Over Easements**

(a) Where approval has been given to construct a concrete slab over a piped drain within a stormwater easement (such as a concrete driveway) it will be necessary for the applicant to submit structural drawings showing slab thickness, reinforcement and jointing details and address all relevant items in section 11.4.3.

4. **Structural Design**

(a) Details of the design of piers, beams and footings prepared by a qualified Civil (or Structural) Engineer must be submitted for approval with the application.

12 **ON-SITE STORMWATER DETENTION**

12.1 **Application of On-Site Stormwater Detention**

12.1.1 **Developments to which OSD Applies**

1. OSD requirements generally apply to all types of development and redevelopment on both flood prone and flood free sites. However, the storage requirement is reduced in flood prone areas (Refer Section 12.2.2).

2. Developments covered by this Policy include the following:

   (a) Subdivisions; the maximum size of subdivision to which this Policy applies is 2ha. It is recommended that wherever practicable, the OSD system be a single storage unit, either as a tank or an above-ground "community basin". OSD facilities for subdivisions of greater than 2ha should be designed using hydrologic and hydraulic analyses in accordance with Section 11.2 of this chapter.

   (b) Development as follows (unless the development meets the exclusion criteria of section 12.1.2):

      (i) Single dwellings including extensions, additions and improvements to existing dwellings;
(ii) Dual occupancies;
(iii) Townhouses, villas, residential flat building development;
(iv) All commercial, industrial and special use developments and buildings;
(v) Tennis courts;
(vi) Roads, car parks and other sealed areas
(vii) Public buildings

12.1.2 Developments to Which OSD Does Not Apply

1. The OSD policy does not apply to:

(a) Development that increases the impervious surface area of a site by less than 75m². No more than one such application for exclusion shall be permitted on a particular lot.

(b) Development that lies within the 5Yr ARI flood extents (Refer section 12.2.2).

(c) Subdivisions of existing dual occupancies where no increase in the impervious surface area is proposed.

(d) Boundary adjustments and consolidations of allotments where no additional lots are created.

(e) Change of use where no increase in the impervious surface area is proposed.

(f) Building additions or internal alterations where they lie within the footprint (plan area) of the existing dwelling.

(g) New developments in subdivisions where OSD has already been provided for the entire subdivision.

(h) Buildings in rural/non urban areas.

(i) In addition, OSD may not be required where development is located in the lower reaches of a catchment where OSD does not provide downstream benefits and where it can be demonstrated that runoff from the site can be conveyed through intervening property to ‘receiving waters’ without adversely impacting flooding of these properties. Areas where OSD would not benefit downstream flooding are shown on the plans of Appendices A1. together with streams qualifying as ‘receiving waters’. Should the location of the proposed development relative to the concession zone boundary or potential application of this concession to the development be unclear, please contact the Manager Design at Council for clarification.

12.1.3 Tributary Area Draining to OSD Basin

1. The full area draining to the proposed OSD basin post development, shall be used as the tributary area in calculations for OSD. This area includes:

(a) All impervious site surfaces on the developing site, and

(b) All pervious areas part of the developing site draining to the basin post development, and

(c) Any existing pervious or impervious surfaces external to the site where runoff from these surfaces can not be arranged to bypass the basin.

2. In general every effort should be made to

(a) Minimise the area of land, unchanged by the development, draining to the basin.
(b) Minimise the area of land draining to the basin from outside of the site.

12.2 Design requirements

1. All of the developing site’s impervious area is to drain to the OSD system. The minimum level of impervious surface to be used in the calculation of SSR for the post development land use is that provided in Table 4 below, unless detail plans for the proposed development are available from which actual impervious surface levels can be calculated.

Table 4: Percentage Impervious Area for Land Use Type

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Percentage Impervious Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Residential Lots</td>
<td>60%</td>
</tr>
<tr>
<td>Half Width Road Reserve</td>
<td>95%</td>
</tr>
<tr>
<td>Medium Density Residential Lots</td>
<td>80%</td>
</tr>
<tr>
<td>Commercial Areas</td>
<td>100%</td>
</tr>
<tr>
<td>Industrial Areas</td>
<td>100%</td>
</tr>
<tr>
<td>Public Recreation Areas</td>
<td>25%</td>
</tr>
</tbody>
</table>

2. Natural catchment boundaries are to remain unaltered. In situations where proposed impervious areas straddle natural catchment boundaries, multiple separate OSD systems shall be provided. Runoff from pervious areas which do not naturally drain to the OSD storage should, wherever possible, be designed to bypass the OSD system.

3. OSD needs to be considered and incorporated into a development as early as possible to ensure a holistic and economical design. The entire site drainage system needs to be considered during the design of a development to ensure that all runoff from impervious surfaces (roofs, gutters, paved yard areas and driveways, etc) is designed to flow into the OSD facility. In addition, a deliberate overland flow path must be created to convey these flows to the facility in the event of blockage or overload, free of obstructions such as fences, buildings, etc.

4. Detention storage is to be located at a level that is above the 5Yr ARI flood level. OSD systems are to be designed using a catchment wide approach, with a Permissible Site Discharge (PSD) and Site Storage Requirement (SSR) calculated in accordance with the procedures set out in this document.

5. Designs shall be prepared by a suitably qualified Civil Engineer in accordance with these requirements and to the satisfaction of the Manager Infrastructure. The OSD system should be designed to take into account principles of good aesthetics and landscaping. Long term viability and maintenance of the storage area must also be considered.

12.2.1 Freeboard

1. The minimum freeboard for the floors of any new structures such as garages, dwellings, commercial and industrial buildings to be constructed on the site, above the adjacent local 100 Yr ARI water surface level or 100 Yr ARI storage water surface level in the facility, shall be as set out in Table 5:
Table 5: Minimum Freeboard

<table>
<thead>
<tr>
<th></th>
<th>Minimum Freeboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwelling/commercial (habitable floors)</td>
<td>+200mm</td>
</tr>
<tr>
<td>Garage Floors</td>
<td>+100mm</td>
</tr>
<tr>
<td>Industrial Floors</td>
<td>at 100YR ARI water level</td>
</tr>
</tbody>
</table>

2. The proposed drainage works shall not reduce the freeboard of any adjacent buildings.

3. Where roof storage is proposed, freeboard requirements are not applicable.

4. It should be noted that Council’s minimum requirements for development on floodplains in which habitable floors are to be set at least 500mm above the 100Yr ARI mainstream flood level may lead to a requirement for a higher floor level than that set out in Table 5.

12.2.2 Flood Prone Land

1. As all land inundated in a 5Yr ARI flood event is effectively impervious once flooded, development on such land is excluded from this Policy, irrespective of its location in the catchment.

2. Where a Floodplain Management Plan has been prepared for the catchment, specific requirements for flood detention and/or storage within that Plan shall have precedence over this Policy.

12.2.3 Design Basis

1. The design objective of this section is the control of post development discharges, at all points in a catchment, to pre-development levels. This control is to be implemented by introducing small basins (OSD basins) on each developing site that serve to delay and reduce peak runoff from the site such that post-development discharges do no exceed pre-development levels anywhere in the catchment. Key to the design of these basins are two parameters, the permissible site discharge (PSD l/sec) and the site storage requirement (SSR m$^3$). The PSD is the discharge limit for runoff from a development site, and SSR is the storage associated with this PSD, required to ensure that there is no increase in flood peak discharges anywhere in the catchment, for all storm frequencies and durations.

2. Two PSD and SSR values are used to describe a particular facility. PSD$_5$ represents the peak discharge permissible in a 5 year ARI storm event and SSR$_5$ the associated storage volume of the basin at that discharge. PSD$_{100}$ represents the peak discharge in a 100 year event and SSR$_{100}$ the corresponding basin volume at that discharge. Note SSR$_{100}$ includes SSR$_5$.

3. High early discharge pits (HED) are not permitted under this policy.

12.2.4 Determination of PSD and SSR for a Developing Site

1. As set out in section 12.1.3, the tributary area to be used in the calculation of PSD and SSR for the OSD basin required to manage runoff from the developing site is:

2. 100% of the impervious site area determined from Table 1 or detail plans for the development proposed on the site,
Any pervious area draining naturally to the OSD facility from within or from above the site,

plus

Any existing impervious area draining naturally to the OSD facility from above the site.

3. **In summary, calculation of OSD requirements for a developing site is a two step process involving.**

**STEP 1**

In this step the OSD requirements for a site transitioning from the existing condition to the post development condition are calculated.

**STEP 2**

This second step is only needed if the tributary area to the proposed OSD facility contains existing impervious surfaces. If there are areas of existing impervious surfaces present in the tributary area, the OSD requirements for a site transitioning from an undeveloped natural condition to the present (partly developed) existing condition are calculated and the SSR requirements calculated in the first step are then reduced by the SSR requirements calculated in this second step.

4. **In detail these steps involve:**

**STEP 1**

5. In this first step, the OSD requirements are calculated for the post-development tributary area draining to the OSD basin reflecting the impervious area ultimately proposed. The PSD is calculated recognising the impact of any existing impervious area within this tributary area, on existing discharges (refer F1 in App A3). If under existing conditions the tributary area is not wholly natural (un-developed), F1 will be greater than 1, recognising the increased PSD of the existing (partly developed) tributary area relative to the PSD of a natural tributary area. Note that the existing impervious area used in the calculation of PSD is only the existing impervious area falling within the tributary area draining to the OSD basin.

6. The permissible site discharges from the post development basin are calculated from the rainfall isohyets, and tributary area as follows:

\[
PSD_5 = F1_5 \times F2 \times 2.67 \times (\text{Area}/10,000) \times I_{50}\quad \text{(l/sec)} \quad \text{eq 1.4.4.1}
\]

\[
PSD_{100} = F1_{100} \times F2 \times 4.67 \times (\text{Area}/10,000) \times I_{50}\quad \text{(l/sec)} \quad \text{eq 1.4.4.2}
\]

Where \( PSD_5 \) is the permitted peak discharge from the basin in a 5Yr ARI event

\( PSD_{100} \) is the permitted peak discharge from the basin in a 100Yr ARI event

\( I_{50} \) (mm/hr) is the one hour 50Yr ARI rainfall intensity at the site (refer App A2)

\( F1_5 \) and \( F1_{100} \) are the factors for existing impervious cover (refer App A3)

\( F2 \) is the factor reflecting variations in area from a 1Ha base (refer App A4)

\( \text{Area} \) (m²) is the tributary area draining to the OSD basin

Note both \( F1_5 \) and \( F1_{100} \) will be 1.00 if the existing tributary area is wholly undeveloped

7. The SSR volumes (m³) for the basin are then calculated from the above PSD values as follows.
SSR_5 = F3 x F4 x 2.25 x PSD_5/F2 \text{ (m}^3\text{)} \quad \text{eq 1.4.4.3}

SSR_{100} = F3 x F4 x 2.25 x PSD_{100}/F2 \text{ (m}^3\text{)} \quad \text{eq 1.4.4.4}

Where:

\textit{SSR}_5 \text{ is the facility storage at a discharge of PSD}_5

\textit{SSR}_{100} \text{ is the facility storage at a discharge of PSD}_{100}

\textit{F}3 \text{ is the factor reflecting post development impervious cover (refer App A5)}

\textit{F}4 \text{ is the factor reflecting variations in area from the 1Ha base (refer App A6)}

8. If there are no existing impervious surfaces in the tributary area, this completes the basin sizing calculations!

\textit{STEP 2.} (Only required if there are existing impervious surfaces in the tributary area)

9. In this second step, The PSD and SSR values are recomputed for the previously defined tributary area to the OSD basin assuming it was initially in a natural state and was then developed to the existing (pre-development) state. In this scenario \textit{F}1 will be 1.00 as the existing (pre-development) case is then natural. The existing impervious surface area used in step 1 then becomes the ‘post-development’ impervious area included in Step 2

10. The PSD’s and SSR’s for this scenario are then calculated as in Step 1

11. The final PSD’s are those from STEP 1 (STEP 2 PSD’s are ignored) and the final SSR’s are the Step 1 SSR’s minus the Step 2 SSR’s.

\textit{12.2.5} \textbf{Internal Drainage System}

1. The stormwater drainage system (including surface gradings, gutters, pipes, surface drains and overland flowpaths) for the property must:

   (a) Be able to collectively convey all runoff from the tributary area to the OSD system in a 1 in 100 year ARI rainfall event with a duration equal to the time of concentration of the site.

   (b) Ensure that the OSD storage is by-passed by all runoff from non-tributary areas in storms up to and including the 1 in 100 year ARI event.

\textit{12.2.6} \textbf{Discharge Control}

1. While the OSD facility is to operate across the storm spectrum from a 5 to 100 Yr ARI event, design has been simplified by requiring the facility to explicitly meet these requirements only at the upper and lower limits of the design spectrum. The facility is therefore designed as a two stage structure with the basin filling to the SSR_5 level in a PSD_5 discharge event and to the SSR_{100} level in a PSD_{100} discharge event. The first stage is controlled by an orifice, the maximum diameter of which is to be sized using the value of PSD_5 when under a head of SSR_5 m^3 of stored water. A second stage outlet must also be provided either in the form of a pipe or weir which permits a maximum discharge equal to PSD_{100} when subject to a head of SSR_{100} m^3 of stored water.
12.2.7 Safety Fences
1. Surface storages should be constructed so as to be easily accessible, with gentle side slopes permitting walking in or out. A maximum gradient of 1:4 (1 vertical to 4 horizontal) will be required on at least one side to permit safe egress in an emergency. Where steep or vertical sides are unavoidable, due consideration should be given to safety aspects such as the need for fencing, both when the storage is full and empty.

12.2.8 Standardised Products
1. Where practical, use may be made of precast or prefabricated items to reduce the cost.

12.3 Alternative Systems
1. Where environmental conditions allow, innovative designs or alternative methods of reducing runoff from development sites are encouraged. Innovative designs should consider how OSD systems can be incorporated into the existing topography and enhance the existing floodplain environment. Natural systems can be replicated and used to provide additional storage over a site, promoting infiltration where possible. Where development is occurring near watercourses, riparian vegetation should be retained and enhanced.

2. Alternative methods of controlling peak discharges from a site include:

(a) On-site retention
On-site retention achieves the same objective as OSD by abstracting part of the flood hydrograph and storing the retained water on-site. Forms of on-site retention include:

(i) rainwater tanks,
(ii) guttering systems,
(iii) underground permeable storage; and
(iv) aquifer access, including weathered rock.

(b) Stormwater reuse
Designs that incorporate a component where stormwater is capable of reuse, for purposes such as cleaning or irrigation are encouraged.

(c) Semi-permeable/Porous Materials
Where soil types are suitable, using porous materials for driveways, footpaths and other typically paved areas is encouraged as a means of preserving pervious areas.

3. Proposed use of alternative systems shall be accompanied by a detailed analysis of how the required control of discharge at all points within the catchment will be achieved.

4. Trading of discharge control permits or payment in lieu of the provision of OSD will not be considered.

12.4 Implementation of OSD requirements
12.4.1 Development Approvals for Subdivisions
1. In general, the OSD requirements are imposed at the subdivision stage as shown below:
2. Development Application – submission and approval of a concept layout of the OSD system. (Stormwater Concept Plan)

3. Submission of Engineering Plans – submission and approval of the detailed design including calculations and construction plans and details.

4. Release of Subdivision Certificate/Linen Plans – submission and approval of work-as-executed drawings, certificates of hydraulic compliance and legal instruments on property titles protecting the OSD system.

12.4.2 Development Approvals and Construction Certificates

1. When the OSD requirements are implemented through the development approval and construction certificate process, the approval is in three stages as follows:

   (a) Development Application – submission and approval of a concept layout of the OSD system (Stormwater Concept Plan)

   (b) Construction Certificate – submission and approval of the detailed design including calculations and construction plans and details

   (c) Final Approval – submission and approval of work-as-executed drawings, certificates of hydraulic (and structural if required) compliance and legal instruments protecting the OSD system

Refer to Figure 2 which summarises the steps involved in the process.
<table>
<thead>
<tr>
<th>Step</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposal</td>
<td>Determine if OSD is required</td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td></td>
</tr>
<tr>
<td>Preliminary Lot Layout</td>
<td>Have a contour survey prepared</td>
</tr>
<tr>
<td></td>
<td>Involve the OSD designer in site/lot layout</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
<tr>
<td>Prepare Stormwater Concept Plan (SCP)</td>
<td>OSD designer prepares SCP</td>
</tr>
<tr>
<td></td>
<td>SCP submitted with development application</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
<tr>
<td>Development Approval</td>
<td>Council approves development/subdivision with OSD conditions</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
<tr>
<td>Detailed Design</td>
<td>OSD designer addresses consent conditions and prepares maintenance schedule.</td>
</tr>
<tr>
<td></td>
<td>Calculations, maintenance schedule, plans &amp; details submitted with application for Construction Certificate. Plans forwarded to council or private certifier.</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
<tr>
<td>Construction Certificate/Engineering Plan Approval</td>
<td>Council or private certifier issues approval</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
<tr>
<td>Construction</td>
<td>OSD designer supervises construction</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
<tr>
<td>Finalisation</td>
<td>Work-as-executed drawings prepared. Positive Covenant prepared &amp; attached to Linen Plan/Subdivision Certificate. OSD designer certifies hydraulic performance of construction</td>
</tr>
<tr>
<td></td>
<td><strong>End of Yes Path</strong></td>
</tr>
</tbody>
</table>

Figure 2: OSD Approval Process
12.5 Development Approval Process

1. OSD is best considered as early as possible in the development process so that the most efficient and effective system can be designed and installed. There are a number of issues to be addressed at the conceptual stage that will have a significant impact on the final solution:

(a) In multi lot subdivisions, a common OSD system should be constructed on one lot rather than a separate system on each individual lot;

(b) Every attempt should be made to maximise surface storage and minimise the amount of underground storages. Surface storage reduces the cost of the system and improves accessibility for maintenance

(c) Overland flows from adjacent properties should, wherever possible, be diverted past the OSD storage

(d) The site should be shaped to ensure all of the site’s impervious areas drain to the OSD basin

(e) In multi lot subdivisions, the OSD basin is to be constructed at the time of subdivision and not be deferred until buildings are constructed.

12.5.1 Stormwater Concept Plan

1. The objectives of the Stormwater Concept Plan (SCP) are to:

(a) Emphasise that the OSD and drainage requirements need to be considered in the initial planning stages of the development;

(b) Simplify the detailed design by identifying adequate storage areas, surface flow paths and treatments, easements (if required) and site constraints in the planning stage;

(c) Reduce project costs by maximising the use of proposed landscape and architectural features as part of the OSD system;

(d) Allow the cost of development consent conditions relating to OSD to be determined at the planning stage; and

(e) In the case of larger developments, assist in addressing the concerns of the local community regarding drainage and flooding issues.

12.5.2 Detailed Design

1. The objectives of a detailed OSD design are to:

(a) Ensure that all components of the OSD system are functional;

(b) Simplify construction of OSD systems by providing detailed design plans;

(c) Increase owner awareness and improve maintenance standards by simply outlining the necessary maintenance practices; and

(d) Encourage storages to be accessible and maintainable.

12.5.3 Minimum data requirements

1. The following information must be included in a detailed design submission:

(a) Calculations for each storage, finalising the storage volumes and discharge rates;
(b) Calculations verifying that flowpaths/floodways and internal drainage systems have sufficient capacity (if necessary);

(c) Design plans and details which include the:
   (i) Location and extent of each storage;
   (ii) Locations and details of each discharge control device;
   (iii) Catchment area draining to each storage;
   (iv) Maximum water surface levels in each storage;
   (v) Overflow structures and surcharge paths;
   (vi) Levels and location of the discharge points for each storage;
   (vii) Internal drainage system;
   (viii) Existing contours and final design levels;
   (ix) Final site/lot layout; and
   (x) Location and extent of any floodway/flowpath.

(d) Cross-sections through the storages.

(e) A maintenance schedule that sets out, in plain English:
   (i) What maintenance is required;
   (ii) How the maintenance will be done;
   (iii) Who should carry out the maintenance; and
   (iv) When the maintenance will be done.

(f) Structural certification for components of the OSD system (if necessary).

(g) Completed Detailed Design checklist (refer Appendix 2).

2. Consideration needs to be given to how occupiers will be affected by the design and any construction variations thereby reducing/preventing alterations later (e.g. disabled access).

### 12.5.4 Free Discharge from an Outlet Pit

1. The orifice discharge equation is:
   \[ Q = CA (2gh)^{0.5} \]
   Where:
   - \( Q \) is the discharge in \( \text{m}^3/\text{sec} \)
   - \( C \) is the coefficient of discharge
   - \( A \) is the orifice area in \( \text{m}^2 \)
   - \( g \) is the acceleration due to gravity
   - \( h \) is the depth of water above the centre of the orifice in metres

2. This equation relies on:
   (a) A circular sharp edged orifice; and
(b) Free discharge from the orifice.

3. Free discharge is not achieved when the outlet from the pit is affected by tailwater levels in the downstream drainage system. In this instance, full hydraulic calculations will be required to ensure early surcharge of the system does not occur.

12.5.5 Storages

1. Where possible, storages should be achieved through surface storage, as underground storages:
   (a) Are more difficult to inspect for silt and debris accumulation;
   (b) Are more difficult to maintain; and
   (c) Can be dangerous to work in and may be unsafe for property owners to maintain.

Surface storages

2. For surface storages, the following minimum requirements are set, however designers are encouraged to apply innovative techniques to utilise the topography of the site and other methods of achieving design requirements.

3. In the interests of safety and amenity, ponded water depths are not to exceed:

<table>
<thead>
<tr>
<th></th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking/Paved Areas</td>
<td>0.2 m</td>
</tr>
<tr>
<td>Landscaping</td>
<td>0.6 m</td>
</tr>
<tr>
<td>Covered/Fenced Storage</td>
<td>No Limit</td>
</tr>
<tr>
<td>Roof Area</td>
<td>As required by structural integrity</td>
</tr>
</tbody>
</table>

4. In the event that these limits are exceeded, it shall be demonstrated that due consideration has been given to the method of addressing the increased hazard.

5. The minimum surface slope for the base is 1.5%. Sub-soil drainage shall be provided around the outlet to prevent the ground becoming saturated.

Underground storages

6. The following design considerations must be taken into account for underground storages:
   (a) Access openings to all underground storage tanks must be secured with a grate or cover, and fastened such that children are not able to remove them. However, as residents/owners must be able to inspect critical parts of the storage, heavy concrete covers should be avoided.
   (b) Openings must be wide enough to allow easy entry to a storage, i.e.:
       600 x 600 (storages up to 600 mm deep)
       900 x 900 (storages greater than 600 mm deep)
   (c) A continuous fall on the floor of the storage of at least 1% must be provided to the storage outlet to minimise ponding in the storage.
(d) The minimum clearance height for accessible tanks is 900 mm. Where this cannot be achieved due to level or other constraints, the following internal heights can be considered:

- Commercial/Industrial developments: 750 mm
- Residential developments: 500 mm.

provided that:

(i) All grates accessing the tank are a minimum of 900 mm x 900 mm, and a maximum lifting weight of 20 kg; and
(ii) Grates are placed at the extremities of the tank with a maximum distance of 3 m from any point in the tank to the edge of the nearest grate.

(e) To minimise the risk of silt and debris blocking the storage outlet or flap valve, the floor of the discharge outlet pit should be a minimum of 150 mm below the outlet and a localised sump provided at the outlet. If a dual (or multiple) chamber system is used, return pipes must also address the avoidance of silt and debris blockage.

(f) The build-up of noxious odour in storages without a grated access can create problems. If the storage is sealed, vents should be provided.

(iii) **Overflow**

7. Provision needs to be made in the design of a storage for overflows from storms more severe than the design storm or for blockages in the system. Overflows should be directed to a flowpath through the development so that buildings are not inundated nor are flows concentrated on an adjoining property.

12.5.6 **Orifice plates**

1. Orifice plates are to be manufactured in corrosion-resistant plate to a minimum thickness of 3 mm (5 mm thick where the orifice exceeds 150 mm) with a clean-cut circular hole.

12.5.7 **Debris control**

1. To reduce the likelihood of the outlet being blocked by debris, the outlet opening shall have a minimum internal diameter or width of at least 50 mm and shall be protected by a mesh screen, generally in accordance with *Appendix 3*. Discharge outlet pits must be fitted with an internal screen. The screen needs to:

(a) Protect the orifice from blockage;
(b) Create static conditions around the orifice which helps to achieve predictable discharge coefficients; and
(c) Retain litter and debris that would degrade downstream water quality.

12.5.8 **Identification System**

1. An Identification System is required for all OSD systems, usually in the form of a corrosion resistant plaque. The plaque shall be on or close to the OSD system and is to indicate:

(a) The structure is an OSD facility, part of the stormwater drainage network;
(b) Its Identification Number, provided as part of the Development Approval process;
12.5.9 Maintenance

1. Maintenance must be considered as part of the design process and proof of this will be required. A maintenance schedule is required to be submitted which sets out the routine maintenance necessary to retain the OSD system’s viability. The resident/owner of the property shall receive a copy of this schedule on approval of the development and it will form an integral part of the Positive Covenants and Restrictions on Use of Land (see Section 9.5.13). The schedule should be signed to indicate that it has been received and understood. A copy of the signed schedule shall also be submitted to Council.

2. This schedule should contain information on the following issues:

(a) Where the storages are located;

(b) Which parts of the system need to be accessed for cleaning and how access is obtained;

(c) A description of any equipment needed (such as keys and lifting devices) and where they can be obtained;

(d) The location of grates/cover and how they can be removed for cleaning;

(e) Who should do the maintenance; and

(f) How often should it be done?

3. An example of such a schedule is attached to this policy (Appendix 4).

4. OSD systems should be designed such that specialist personnel (e.g., confined spaces certified) are not required to perform ongoing maintenance.

12.5.10 Construction and Final Approval

1. The objectives of the construction supervision and certification arrangements are to:

(a) Encourage supervision of critical stages of construction by the OSD designer to improve construction standards;

(b) Minimise delays and additional expenditure on rectification works by ensuring adequate construction supervision;

(c) Increase community acceptance of OSD by eliminating nuisances created by poor construction; and

(d) Enable Council to inspect and insist on essential maintenance of the system.

12.5.11 Supervision

1. Construction supervision is essential in achieving a properly working OSD system. OSD construction is often multi-disciplined with many tradesmen (such as bricklayers, landscapers and concrete finishers) who may be unfamiliar with stormwater drainage, being responsible for constructing critical features of the system. OSD systems require closer attention to set-out and levels than a conventional drainage system. Without adequate supervision during construction,
expensive and time consuming rectification works are often necessary before a Certificate of Hydraulic Compliance (see Appendix 5) can be issued by the OSD designer.

12.5.12 Work-as-Executed plans

1. Work-as-Executed (WAE) plans prepared by a Registered Surveyor or the OSD designer must be submitted. A general set of guidelines for preparation of WAE plans is provided below. However, in some projects there will be site-specific features that will require additional details. The OSD designer should therefore be consulted before preparing these plans. As the OSD designer is responsible for the Hydraulic Compliance Certificate, it is important that the WAE plans provide the designer with sufficient information to ascertain that the as-constructed system will function in accordance with the approved design. Note that any changes to the top water level in the storage or depth of storage may alter the required orifice diameter. Calculations should be submitted to show that the orifice diameter is correct if the approved design water level has been changed.

(i) Storage

2. The following details of the OSD storage should be provided:

(a) Type of storage - roof, above ground, below ground or combination;
(b) Detailed calculations of the actual volume achieved for each storage;
(c) The diameter of the orifice plate and verification that it has been fitted correctly;
(d) Verification that a screen has been fitted, as well as its location, dimensions and the minimum distance from the orifice;
(e) Level and location of any overflow structures (eg. spillways, weirs);
(f) Sufficient levels and dimensions to verify storage volumes – as a minimum, WAE plans should give the constructed level of all design levels shown on approved plans;
(g) Any changes to storage depth or top water level and whether the orifice size is affected; and
(h) Internal diameter of the outlet pipe.

(ii) Internal drainage

3. The following information on the internal drainage system is to be included:

(i) Pit surface levels;
(j) Invert levels and diameters of pipes;
(k) Location and levels of any floodways and/or overland flowpaths; and
(l) Sufficient spot levels to show site gradings and extent of areas not draining to the storage(s).

(iii) Freeboards

4. The finished floor levels of adjacent structures on the property such as garages and dwellings are to be shown to ensure they are sufficiently above the maximum storage water surface levels and water levels on overland flowpaths. Refer to Section 1.4.1 for required freeboard.
(iv) **Certificates of Hydraulic Compliance**

5. Certificates of Hydraulic Compliance are required to confirm that the drainage and On-site Stormwater Detention (OSD) works have been carried out in accordance with the approved design.

6. To avoid delays in obtaining certification, developers and builders are encouraged to have the OSD designer supervise and certify the construction of these systems. This certification is for the Certificates of Hydraulic Compliance only, not the Certification of the Development required under Section 109 of the Environmental Planning and Assessment Act. Defects are expensive to repair once the development is completed.

7. Certificates of Hydraulic Compliance are to be attached to the Work-As-Executed plans and submitted to Council prior to the release of Subdivision Certificate linen plans, certificates of occupation and/or Occupation Certificate. A separate structural certification will be required for any structural elements. The Certificate of Hydraulic Compliance needs to:

   (a) State that the system will function in accordance with the approved designs, subject to satisfactory maintenance;

   (b) Identify any variations from the approved design; and

   (c) State that these variations will not impair the performance of the OSD system.

8. Alternatively, where variations are identified that impair the performance of the OSD system, the OSD designer will need to complete an Outstanding Works Form. This form shall list the variations from the approved design and the required remedial works. Where significant remedial works are necessary, discussions should be held with the relevant Council officers and arrangements made to have these works carried out prior to the issue of a Certificate of Hydraulic Compliance by the OSD designer or final approval by Council.

9. The Certificate of Hydraulic Compliance is the principal means by which adequate construction standards are ensured and certification needs to be conducted in a professional manner. Whilst the Certificate will be based on the WAE plans, the OSD designer will need to inspect the site to check critical design features.

10. Some of the important considerations to be addressed when certifying hydraulic compliance are:

   (a) **Storage:**

      (i) Actual storage volumes achieved are adequate;

      (ii) A plate with a sharp-edged orifice of the correct diameter and the specified material has been securely fitted;

      (iii) The orifice is screened and the screen is properly fixed, located and able to be removed for cleaning;

      (iv) Outlet pipes from the discharge outlet pit are the correct size, level and grade to ensure there is free discharge through the orifice;

      (v) The levels of the top water surface and storage invert are such that the design discharge from the storage is achieved;

      (vi) The actual top water surface level of the storage will not cause either unintended surcharge of the internal drainage system or inundation of/or inadequate freeboards to finished floor levels; nor will it alter the storage depth sufficiently to impact on the required orifice size;

      (vii) The base of the storage is well graded and drains to the discharge outlet pit; and
(viii) Spillways and overflow paths are the correct level and free from obstructions.

(b) Internal drainage:

(i) Site gradings are correct;

(ii) The internal drainage lines are of a sufficient size, level and grade to convey flows to the storage;

(iii) If a blockage occurs or the internal drainage lines cannot convey all runoff in a 100 year rainfall event, the site is graded to direct surcharging flows to the storages;

(iv) Storages cannot be by-passed by overflows from the internal drainage system or by overflows from any surface area designed to drain to the storages;

(v) Flowpaths designed to divert upstream flows around the basin have been properly constructed and will function as designed; and

(vi) General workmanship is adequate to prevent long-term failure of the system.

(c) Freeboards

(i) The levels of structures (such as garages, factories, offices and dwellings) are sufficiently above the as-constructed maximum water surface levels in the storage and flowpaths; and

(ii) An emergency spillway or overflow path is provided to ensure that surcharge of the drainage system and storage (even in the event of an extreme storm or accidental blockage of pits, pipes etc.) will not cause stormwater to enter buildings where significant damage would occur.

11. Sample Standard Certificate of Hydraulic Compliance Forms and Outstanding Works forms are attached in Appendix 5.

(v) Structural certification

12. Due to hydrostatic loadings, certain OSD storage components may require specific structural certification for design and construction. The following list is typical but not exhaustive. This certification should be provided by a qualified, practising structural engineer, except where the components match the standard designs.

(a) Free standing walls

(i) These are subject to hydrostatic loads when a storage is full or filling. The significance will depend on the maximum ponding depth.

(b) Retaining walls

(i) In addition to the normal earth and hydrostatic loadings, it may be necessary to consider the possibility of saturated sub-soil conditions.

(c) Underground storages

(i) These may be subject to a combination of earth pressures, hydrostatic loadings, traffic loadings and buoyancy forces.

12.5.13 Legal Protection of OSD Systems

1. OSD systems are structures intended to control site discharges over the entire life of the development. To guarantee the system's continued operation, it needs to be protected from alteration and regularly maintained.

2. Prior to the issue of final approval, the OSD system and associated floodways and flowpaths need to be legally protected. This is achieved by applying a restriction on the use of the land and
a positive covenant over the lot in favour of the local council. These can be imposed either by submitting a suitable Request Form to the Land Titles Office or in conjunction with the registration of a plan showing the new lots to be created. An explanation of the process involved, sample instruments, standard terms and conditions, a copy of the Land Titles Office Information Bulletin 14 and sample forms 13PC and 13RPA, are included in Appendix 6, and as listed below.

- **F.1** Explanatory notes on the preparation and registration of Positive Covenants and Restrictions on Use of Land.
- **F.2** Forms for use under Section 88E(3) of the Conveyancing Act where there is no subdivision of land involved and the covenant and restriction on use are being imposed on an existing parcel of land.
- **F.3** Terms and conditions for Restriction on Use of Land and Positive Covenant.
- **F.4** Sample Restriction on Use of Land and Covenant where a deposited plan is being registered together with a Section 88B instrument.
- **A Guide to the Preparation of a Section 88B Instrument to:**
  - Create Easements, Profits à Prendre, Restrictions on the Use of Land or Positive Covenants, Release Easements or Profits à Prendre
  - **F.6** Sample Covenant used where a deposited plan is being registered together with a Section 88B instrument and construction of the OSD system is being deferred.

Note: Council will only permit deferral of the construction of the OSD systems in exceptional circumstances.

### 12.6 Record System

1. A database of all OSD systems is to be maintained by Wollongong City Council. This database will include information on:
   
   (a) Site location
   
   (b) Catchment
   
   (c) Type of development
   
   (d) Design details (area, PSD, SSR, storages);
   
   (e) Location of WAE drawings; and
   
   (f) Details and location of maintenance schedules;
   
   (g) Identification Number

2. This database will be accessible by relevant officers to ensure that any changes to a property approved at a later date are considered with reference to the OSD system.
12.7 Inspections

1. A program of random audits of infrastructure will be implemented by Wollongong City Council. This will involve:
   (a) Notification of the owners of an inspection due to take place;
   (b) An inspection of the system, comparing the structure with the WAE drawings and completing a checklist of maintenance items; and
   (c) Issuing owners with a record of the inspection noting what items need to be followed up, and specifying the timeframe in which this needs to be done.

13 INFORMATION REQUIREMENTS (TO BE SUBMITTED BY APPLICANT)

13.1 Development Application Stage (Where Construction Certificate is required)

1. The following information will be required:
   (a) A site stormwater layout (1:100 scale). This plan must also show how the proposed stormwater system is integrated with the proposed landscape plan for the site. For larger sites, an overall site stormwater layout shall be provided at a scale of 1:200 in addition to the above requirement.
   (b) The extent and area (in plan) of any upstream catchment for external flows entering the site.
   (c) Hydrologic and hydraulic calculations, including calculations of velocities and flows leaving the site both prior and after development.
   (d) Information relating to proposed overflow paths must include contours of the land within which the overflow path will be located, the capacity of the overflow path, details of any bed reinforcement such as grass.
   (e) Except for minor developments (refer to Glossary), longitudinal section of pipelines showing calculated flows, velocity, size and class of pipe, grade, invert levels, services and ground levels.
   (f) Where connection is to be made to an existing underground stormwater system, a hydraulic grade line analysis must be carried out and the pressure line plotted on the longitudinal section.
   (g) Details, dimensions and location of pits, grates, on-site detention storage, weirs, orifice plates, outlet structures and scour protection.
   (h) The location and extent of any floodways, flowpaths or stormwater concentrations affecting the site.
   (i) Flood study if applicable.
   (j) Proposed point/s of discharge.
   (k) Fencing location and type.
   (l) Written agreement from downstream property owners to provide an easement to drain water if applicable.
(m) Survey of the development site and surrounding areas, to provide sufficient information in order to assess the Application, which includes lot boundaries, contours/spot levels, buildings, easements, services, landscaped areas, site area, roadways etc.

(n) Plan (1:100 scale) showing proposed and existing floor, ground and pavement levels to AHD.

Note: Sufficient contours and spot levels must be shown on the plan to enable its proper construction. It is insufficient to show arrows to indicate a fall in the pavement. All levels to be related to Australian Height Datum (AHD).

2. Where on-site detention is proposed, the following additional information will be required:

(a) The location and extent of the detention storage.

(b) The location and levels of discharge points for the storage.

(c) Preliminary estimates on the SSR and PSD values.

(d) The location and area of any portion of the site unable to drain to the storage.

(e) The final disposal point, where the runoff from the site is unable to drain to the storage, together with justification that this runoff will not cause any adverse effects to the development site or neighbouring properties.

13.2 Construction Certificate Stage

1. The following information will be required:

(a) If applicable, evidence to show that the creation of an easement to drain water over downstream properties has occurred.

(b) Where applicable, evidence that all Development Application conditions have been incorporated into the plans.

(c) Sufficient set-out information to allow the development to be constructed in accordance with the Development Consent and the intent of the Development Application plans.

(d) Location of all services in the vicinity of the proposed development.

2. Where on-site detention is proposed, refer to sections 12.5.3 and 12.5.8 for the additional information required:

13.3 Prior to Final Occupation Stage

1. Where a work-as-executed (WAE) plan and engineer's certification is required as a condition of development consent, it must include at least the following. The sections in italics are to be included on the certification:

(a) A statement certifying that "all stormwater drainage and related work has been constructed in accordance with the approved plans". A statement that the work is in accordance with the intent, character, principle or key aspects of the plan for example, will not be accepted.

(b) A statement certifying that the work-as-executed survey plan has been prepared by a registered surveyor. Further, the surveyors’ name and organisation are to be clearly shown on the plan.
(c) A statement certifying that "the stormwater infrastructure has been constructed in accordance with the development consent. A statement that the work is in accordance with the intent, character, principle or key aspects of this chapter for example, will not be accepted.

2. Where on-site detention was required as part of the development approval, refer to sections 12.5.12 and 12.5.13 with respect to the provision of a work-as-executed plan, hydraulic compliance certificate, restriction on use and positive covenant.

Note: Under normal circumstances, Council will require demolition of any structure which has not been constructed in accordance with the approved plans and which is considered likely to exacerbate or cause problems related to stormwater drainage. Any variations from the approved plans will need to be documented and will need to be certified by the Certifying Authority as not affecting the performance of the designed system.

13.4 At Development Application Stage (Where No Construction Certificate Is Required)

1. The following information will be required:

(a) Information indicated in Sections 13.1(a) & (b) as applicable.

(b) Where a flood study is required as part of a Development Application, the consultant shall provide as a minimum the following information:

(i) Catchment plan 1:4000.

(ii) Hydrologic and hydraulic calculations.

(iii) A section detailing investigations carried out to determine the potential for upstream diversions affecting the site and reporting the findings.

(iv) A section detailing recorded flood levels used or information from local residents used in calibrating the model.

(v) Survey of the site showing all necessary features, along with creek cross-sections drawn to a suitable scale and which adequately reflect the existing characteristics of the channel and floodplain. Cross-sections are to be taken perpendicular to the flow for the particular flood event being considered. Where roadways and/or driveways are used as weirs, detailed survey must be provided. Water surface profiles for both pre and post development conditions drawn to a suitable scale.

(vi) Extent of inundation for both pre and post development conditions.

(vii) Floor levels of proposed and existing buildings on the development site and other affected properties.

(vii) Velocity and depth product contours.

(ix) Delineation of flood risk precincts relevant to individual floodplains.

(x) Channel and overbank velocities for both pre and post development conditions.

(xi) An assessment of the need for scour and/or erosion protection along bed, banks or discharge points.
13.5 **Standard of Engineering Submission**

1. Both Development and Construction Certificate Applications must be prepared in accordance with the Australian Technical Drawing Standard AS1100.

2. Flood studies must be clearly and concisely presented.

3. Calculations to be clearly presented in a logical sequenced manner. Calculations will not be accepted on disc without hard copy attached.

13.6 **Computer Programs**

1. Prior to the use of in-house developed computer programs for hydrologic/hydraulic analysis, the consulting engineer must supply to Council a flowchart showing the steps and formulae involved in the execution of the program. The limits of applicability must also be defined.

2. Computer output from programs developed in-house without having been previously approved by Council will not be accepted.

14 **APPLICATION OF THIS CHAPTER**

1. Responsibility for technical interpretation of this chapter and investigations/designs produced in accordance with this chapter rests with the Manager Infrastructure. If the Manager Infrastructure does not consider that the requirements have been satisfied, for investigations of a complex nature, the Manager Infrastructure will facilitate peer review of the studies submitted, by a specialist technical panel comprising of representative(s) from one or more of the following bodies:

   (a) Wollongong City Council (Relevant Internal Divisions);

   (b) NSW Department Environment and Climate Change;

   (c) Institution of Engineers, Australia Illawarra/Sutherland Regional Group; and

   (d) University of Wollongong Engineering Department.
15 REFERENCES


Drainage Design Code (1994) Wollongong City Council


AS/NZS 3500.3:2003 : Plumbing and Drainage – Stormwater Drainage


DCP 54 – Managing Our Flood Risks - Wollongong City Council.
Appendix: 1 OSD DESIGN

CONTAINING:

ii. Appendix A1. Concessional OSD Zones
iii. Appendix A2. Wollongong Rainfall Isohyets
iv. Appendix A3. F1 –v- %imp
v. Appendix A4. F2 –v- Area
vi. Appendix A5. F3 –v- %imp
viii. Appendix A7. OSD Basin Sizing Examples
APPENDIX A1: Concessional OSD Zones

OSD Concession Zones
Tile 1 of 5

Unanderra
Dapto
Oak Flats

LAKE ILLAWARRA

OSS Concession Zone
Wetland
Catchment Boundary
National Park
APPENDIX A2: Wollongong Rainfall Isohyets
APPENDIX A3: F1 –v- %Imp

Appendix A3 - Factor F1 vs Existing % IMP
1Ha Tributary Area To Basin - Wollongong LGA

\[ y = -1.56 \times 10^{-5} x^2 + 0.0043 x + 0.9890 \]

\[ y = -1.54 \times 10^{-5} x^2 + 0.0033 x + 0.9938 \]
APPENDIX A4 F2 –v- Area

Appendix A4 - Factor F2 vs Tributary Area
O.1 to 2Ha Tributary Area To Basin- Wollongong LGA

\[ y = 0.0388x^2 - 0.1696x + 1.1308 \]
APPENDIX A5: F3 –v- %Imp

Appendix A5 - Factor F3 vs Post Development %IMP
1ha Tributary Area To Basin - Wollongong LGA

\[ y = -1.3E-05x^2 + 0.0032x \]
APPENDIX A6: F4 –v- Area

Appendix A6 - Factor F4 vs Tributary Area
0.1 to 2 Ha Tributary Area To Basin - Wollongong LGA

\[ y = x^{0.2506} \]
APPENDIX A7: Examples

EXAMPLE 1 - NEW DWELLING ON UNDEVELOPED SITE
(TRIBUTARY AREA WITHIN SITE)

<table>
<thead>
<tr>
<th>PLAN DATA</th>
<th>GRAPHS</th>
<th>OSD REQD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE AREA (m²)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>TRIBUTARY AREA (m²)</td>
<td>414</td>
<td></td>
</tr>
<tr>
<td>EX. IMPERVIOUS AREA (m²)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>DEV. IMPERVIOUS AREA (m²)</td>
<td>316</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: EXISTING CONDITION OF THE TRIBUTARY AREA IS ‘NATURAL’ (F1 = 1)

(REDUCED TO 100mm/HR)

17

STREET DRAINAGE

1.5

4

7

1.5

PiT

KERB

FRONT BOUNDARY

PERVIOUS AREA

IMPERVIOUS AREA

BOUNDARY OF TRIBUTARY AREA

POOLS

CLOTHES HOIST

LAWN AND GARDEN

HOUSe

DRIVE-WAY

PATIO

PAVING

CHANGE ROOMS

LAWN

REAR BOUNDARY

APPENDIX A7

Wollongong Development Control Plan 2009
### Example 2 - New Units on Undeveloped Site (Tributary Area Beyond Site)

#### Plan Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Area (m²)</td>
<td>823</td>
</tr>
<tr>
<td>Tributary Area (m²)</td>
<td>1901</td>
</tr>
<tr>
<td>Ex. Impervious Area (m²)</td>
<td>0</td>
</tr>
<tr>
<td>Dev. Impervious Area (m²)</td>
<td>518</td>
</tr>
</tbody>
</table>

**Note:** Existing condition of the tributary area is 'natural' (P = 1)

#### Graphs

<table>
<thead>
<tr>
<th>Graph</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>1.00</td>
</tr>
<tr>
<td>G2</td>
<td>1.00</td>
</tr>
<tr>
<td>G4</td>
<td>1.00</td>
</tr>
<tr>
<td>G5</td>
<td>0.08</td>
</tr>
<tr>
<td>G6</td>
<td>0.66</td>
</tr>
</tbody>
</table>

#### OSD Req'd

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>G100</td>
<td>55.8</td>
</tr>
<tr>
<td>G100</td>
<td>97.7</td>
</tr>
<tr>
<td>SSR₁₀₀ (m³)</td>
<td>6.03</td>
</tr>
<tr>
<td>SSR₁₅₀ (m³)</td>
<td>10.55</td>
</tr>
</tbody>
</table>

**Note:** See Appendix A.2 for calculations.
EXAMPLE 3 (fig 1) - NEW UNITS ON PREVIOUSLY DEVELOPED SITE (TRIBUTARY AREA WITHIN SITE) (STEP 1)

**PLAN DATA**

<table>
<thead>
<tr>
<th>Site Area (m$^2$)</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tributary Area (m$^2$)</td>
<td>372</td>
</tr>
<tr>
<td>Ex. Impervious Area (m$^2$)</td>
<td>118</td>
</tr>
<tr>
<td>Dev. Impervious Area (m$^2$)</td>
<td>300</td>
</tr>
</tbody>
</table>

1. Refer Fig 1 for proposed development tributary area plan

**GRAPHS**

<table>
<thead>
<tr>
<th>Graph</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1.12</td>
</tr>
<tr>
<td>A2</td>
<td>1.09</td>
</tr>
<tr>
<td>A3</td>
<td>1.12</td>
</tr>
<tr>
<td>A4</td>
<td>0.17</td>
</tr>
<tr>
<td>A5</td>
<td>0.44</td>
</tr>
<tr>
<td>A6</td>
<td></td>
</tr>
</tbody>
</table>

**FINAL OSD REQU**

<table>
<thead>
<tr>
<th>Graph</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** SSR$^*$ Required is equal to SSR for proposed development less SSR for existing development calculated in Fig 2.
EXAMPLE 4 - 17 LOT GREENFIELD SUBDIVISION (STAGE 3)  
(Tributary area beyond site)

**PLAN DATA**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Area</td>
<td>13,290</td>
</tr>
<tr>
<td>Tributary Area</td>
<td>19,967</td>
</tr>
<tr>
<td>Ex. Impervious Area</td>
<td>0</td>
</tr>
<tr>
<td>Dev. Impervious Roads Area</td>
<td>2,490</td>
</tr>
<tr>
<td>(25290 x 95%)</td>
<td></td>
</tr>
<tr>
<td>Dev. Impervious Lots Area</td>
<td>6,402</td>
</tr>
<tr>
<td>(10,649 x 69%)</td>
<td></td>
</tr>
<tr>
<td>Dev. Total Impervious Area</td>
<td>8,892</td>
</tr>
</tbody>
</table>

**GRAPHS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value (mm/hr)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAINFALL</td>
<td>100</td>
<td>Appendix A3</td>
</tr>
</tbody>
</table>

**OSD REQD**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value (mm)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dev. Rainfall 100 mm/hr</td>
<td>10,000</td>
<td>14.4.1.1</td>
</tr>
<tr>
<td>Dev. Rainfall 50 mm/hr</td>
<td>500</td>
<td>14.4.2.1</td>
</tr>
<tr>
<td>Dev. Rainfall 80 mm/hr</td>
<td>800</td>
<td>14.4.3.1</td>
</tr>
<tr>
<td>Dev. Rainfall 90 mm/hr</td>
<td>950</td>
<td>14.4.4.1</td>
</tr>
<tr>
<td>Dev. Rainfall 100 mm/hr</td>
<td>110</td>
<td>14.4.4.2</td>
</tr>
<tr>
<td>Dev. Rainfall 125 mm/hr</td>
<td>110</td>
<td>14.4.4.3</td>
</tr>
<tr>
<td>Dev. Rainfall 150 mm/hr</td>
<td>150</td>
<td>14.4.4.5</td>
</tr>
</tbody>
</table>

**NOTE:**

1. Catch drains, swale drains and road designed to intercept, contain and convey 100 yr ARI discharge to basin.
2. Road and basin geometries designed to provide isolation between basin inflows & outflows in a 100 yr ARI event.
### DETAILED DESIGN CHECKLIST

#### OSD DETAILED DESIGN CHECKLIST

NOTE This checklist is specific to the OSD requirements of a proposed development

It should be read in conjunction with Council’s current Drainage Design Code

and included with the detail drainage design submission documents

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESIGNER</th>
<th>COUNCIL REVIEW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A Stormwater Concept Plan (SCP) has been approved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The site is within the OSD ‘Concession’ zone and flows can be conveyed to a ‘registered’ watercourse without adversely impacting others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If YES - refer supporting calculations (OSD not required)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If NO - OSD is required – (remainder of list to be completed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The site is (whole or partly) inundated in a 5 year ARI event</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If YES - see Plan No ............... for 5Yr flood extents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. The tributary area to the basin is shown on Plan No ...............</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The tributary area to the basin is currently in a natural condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If NO – see Plan No ............... For details of existing development</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Surface floodways/flowpaths of sufficient capacity to contain and convey the 100Yr discharge to the basin are shown on Plan No ...............</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Buildings are not inundated and have the required freeboard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Flows are not increased or concentrated on an adjoining property</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Ground levels/contours extending into adjoining properties sufficiently to quantify bypass flow hydraulics are shown on Plan No. ...............</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. The invert level of the storage is not less than ground level (or top of kerb) at the point of connection to external stormwater system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If YES, see Plan No. ...............</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If NO, refer attached hydraulic analysis confirming potential impact of downstream control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. The discharge outlet pit design is consistent with the policy principles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. The discharge outlet pit design is consistent with the policy. If YES, see Plan No .......... for details of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orifice plate geometry, matl and fixing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>screen type, matl fixing, area and orientation,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>confirmation that all inflows to the discharge control pit are on the upstream side of the screen protecting the orifice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If NO refer separate explanatory attachment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. If an above ground/landscaped storage is specified, answer Q13(a) to Q13(g), otherwise move to Q14.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13(a) Where the depth of ponding exceeds 600 mm, consideration has been given to whether there are steep drops, and/or a need for steps or ‘walk-in’ ‘walk-out’ batters, etc. when deciding if fencing and/or warning signs are required.

13(b) The landscaping treatment within the storage area is such that it does not limit storage volumes or provide a significant source of debris loading.

13(c) The minimum surface slope is consistent with the policy.

13(d) Subsoil drainage is provided in areas subject to frequent ponding and around the outlet.

13(e) If the design includes a retaining wall, has it been structurally checked?

13(f) Does the system have the correct storage?
   If YES, see stage-storage calculations attached
   If NO, refer separate explanatory attachment.

14. If a driveway/car-park storage is specified, answer Q14(a) to Q14(b), otherwise move to Q15.

   14(a) The maximum depth is less than or equal to 200mm
   14(b) The minimum transverse slope is 1.5%

15. If a structural/underground storage is specified, answer Q 15(a) to Q 15(f), otherwise move to Q16.

   15(a) The dimensions of openings are consistent with the policy
   15(b) The storage floor has a minimum slope of 0.7%
   15(c) There are sufficient access points for flushing purposes
   15(d) There are sufficient grated openings for ventilation purposes
   15(e) All access points have light weight covers

16. The distribution of storage minimises inconvenience.

17. The OSD plans have been checked for consistency against the architectural and landscaping plans.

18 The OSD Design Summary details are consistent with the engineering plans.

19. The OSD Design Summary & Plans are consistent with the approved SCP.

20 The OSD Design Summary is attached.

21. A maintenance schedule has been prepared.
Part E – General Controls – Environmental Controls

Chapter E14: Stormwater Management

Name of Designers Organisation ………………………………………………………

Signature of Authorised Designer ……………………………… ....../...../.....

Signature of Reviewing Officer ……………………………… .../...../.....
TECHNICAL DATA – MESH SCREENS

Technical Data – Mesh Screens

Discharge outlet pits must be fitted with an internal screen. The screen needs to:

(a) Protect the orifice from blockage

(b) Create static conditions around the orifice which helps to achieve predictable discharge coefficients

(c) Retain litter and debris which would degrade downstream waterways.

i. Screen type

A small aperture-expanded steel mesh, such as Maximesh Rh3030, is recommended for orifices less than 150 mm in diameter. This type of screen retains relatively fine material (eg. cigarette butts and grass clippings) while maintaining the performance of the orifice under heavy debris loading. For orifices larger than 150 mm, the screen area necessary for a fine mesh screen can make it difficult to fit in a discharge outlet pits. A grid mesh, such as Weldlok F40/203, may be used for these larger orifices. Where the grid mesh is used, a fine mesh screen should be installed upstream of the discharge outlet pits, for areas likely to collect litter or debris.

ii. Screen area

The minimum recommended area (including blocked area) for an internal screen in a discharge outlet pits is:

(a) 50 times the orifice area where a fine mesh screen is used (eg. Maximesh Rh3030)

(b) 20 times the orifice area where a grid mesh is used (e.g. Weldlok F40/203).

iii. Screen orientation

The inlet pipe to a discharge outlet pits should direct inflows parallel (or at a small angle) to the screen. Perpendicular inflows drive debris into a mesh screen making it difficult to dislodge.

When inflows are directed parallel to the screen, the debris is layered on the screen but is blown off when the inflow exceeds approximately 2-3 times the PSD. The performance of the orifice and screen is influenced by the orientation of the screen. To assist in shedding debris, the screen should be positioned as close to vertical as possible. This allows debris to fall off once the water level in the discharge outlet pits drops. However, the screen must fit securely to the pit to avoid debris floating over or around the screen and blocking the orifice. The screen should be placed no less than 60 degrees to the horizontal.

iv. General

To prevent blockages, Maximesh screens must be positioned so that the long axis of the oval shaped holes is horizontal, the protruding lip is uppermost and above the hole and the screen is tilted downstream (See Figure 1). Blockages can occur if the screen is accidentally placed upside down. Fitting a handle to the screen not only reduces the chance of incorrect placement but also makes removal for cleaning easier. Fixings need to be selected to suit the screen and to promote easy removal for maintenance. Reducing the screen size also facilitates cleaning by reducing the weight. Proprietary screens may be considered to achieve this end. After being cut to size, Maximesh screens need to be ‘hot dipped’ galvanised to prevent corrosion. All mesh screens deflect under high inflows and heavy debris loading and should be braced to stop debris being carried around the screen.
Figure 3: Maximesh Screen

(Source: UPRCT OSD Design Handbook)
## SAMPLE MAINTENANCE SCHEDULE

<table>
<thead>
<tr>
<th>ACTION</th>
<th>FREQUENCY</th>
<th>PERFORMED BY</th>
<th>PROCEDURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect &amp; remove any blockage of orifice</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Remove grate &amp; screen to inspect orifice. See plan for location of discharge outlet pit.</td>
</tr>
<tr>
<td>Inspect screen and clean</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Remove grate and screen if required to clean it.</td>
</tr>
<tr>
<td>Inspect flap valve &amp; remove any blockage</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Remove grate. Ensure flap valve moves freely and remove any blockages or debris.</td>
</tr>
<tr>
<td>Inspect pit sump &amp; remove any sediment/sludge</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Remove grate and screen. Remove sediment/sludge build-up and check orifice and flap valve clear.</td>
</tr>
<tr>
<td>Inspect grate for damage or blockage</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Check both sides of grate for corrosion, (especially corners and welds) damage or blockage.</td>
</tr>
<tr>
<td>Inspect &amp; remove any debris/litter/mulch etc blocking grates of return pit</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Remove blockages from grate and check if pit blocked.</td>
</tr>
<tr>
<td>Inspect storage areas &amp; remove debris/mulch/litter etc likely to block screens/grates</td>
<td>Six monthly</td>
<td>Owner</td>
<td>Remove debris and floatable material likely to be carried to grates.</td>
</tr>
<tr>
<td>Check attachment of orifice plate to wall of pit (gaps less than 5 mm)</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Remove grate and screen. Ensure plate mounted securely, tighten fixings if required. Seal gaps as required.</td>
</tr>
<tr>
<td>Check orifice diameter correct and retains sharp edge</td>
<td>Five yearly</td>
<td>Maintenance Contractor</td>
<td>Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.</td>
</tr>
<tr>
<td>Check attachment of screen to wall of pit</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Remove grate and screen. Ensure screen fixings secure. Repair as required.</td>
</tr>
<tr>
<td>Check screen for corrosion</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Remove grate and examine screen for rust or corrosion, especially at corners or welds.</td>
</tr>
<tr>
<td>Inspect overflow weir &amp;</td>
<td>Six monthly</td>
<td>Maintenance</td>
<td>Remove grate and open cover to ventilate underground storage if present. Ensure weir clear of</td>
</tr>
</tbody>
</table>

Wollongong Development Control Plan 2009  67
<table>
<thead>
<tr>
<th>Task Description</th>
<th>Frequency</th>
<th>Party of Responsibility</th>
<th>Task Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty basket at overflow weir (if present)</td>
<td>Six monthly</td>
<td>Maintenance Contractor</td>
<td>Remove grate and ventilate underground storage chamber if present. Empty basket, check fixings secure and not corroded.</td>
</tr>
<tr>
<td>Inspect pit walls (internal and external, if appropriate) for cracks or spalling</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Remove grate to inspect internal walls. Repair as required. Clear vegetation from external walls if necessary and repair as required.</td>
</tr>
<tr>
<td>Inspect outlet pipe &amp; remove any blockage</td>
<td>Six monthly</td>
<td>Maintenance Contractor</td>
<td>Remove grate and screen. Ventilate underground storage if present. Check orifice and remove any blockages in outlet pipe. Flush outlet pipe to confirm it drains freely. Check for sludge/debris on upstream side of return line (if relevant).</td>
</tr>
<tr>
<td>Check step irons for corrosion</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Remove grate. Examine step irons and repair any corrosion or damage.</td>
</tr>
<tr>
<td>Check fixing of step irons is secure</td>
<td>Six monthly</td>
<td>Maintenance Contractor</td>
<td>Remove grate and ensure fixings secure prior to placing weight on step iron.</td>
</tr>
<tr>
<td>Inspect internal walls of return pit (and external, if appropriate) for cracks or spalling</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Remove grate to inspect internal walls. Repair as required. Clear vegetation from external walls if necessary and repair as required.</td>
</tr>
<tr>
<td>Compare storage volume to volume approved. (Rectify if loss &gt; 5%)</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Compare actual storage available with Work-as Executed plans. If volume loss is greater than 5%, arrange for reconstruction to replace the volume lost. Council to be notified of the proposal.</td>
</tr>
<tr>
<td>Inspect storages for subsidence near pits</td>
<td>Annually</td>
<td>Maintenance Contractor</td>
<td>Check along drainage lines and at pits for subsidence likely to indicate leakages.</td>
</tr>
</tbody>
</table>
CERTIFICATE OF HYDRAULIC COMPLIANCE &
OUTSTANDING WORKS FORM
FORM X.XX
WOLLONGONG CITY COUNCIL
ON-SITE STORMWATER DETENTION SYSTEM

CERTIFICATE OF HYDRAULIC COMPLIANCE

JOB NO: ________________ DA NO: ________________
PROJECT: _______________________________________________________________________

LOCATION: _______________________________________________________________________

CONSTRUCTION
DESIGNED BY: _________________________ CERTIFIED BY: _________________________
QUALIFICATIONS: ______________________ TELEPHONE: _________________________

1.0 WORKS CONSTRUCTED IN ACCORDANCE WITH DESIGN. (Delete if not applicable)

I ____________________ of ______________________ (accredited professional being competent to
practice in the field of stormwater drainage design) have inspected the above on-site stormwater
detention system and certify that the works have been constructed in accordance with the approved
design details for the above mentioned project.

Signature: ______________________ Date: __________
2.0 CONSTRUCTION VARIATIONS NOT AFFECTING DESIGN PERFORMANCE  (Delete if not applicable)

I _____________________ of ______________________ (accredited professional being competent to practice in the field of stormwater drainage design) have inspected the above on-site stormwater detention system and certify that the works have been constructed in accordance with the approved design details for the above mentioned project, except for the variations listed below which do not affect the performance of the system, subject to satisfactory maintenance.

Variations:

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

Signature: _____________________ Date: ____________

3.0 AUTHORITY TO RELEASE PLANS TO FUTURE OWNERS OF THE PROPERTY

As the copyright owner of the drainage plans, I hereby authorise release of the approved plans/attached sketch plan to future owners of the property to assist in the maintenance of the On-site Stormwater Detention system.

Signature: _____________________ Date: ____________

Name: ____________________________________ (Print)
FORM X.XX

WOLLONGONG CITY COUNCIL

ON-SITE STORMWATER DETENTION SYSTEM

LIST OF OUTSTANDING WORKS

JOB NO: ________________ DA NO: ________________

PROJECT:
_______________________________________________________________________________

LOCATION:
_______________________________________________________________________________

CONSTRUCTION

DESIGNED BY: _________________________ CERTIFIED BY: ________________________

QUALIFICATIONS: ______________________ TELEPHONE: ________________________

1.0 CONSTRUCTION VARIATIONS AFFECTING DESIGN PERFORMANCE.

I _____________________ of ______________________ (accredited professional being competent to practice in the field of stormwater drainage design) have inspected the above on-site stormwater detention system and the following variations to the approved design. The listed remedial works will be necessary to make the system function according to the approved design.
Variation Remedial Work Necessary

Signature: ______________________ Date: ____________
LEGAL PROTECTION OF OSD SYSTEMS

F.1 Explanatory notes on the preparation and registration of Restrictions on Use of Land and Positive Covenants

Private developers within the area administered by Wollongong City Council are required to construct On-site Stormwater Detention (OSD) facilities as part of their development consent in accordance with Section 1.3 of this Policy.

OSD systems consist of a storage area, an outlet and a collection network. The collection network directs stormwater flow to the storage. The collection network includes those surfaces which are sloped so as to direct flow to the storage, as well as the more obvious devices such as roof gutters, downpipes, drainage lines and pits. In effect, the whole lot is part of the OSD system.

All the components of an OSD system need to be kept intact and maintained so that the overall system continues to function as it was intended for the life of the development. To ensure that the OSD system is not altered during the life of the development, a Restriction on Use of the land is created. This prevents owners making changes to any of the site drainage components which would alter the way the facility works, without the permission of their local council. To ensure that the OSD system is adequately maintained, a Positive Covenant is registered on the title of the property, placing the responsibility for this maintenance on the owner of the land. By registering the covenant and restriction on the property title, the obligations can be transferred to future owners. The Positive Covenant will be established to benefit the local Council.

A sketch plan showing the location of the different components of the OSD system and a copy of the Maintenance Schedule must be included as attachments to the Positive Covenant. This will ensure future owners are aware of their maintenance obligation.

If no new lot is being created, the cheapest and quickest way to register the Positive Covenant and Restriction on Use on the title of Torrens Title land is through:

Form 13PC for a Positive Covenant, and
Form 13RPA for a Restriction on Use.

For Old System land the covenant and restriction should be imposed with a suitable deed.

A copy of forms 13PC and 13RPA is included in Appendix F.2.

The covenant and restriction on use may also be imposed under Section 88B of the Conveyancing Act, 1919 in conjunction with the creation of a new lot or lots. The Positive Covenant will be in favour of the local council but, because the land is privately owned, the covenant and restriction will be imposed through Section 88E of the Act.

A copy of Information Bulletin No 14, prepared by the Land Titles Office (LTO), A Guide to the Preparation of a Section 88B Instrument to:

· Create Easements, Profits à Prendre, Restrictions on the Use of Land or Positive Covenants  
· Release Easements or Profits à Prendre

is included below.

The terms and conditions of the covenant and restriction must be shown in part 2 of the Section 88B Instrument or be attached to the forms 13PC and 13RPA. A copy of suitable wording for the terms and
conditions is below. The local Council has the right to release, vary or modify the terms and conditions of
the covenant and restriction.

F.2 Blank Copy of Forms 13RPA AND 13PC

These forms for a Restriction on Use of Land and Positive Covenant are required by the Lands Titles
Office where there is no subdivision of land, and the covenant and restriction are being imposed on an
existing parcel of land.

A plan should be attached showing the location and various components of the On-site Stormwater
Detention system. This should be accompanied by the Maintenance Schedule. (See Appendix D)
RESTRICTION ON THE USE OF LAND BY A PRESCRIBED AUTHORITY

New South Wales
Section 88E(3) Conveyancing Act 1919

(A) TORRENS TITLE

<table>
<thead>
<tr>
<th>Land Titles Office use only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not affix additional pages here; use the left-hand corner</td>
</tr>
</tbody>
</table>

(B) LODGED BY

<table>
<thead>
<tr>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
</tr>
</tbody>
</table>

(C) REGISTERED PROPRIETOR

Of the above land

(D) LESSEE/MORTGAGEE OR CHARGEEE

<table>
<thead>
<tr>
<th>Nature of Interest</th>
<th>Number of Instrument</th>
<th>Name</th>
</tr>
</thead>
</table>

(E) APPLICANT

A prescribed authority

The applicant, being a prescribed authority within the meaning of section 88E(1) of the Conveyancing Act 1919, imposes on the above land a restriction on the use of land in the terms set out in annexure hereto, applies to have it recorded in the Register and certifies this application correct for the purposes of the Real Property Act 1900.

DATE:

Signed in my presence by the an authorised officer of the prescribed authority who is personally known to me.

Signature of witness: Signature of authorised officer:

Name of witness: Name of authorised officer:

Address of witness: Position of authorised officer:

Signed in my presence by the registered proprietor of the land who is personally known to me.

Signature of witness: Signature of registered proprietor:

Name of witness: Name of registered proprietor:

Address of witness: Address of registered proprietor:

Signed in my presence by the lessee/mortgagee/chargee under lease/mortgage/charge No., agree to be bound by this restriction.

Signed in my presence by the above lessee/mortgagee/chargee who is personally known to me.

Signature of witness: Signature of lessee/mortgagee/chargee:

Name of witness: Name of lessee/mortgagee/chargee:

Address of witness: Address of lessee/mortgagee/chargee:

All handwriting must be in block capitals.

A set of notes on this form (13RPA-2) is available from the Land Titles Office.

Page 1 of

Checked by (LTO use):
Restriction on the Use of Land by a Prescribed Authority form 13RPA:
Instructions for Completion

Note: This form is to be used only where the restriction is imposed by a prescribed authority on land in private ownership.

1. Complete the form in dense black or dark blue ink. If handwriting, use block capitals only.

2. Do not use an eraser or correction fluid to make alterations: rule through rejected material and initial the left-hand margin.

3. If the space provided at any point is insufficient, insert “See Annexure” at that point and include the required material on sheets of white A4 paper at least 80gsm (ordinary copier paper satisfies these requirements) using one side only. Insert a heading beginning “Annexure to ...” and specifying the type of form, the date and the parties to the transaction. Identify the material included, where possible by referring to the relevant marginal heading on the form. In the case of signatures which could not be fitted in the space provided, reproduce the text and layout used on the form. Number all pages in sequence with the form using the format “Page ... of ...”, the number to be placed at the foot of the form in the centre. The first and last pages must be signed by the parties and any witness. Securely attach the additional pages to the upper left-hand corner of the form: a Nalclip is preferred; stapling should be avoided.

4. Insert the total number of pages, including any additional pages (see above), in the space provided at the foot of the form.

5. Lodge the completed form by hand at the Land Titles Office, Queens Square, Sydney (adjacent to Hyde Park Barracks). Lodgment of the certificate of title is optional.

6. The following instructions relate to the marginal letters on the form:

   (A) TORRENS TITLE
   Insert the number of the folio of the Register for the property affected. If the restriction affects only part of the land, add a description of the part, for example, “... part formerly comprised in Lot 1 in DP123456”.

   (B) LODGED BY
   This section must be completed by the person or firm lodging the form at the Land Titles Office. If the party lodging does not have a Land Titles Office delivery box, leave this panel blank. Provision of a reference is optional.

   (C) REGISTERED PROPRIETOR
   Insert the full name of the registered proprietor of the land subject to the restriction. Address and occupation are not required.

   (D) LESSEE, MORTGAGEE or CHARGEE
   Insert the details of any lessee, mortgagee or chargee who agrees to be bound by the restriction.

   (E) APPLICANT
   The applicant must be a prescribed authority within the meaning of section 88E(1) of the Conveyancing Act 1919.

   (F) SPECIFY the annexure containing the terms of the restriction.

   (G) EXECUTION
   The completed form must be executed by an authorised officer of the prescribed authority, and by or on behalf of the registered proprietor of the land and any lessee, mortgagee or chargee who agrees to be bound by the restriction. Any witness must be an adult who is not a party to the application and knows the person executing. Where the form is executed—
   By an individual on his/her own behalf. The signature must be witnessed.
   By an attorney. The power of attorney must be registered at the Land Titles Office. In addition to the attorney’s signature, a statement in the following format must be added: “John Smith by his attorney Jane Smith pursuant to power of attorney Book 1234 No. 567”’. The signature must be witnessed.
   By a receiver or delegate. Use the format given in “By an attorney” suitably modified. The signature must be witnessed.
   By a corporation. The form of execution must include reference to the power or authority relied on by the signatories, for example, “Executed by ABC Pty Ltd ACN 123456 by a director and secretary”.

   Note: The application may be executed by a solicitor or licensed conveyancer on behalf of the registered proprietor of the land or any lessee, mortgagee or chargee who agrees to be bound by the restriction.

   (H) Rule through the inapplicable words and insert the number of the relevant instrument. If this section of the form does not apply rule it through.

If you have any questions, please call Land Titles Office Client Services on 02 9228 6713.
**POSITIVE COVENANT**

New South Wales

Section 88E(2) Conveyancing Act 1919

<table>
<thead>
<tr>
<th>Part E – General Controls – Environmental Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chapter E14: Stormwater Management</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(A)</th>
<th>TORRENS TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(B)</td>
<td>LODGED BY</td>
</tr>
<tr>
<td>LTO Box</td>
<td>Name, Address or DX and Telephone</td>
</tr>
<tr>
<td>Reference (optional):</td>
<td></td>
</tr>
<tr>
<td>(C)</td>
<td>REGISTERED PROPRIETOR</td>
</tr>
<tr>
<td>Of the above land</td>
<td></td>
</tr>
<tr>
<td>(D)</td>
<td>LESSEE/MORTGAGEE or CHARGEES</td>
</tr>
<tr>
<td>Of the above land agreeing to be bound by this positive covenant</td>
<td></td>
</tr>
<tr>
<td>Nature of interest</td>
<td>Number of Instrument</td>
</tr>
<tr>
<td>(E)</td>
<td>APPLICANT</td>
</tr>
<tr>
<td>A prescribed authority</td>
<td></td>
</tr>
</tbody>
</table>

The applicant, being a prescribed authority within the meaning of section 88E(1) of the Conveyancing Act 1919, imposes on the above land a positive covenant in the terms set out in annexe hereof, applies to have it recorded in the Register and certifies this application correct for the purposes of the Real Property Act 1900.

Signed in my presence by the **authorised officer of the prescribed authority** who is personally known to me.

Signature of witness:  
Name of witness:  
Address of witness:

Signed in my presence by the **registered proprietor of the land** who is personally known to me.

Signature of witness:  
Name of witness:  
Address of witness:

Signed in my presence by the **lessee/mortgagee/chargee** under lease/mortgage/charge No. , agree to be bound by this positive covenant.

Signature of lessee/mortgagee/chargee:  
Name of witness:  
Address of witness:

All handwriting must be in block capitals.

A set of notes on this form (13PC-2) is available from the Land Titles Office.

Page 1 of [ ]  
Checked by (LTO use):
**13PC-2 (9909)**

**Positive Covenant form 13PC: Instructions for Completion**

1. Complete the form in dense black or dark blue ink. If handwriting, use block capitals only.
2. Do not use an eraser or correction fluid to make alterations; rule through rejected material and initial the left-hand margin.
3. If the space provided at any point is insufficient, insert “See Annexure” at that point and include the required material on sheets of white A4 paper at least 80gsm (ordinary copy paper satisfies these requirements) using one side only. Insert a heading beginning “Annexure to …” and specifying the type of form, the date and the parties to the transaction. Identify the material included, where possible by referring to the relevant marginal heading on the form. In the case of signatures which could not be fitted in the space provided, reproduce the text and layout used on the form. Number all pages in sequence with the form using the format “Page ... of ...”, the number to be placed at the foot of the form in the centre. The first and last pages must be signed by the parties and any witness. Securely attach the additional pages to the upper left-hand corner of the form; a neat slip is preferred; stapling should be avoided.
4. Insert the total number of pages, including any additional pages (see above), in the space provided at the foot of the form.
5. Lodge the completed form by hand at the Land Titles Office, Queens Square, Sydney (adjacent to Hyde Park Barracks). Lodgment of the certificate of title is optional.
6. The following instructions relate to the marginal letters on the form.
   (A) TORRENS TITLE
   Insert the number of the folio of the Register for the property affected. If the positive covenant affects only part of the land, add a description of the part, for example, “... part formerly comprised in Lot 1 in DP123456”.
   (B) LODGED BY
   This section must be completed by the person or firm lodging the form at the Land Titles Office. If the party lodging does not have a Land Titles Office delivery box, leave this panel blank. Provision of a reference is optional.
   (C) REGISTERED PROPRIETOR
   Insert the full name of the registered proprietor of the land subject to the positive covenant. Address and occupation are not required.
   (D) LESSEE, MORTGAGEE or CHARGEE
   Insert the details of any lessee, mortgagee or chargee who agrees to be bound by the positive covenant.
   (E) APPLICANT
   The applicant must be a prescribed authority within the meaning of section 85E(1) of the Conveyancing Act 1919.
   (F) Specify the annexure containing the terms of the positive covenant.
   (G) EXECUTION
   The completed form must be executed by an authorised officer of the prescribed authority, and by or on behalf of the registered proprietor of the land and any lessee, mortgagee or chargee who agrees to be bound by the positive covenant. Any witness must be an adult who is not a party to the application and knows the person executing. Where the form is executed—
   By an individual on his/her own behalf: The signature must be witnessed.
   By an attorney: The power of attorney must be registered at the Land Titles Office. In addition to the attorney’s signature, a statement in the following format must be added: “John Smith by his attorney Jane Smith pursuant to power of attorney Book 1234 No. 567”. The signature must be witnessed.
   By a receiver or delegate: Use the format given in “By an attorney” suitably modified. The signature must be witnessed.
   By a corporation: The form of execution must include reference to the power or authority relied on by the signatories, for example, “Executed by ABC Pty Ltd ACN 123456 by a director and secretary”.
   Note: The application may not be executed by a solicitor or licensed conveyancer on behalf of the registered proprietor of the land or any lessee, mortgagee or chargee who agrees to be bound by the positive covenant.
   (H) Rule through the inapplicable words and insert the number of the relevant instrument. If this section of the form does not apply rule it through.

*If you have any questions, please call Land Titles Office Client Services on 02 9228 6713.*

B.4-2
F.3 Terms and Conditions for Restriction on Use of Land and Positive Covenant

This appendix contains standard clauses for the Terms and Conditions to be applied in Restrictions on Use of Land and or Positive Covenants in relation to OSD systems. Appendix F.4 contains a sample instrument which shows how these terms and conditions are applied.

Both the Restriction on Use and the Positive Covenant will normally be required, however in cases where only the Positive Covenant is used, the definition of the OSD system (given in clause 1 of the Restriction on Use) should be included in the Positive Covenant.

Restrictions on Use of Land for OSD Systems

1. The registered proprietor of the lot burdened must not make or permit or suffer the making of any alterations to any on-site stormwater detention system on the lot(s) burdened without the prior consent in writing of the authority benefited. The expression “on-site stormwater detention system” shall include all ancillary gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to those structures.

   Name of authority having the power to release, vary or modify the restriction referred to is Wollongong City Council.

2. The registered proprietor of the lot burdened must not erect or permit the erection of or permit to remain any dwelling house or other structure on the lot burdened unless the registered proprietor has constructed an on-site stormwater detention system on the said lot burdened, in accordance with the requirements of Wollongong City Council The expression “on-site stormwater detention system” shall include all ancillary gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to those structures.

   Note: Clause 2 is only necessary when construction of the OSD system is being deferred, which will only be permitted by Council in exceptional circumstances.

Positive Covenants

1. The registered proprietor of the lot burdened must in respect of the on site stormwater detention system on the lot burdened:

   (a) keep the system clean and free from silt, rubbish and debris
   (b) maintain and repair the system so that it functions in a safe and efficient manner
   (c) permit the prescribed authority or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
   (d) comply with the terms of any written notice issued by the prescribed authority in respect of the requirements of this covenant.

2. Under Section 88F(3) of the Conveyancing Act 1919 the Prescribed authority has the following additional powers:

   (a) If the registered proprietor fails to comply with the terms of any written notice issued by prescribed authority under part 1(d) above the prescribed authority may enter the land with all necessary materials and equipment and carry out any work which the prescribed authority in its discretion considers necessary to comply with that notice.

   (b) the prescribed authority may recover from the registered proprietor of the burdened lot in any court of competent jurisdiction:

      (i) any expense reasonably incurred by it in exercising its powers under part 2(a) above including reasonable wages for the prescribed authorities employees engaged in carrying out and supervising and administering the work and the costs of materials, machinery, tools and equipment used to carry out the work.

      (ii) legal costs on an indemnity basis for issue of the notices for recovery of the costs and expenses for registration of a covenant charge under section 88F of the Act for
providing any certificate required under section 88G of the Act and for obtaining any injunction under section 88H of the Act.

Name of authority having the power to release vary or modify the positive covenant referred to is Wollongong City Council.

**F.4 Sample Restriction on Use of Land and Covenant where a Deposited Plan is being registered together with a Section 88B instrument.**

In this case the On-Site Detention system is provided with Development Approval involving subdivision of land.

A Plan of the OSD system and a copy of the Maintenance Schedule should be attached to the Instrument.
INSTRUMENT SETTING OUT TERMS OF RESTRICTION ON THE USE OF LAND AND POSITIVE COVENANT INTENDED TO BE CREATED PURSUANT TO SECTION 88E OF THE CONVEYANCING ACT 1919.

Plan: Subdivision of Lot ……D.P……………..
Covered by Council Clerk’s Certificate No. ……………………..
Of ………………………………..

Full name and address ……………………………………………..
Of proprietor of the land ……………………………………………..
……………………………………………………………..

PART 1

( ) Identity of restriction………………….. Restriction on use under Section 88E of the Conveyancing Act 1919
referred to in abovementioned plan

SCHEDULE OF LOT(S), ETC. AFFECTED

Lot(s) Burdened Authority Benefited
……………………………………………….. Insert name of Council

( ) Identity of Positive Covenant Positive Covenant under
referred to in above-mentioned plan Section 88E of the
Conveyancing Act 1919
SCHEDULE OF LOT(S), ETC. AFFECTED

Lot(s) Burdened Authority Benefited

........................................................ Insert name of Council

PART 2

TERMS OF RESTRICTION ON USE ........................................ REFERRED TO IN THE ABOVE-MENTIONED PLAN

The registered proprietor shall not make or permit or suffer the making of any alterations to the on-site stormwater detention system which is constructed on the lot(s) burdened without the prior consent in writing of ............................................ (Insert name of Council). The expression “on-site stormwater detention system” shall include all ancillary gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to the temporary storage. Any on-site stormwater detention system constructed on the lot(s) burdened is hereafter referred to as “the system”.

Name of Authority having the power to release, vary or modify the Restriction ............... referred to is ......................................................... (Insert name of Council).
TERMS OF POSITIVE COVENANT …………………………………………….. REFERRED TO IN THE ABOVE-MENTIONED PLAN

1. The registered proprietor of the lot(s) hereby burdened will in respect of the system:
   (a) keep the system clean and free from silt, rubbish and debris
   (b) maintain and repair at the sole expense of the registered proprietors the whole of the system so that it functions in a safe and efficient manner
   (c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant
   (d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.

2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
   (i) in the event that the registered proprietor fails to comply with the terms of any written notice issued by the Council as set out above the Council or its authorised agents may enter the land with all necessary materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above
   (ii) The Council may recover from the registered proprietor in a Court of competent jurisdiction:
       (a) any expense reasonably incurred by it in exercising its powers under subparagraph (i) hereof. Such expense shall include reasonable wages for the Council’s employees engaged in effecting the work referred to in (i) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
       
       (b) legal costs on an indemnity basis for issue of the said notices and recovery of the said costs and expenses together with the costs and expenses of registration of a covenant charge pursuant to section 88F of the Act or providing any certificate required pursuant to section 88G of the Act or obtaining any injunction pursuant to section 88H of the Act.

Name of Authority having the power to release vary or modify the Positive Covenant
…………………………………………. referred to is …………………………………….. (Insert name of Council).
F.5 Land Titles Office Information Bulletin September 1998 Number: 14

A Guide to the preparation of a Section 88B Instrument to:

- Create Easements, Profits à Prendre, Restrictions on the Use of Land or Positive Covenants
- Release Easements or Profits à Prendre

Note: This bulletin should be read in conjunction with the following:

- Information Bulletin No. 43 - ‘Creating an Easement over a Track in Use’

1. Introduction:

A Section 88B Instrument is the part of a deposited plan which upon registration

- creates Easements, Profit à Prendre, Restrictions on the Use of Land, and Positive Covenants [clause 27 Conveyancing (General) Regulation 1998]
- releases Easements and Profits à Prendre [clause 28 Conveyancing (General) Regulation 1998]

Note: Restrictions on the use of land and Positive Covenants cannot be varied or released by a Section 88B instrument. The Instrument must be drawn in accordance with Approved Form 10 (Annexures 2 and 3).

The original instrument must be lodged as part of the plan. Stamp Duty is not payable.

Identification of easements:

Easements must be identified on the face of the plan using 'alpha' symbols. A specimen plan is attached as Annexure 1.

It is necessary to identify easements with the same expression:

(a) In the statements of intention panel on the plan
(b) In the Section 88B Instrument and
(c) On the face of the plan

Note: Where a Section 88B Instrument, includes height limitations to define the stratum of an easement, profit à prendre, restriction or positive covenant, the accompanying deposited plan must comply with clause 47 of the Surveyors (Practice) Regulation 1996.

2. Preparation of a Section 88B Instrument:

A Section 88B instrument comprises three parts:

Part 1: Identifies each easement, profit à prendre, restriction or positive covenant to be created.

Part 1A: Identifies each easement or profit à prendre to be released.

Examples of the Schedules of lots burdened and benefited in Parts 1 and 1A are shown in Annexure 4
Part 2: Sets out the terms and conditions of easements profits à prendre, restrictions or positive covenants referred to in Part 1). Part 2 may not be required see Para.3.1

3. Creating easements:

Easements may be created with or without terms and conditions shown in Part 2 of the section 88B instrument.

3.1 Terms and conditions not required:

In order to simplify the creation of easements, the statutory form of easements may be used. Statutory easements adopt the terms and conditions specified in Schedule 4A (easements in gross) and Schedule 8 (easements having a dominant tenement) Conveyancing Act 1919.

The terms and conditions of an easement cannot refer to persons empowered to release vary or modify the easement. (see sec. 88[1](c) Conveyancing Act 1919). Following is a list of statutory easements (referred to as short form easements) set out in the Schedules that do not require terms and conditions to be included in Part 2 of the instrument:

(a) Right of Carriage Way
(b) Right of Foot Way
(c) Easement to Drain Water
(d) Easement to Drain Sewage
(e) Easement for Repairs
(f) Easement for Batter
(g) Easement for Drainage of Sewage
(h) Easement for Drainage of Water
(i) Easement for Electricity Purposes
(j) Easement for Overhang
(k) Easement for Services
(l) Easement for Water Supply
(m) Easement to permit Encroaching Structure to remain
(n) Right of Access

Note: The use of these expressions does not prevent the inclusion in Part 2 of variations of the terms and conditions referred to in the Schedules. Such variations may be by way of addition, exception, qualification or omission.

3.2 Terms and conditions required

Alternatively, an easement may be created for another purpose. In this case relevant terms and conditions must be shown in Part 2 of the instrument

Terms and conditions of profits à prendre and restrictions on the use of land must always be shown in Part 2 of the instrument.

The terms and conditions of a Restriction on the Use of Land may state the person(s) empowered to release, vary or modify the restriction. (sec. 88[1](c) Conveyancing Act 1919)

**Note:** The sites of Restrictions and Profits à Prendre and are only identified on the face of the plan if they affect part of a lot.

5. Creating Positive Covenants

Terms and conditions of Positive Covenants must always be shown in Part 2 of the instrument. They may be created in favour of:

(a) Prescribed authorities (sections 88D & 88E Conveyancing Act 1919) or

(b) Privately owned land, where the covenant relates to maintenance or repair of an easement to be created by the instrument.

The site of the Positive Covenant is only shown on the face of the plan if it affects part of a lot.

**Note:**

A Section 88B Instrument cannot be used to create a Positive Covenant over an existing easement.

To record an interest relating to maintenance and repair of the site of an existing easement over:

(a) Torrens title land, a Request (97-11R) should be registered containing the terms of the covenant or

(b) Old System land, a deed containing the terms of the covenant should be registered in the General Register of Deeds.

6. Releasing Easements or Profits à Prendre

Section 88B Conveyancing Act 1919 provides for the release of easements and profits à prendre by the registration of a plan.

The identity of easements and Profits à Prendre to be released must be set out in:

- Part 1A of the instrument and
- the statement of intention panel of the plan.

An example is shown in Annexure 3.

7. Signatures and Consents

Where an easement, profit à prendre, restriction or positive covenant is being created the plan and Section 88B instrument must be signed by:

(a) The registered proprietor

(b) Mortgagee

(c) Chargee or

(d) Covenant chargee and
Written consents must be furnished by any

(a) Caveator,
(b) Lessee, or
(c) Judgement creditor under any writ

in accordance with Section 195D Conveyancing Act 1919.

Note: Written consents may be dispensed with if the caveator, lessee or judgement creditor signs the plan and instrument.

Where an Easement or Profit à Prendre is being released:

The signatures and consents of all the parties relating to the dominant tenement

should be furnished.

Inquiries on all matters related to plans and associated dealings should initially be made in person at Customer Services Branch, second level, Land Titles Office, Queens Square, Sydney or by contacting the Telephone Inquiry Service on (02) 9228 6713.

David Mulcahy

Director of Land Titles and Registrar General

First issued July 1987

Annexure 1
PLAN OF SUBDIVISION OF LOT B
IN DP29743
Lengths are in metres. Reduction Ratio: 1:300
L.G.A.: GOODAREA
Locality: FINE
Parish: GOOD
County: PLEASANT

NOTE
THIS PLAN HAS BEEN
PREPARED FOR SAMPLE
PURPOSES ONLY
BEARINGS AND OTHER
SURVEY INFORMATION HAVE
BEEN OMITTED

Surveyor's Reference:
WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

ANNEXURE 1
Annexure 2

Instrument setting out Terms of Easements/Profits à Prendre intended to be created or released and of Restrictions on the Use of Land and Positive Covenants intended to be created pursuant to Section 88B of the Conveyancing Act 1919.


Full name and address of the owner of the land Grace Mary Brothers
4 Crane Avenue
Fine NSW 2775

Part 1

1. Identity of easement, profit à prendre, Right of Carriage Way and restriction or positive covenant to be Easement for Services 2.7 wide created and firstly referred to in the plan

<table>
<thead>
<tr>
<th>Schedule of Lots etc. Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lots Burdened</td>
</tr>
<tr>
<td>82</td>
</tr>
</tbody>
</table>

2. Identity of easement to be created and Right of Way 2.1 wide and variable width secondly referred to in the plan

<table>
<thead>
<tr>
<th>Schedule of Lots etc. Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lots Burdened</td>
</tr>
<tr>
<td>81</td>
</tr>
</tbody>
</table>

3. Identity of positive covenant thirdly referred to in the plan Positive Covenant

<table>
<thead>
<tr>
<th>Schedule of Lots etc. Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lots Burdened</td>
</tr>
<tr>
<td>81</td>
</tr>
</tbody>
</table>

4. Identity of restriction fourthly referred to in the plan Restriction on the Use of Land

<table>
<thead>
<tr>
<th>Schedule of Lots etc. Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lots Burdened</td>
</tr>
<tr>
<td>81</td>
</tr>
<tr>
<td>Lots Burdened</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td>81</td>
</tr>
<tr>
<td>82</td>
</tr>
</tbody>
</table>
Annexure 2

Instrument setting out Terms of Easements/Profits à Prendre intended to be created or released and of Restrictions on the Use of Land and Positive Covenants intended to be created pursuant to Section 88B of the Conveyancing Act 1919.


Part 1A

1. Identity of easement to be released and firstly referred to in the plan

Easement to Drain Water 2 wide

(DP 840601)

Schedule of Lots etc. Affected

<table>
<thead>
<tr>
<th>Lots Burdened</th>
<th>Lots Benefited</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/29743</td>
<td>9/29743</td>
</tr>
</tbody>
</table>

Part 2

Note: The terms for the positive covenant and restriction on the use of land, set out in Part 2, are included for the purposes of illustration only.

1. Terms of Right of Way 2.1 wide and variable secondly referred to in the plan.

(Insert terms and conditions).

2. Terms of Positive Covenant thirdly referred to in the plan

The Proprietor of the land hereby burdened (herein called 'the Proprietor') shall at all times in respect of the land hereby burdened, identified on the plan as 'stormwater retention basin' (herein called 'the basin'): ..... (Insert terms and conditions).

3. Terms of Restriction on the Use of Land fourthly referred to in the plan

a. Not to erect or suffer to permit any building, structure or erection on the whole or in part of the land hereby burdened identified on the plan as 'stormwater retention basin' (herein called 'the basin') except: ..... (Insert terms of restrictions).

b. No alteration is to be made to the retention levels ..... (Insert terms of restrictions).

Name of authority empowered to release, vary or modify positive covenant and restriction thirdly and fourthly referred to in the plan.

Goodarea Council.
Annexure 2

Instrument setting out Terms of Easements/Profits à Prendre intended to be created or released and of Restrictions on the Use of Land and Positive Covenants intended to be created pursuant to Section 88B of the Conveyancing Act 1919.


Signed in my presence by Grace Mary Brothers who is personally known to me.

Signature of witness Grace Mary Brothers

Name of Witness (Block Letters)

Address and Occupation of Witness

Signed in my presence by Francis Richard Drake (registered proprietors of dominant tenement 9/29743) who is personally known to me.

Signature of Witness Francis Richard Drake

Name of Witness (Block Letters)

Address and occupation of Witness
Annexure 3

Copy of Approved Form 10

Instrument setting out Terms of Easements/Profits à Prendre intended to be created or released and of Restrictions on the Use of Land and Positive Covenants intended to be created pursuant to Section 88B of the Conveyancing Act 1919.

Plan: (Please leave 26 mm to allow for plan number and heading of plan) reference

Plan of (heading of plan) covered by Subdivision Certificate No. (add as appropriate)

Full name and address of the owner of the land:

Part 1

1. Identity of easement, profit à prendre, restriction or positive covenant to be created and firstly referred to in the plan.

Schedule of Lots etc. affected

Lots burdened Lots, relevant roads, bodies or prescribed authorities benefited.

(Brief description in same terms as used in relevant statement in the plan). (Set out vertically in numerical sequence of lot numbers. Title details should be added if the land referred to is outside the plan).

(Continue above pattern until all easements, profits à prendre, restrictions, or positive covenants to be created and referred to in the plan have been dealt with).

Part 1A
1. Identity of easement, profit à prendre, restriction or positive covenant to be created and firstly referred to in the plan.

Lots burdened by existing prescribed easement, profit à prendre

Lots benefited

The following examples show recommended formats for the scheduling of lots burdened and benefited in Parts 1 and 1A of a Section 88B Instrument.

Annexure 4

Examples of the Schedule of Lots Burdened and Benefited

Lots burdened

Lots benefited
1 2, 3 & 4
2 3 & 4
3 4

or

Each lot except lot 6 (see note) Every other lot except lot 6 (see note)

or

Every other lot and the Council of .................

or

Each of the lots 1 to 4 inclusive Every other lot and the

the part of lot 5 designated (A) in

the plan and lot 6

or

Council of ..................

or

Each lot

Each of the lots 1 to 4 inclusive

the part of lot 5 designated (A) in

the plan and lot 6

or

Any prescribed authority

Note: This format should be used only for Restrictions on the Use of Land. The current title details and parcel identity must be shown for each lot or parcel of land burdened and/or benefited by the easement, profit à prendre, restriction, or positive covenant. The reference to title need only be referred to once throughout the instrument.

Copyright © 1998 NSW Land Titles Office.
F.6 Sample instrument when OSD is deferred

Sample 88B Instrument for use when the On-Site Detention system is not provided at the time of subdivision but is deferred until construction of a building development on the land.

This situation has caused considerable difficulties for new home builders in the past and will only be permitted by Council in exceptional circumstances.
INSTRUMENT SETTING OUT TERMS OF RESTRICTION ON THE USE OF LAND INTENDED TO BE CREATED PURSUANT TO SECTION 88E OF THE CONVEYANCING ACT 1919.

(Sheet .. of .. sheets)

Plan: Subdivision of Lot ……D.P……………

Covered by Council Clerk’s

Certificate No. ………………..

Of ……………………………

Full name and address …………………………………………………

Of proprietor of the land ………………………………………………

………………………………………………

PART 1

( ) Identity of restriction…………….. Restriction on use under Section 88E of the referred to in abovementioned plan Conveyancing Act 1919

SCHEDULE OF LOT(S), ETC. AFFECTED

Lot(s) Burdened Authority Benefited

………………………………………… Insert name of Council

( ) Identity of Positive Covenant Positive Covenant under referred to in above-mentioned plan Section 88E of the

Conveyancing Act 1919

SCHEDULE OF LOT(S), ETC. AFFECTED

Lot(s) Burdened Authority Benefited

………………………………………… Insert name of Council

PART 2

TERMS OF RESTRICTION ON USE …………………………………………….. REFERRED TO IN THE ABOVE-MENTIONED PLAN

(i) The registered proprietor shall not erect or suffer the erection of any dwelling house or other structure on the lot(s) hereby burdened unless the registered proprietor has first constructed or has made provision for the construction of an on site stormwater detention system on the
said lot(s), in accordance with the design, construction and/or provision requirements of the …………………………………………(Insert name of Council) and to the satisfaction of the ………………………………………… (Insert name of Council). The expression “on-site stormwater detention system” shall include all ancillary gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to the temporary storage.

PART 2 (Continued)

(ii) The registered proprietor shall not make or permit or suffer the making of any alterations to any onsite stormwater detention system which is, or shall be, constructed on the lot(s) burdened without the prior consent in writing of …………………………………………(Insert name of Council) . The expression “on-site stormwater detention system” shall include all ancillary gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to the temporary storage. Any on-site stormwater detention system constructed on the lot(s) burdened is hereafter referred to as “the system”. Name of Authority having the power to release, vary or modify the Restriction …………………… referred to is ……………………(Insert name of Council).

TERMS OF POSITIVE COVENANT …………………………………..…………..REFERRED TO IN THE ABOVE-MENTIONED PLAN

3. The registered proprietor of the lot(s) hereby burdened will in respect of the system:
   (a) keep the system clean and free from silt, rubbish and debris
   (b) maintain and repair at the sole expense of the registered proprietors the whole of the system so that it functions in a safe and efficient manner
   (c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant
   (d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.

4. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
   (iii) in the event that the registered proprietor fails to comply with the terms of any written notice issued by the Council as set out above the Council or its authorised agents may enter the land with all necessary materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above
   (iv) The Council may recover from the registered proprietor in a Court of competent jurisdiction:
       (a) any expense reasonably incurred by it in exercising its powers under subparagraph (i) hereof. Such expense shall include reasonable wages for the Council’s employees engaged in effecting the work referred to in (i) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
       (b) legal costs on an indemnity basis for issue of the said notices and recovery of the said costs and expenses together with the costs and expenses of registration of a covenant charge pursuant to section 88F of the Act or providing any certificate required pursuant to section 88G of the Act or obtaining any injunction pursuant to section 88H of the Act.

Name of Authority having the power to release vary or modify the Positive Covenant

……………………………………… referred to is …………………………………………(Insert name of Council)
The apparent discrepancy in the capacity of the roadway widths shown on Drawing No. 1238 over, is not obvious at first glance. An explanation follows:

1. The most efficient hydraulic cross-section is one which is rectangular.

2. As the roadway widens the hydraulic cross-section changes from almost rectangular at 6m wide to 2 distinct separate triangles.

3. By this, at a fixed depth of 150mm on the roadway, the cross-sectional flow area increases marginally by widening the road. However, the hydraulic radius decreases as does the conveyance of the cross-sections. Therefore, the capacity of the cross-section of the 12m road is actually less than the 6m roadway.

4. Note the roadway capacities are calculated by Manning’s equation for a compound cross-section.
### TABLE 7.1

Maximum Flow Capacities of Roadways with Standard Kerb & Gutter, 3% Crossfall and Depth of Ponding 150mm

<table>
<thead>
<tr>
<th>Slope</th>
<th>Longitudinal Width of Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>6m</td>
</tr>
<tr>
<td>1</td>
<td>668</td>
</tr>
<tr>
<td>2.5</td>
<td>1054</td>
</tr>
<tr>
<td>5</td>
<td>1492</td>
</tr>
<tr>
<td>7.5</td>
<td>1826</td>
</tr>
<tr>
<td>10</td>
<td>2108</td>
</tr>
<tr>
<td>12.5</td>
<td>2358</td>
</tr>
<tr>
<td>15</td>
<td>2580</td>
</tr>
<tr>
<td>16.7</td>
<td>2724</td>
</tr>
</tbody>
</table>

### TABLE 7.2

Maximum Flow Capacities of Roadways with Roll Top Kerb, 3% Crossfall and Depth of Ponding 130mm

<table>
<thead>
<tr>
<th>Slope</th>
<th>Longitudinal Width of Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>6m</td>
</tr>
<tr>
<td>1</td>
<td>578</td>
</tr>
<tr>
<td>2.5</td>
<td>914</td>
</tr>
<tr>
<td>5</td>
<td>1292</td>
</tr>
<tr>
<td>7.5</td>
<td>1584</td>
</tr>
<tr>
<td>10</td>
<td>1828</td>
</tr>
<tr>
<td>12.5</td>
<td>2044</td>
</tr>
<tr>
<td>15</td>
<td>2240</td>
</tr>
<tr>
<td>16.7</td>
<td>2360</td>
</tr>
</tbody>
</table>
STANDARD SUMPS AND INLET PITS

APPLICATION
1. Car parking areas
2. Parks
3. Common drainage lines

CITY OF WOLLONGONG
STANDARD CONCRETE PIT WITH SINGLE GRATING

STANDARD SUMPS AND INLET PITS

SECTION A

APPLICABLE
1. Car parking areas
2. Parks
3. Common drainage lines

CITY OF WOLLONGONG
STANDARD CONCRETE PIT WITH SINGLE GRATING

STANDARD SUMPS AND INLET PITS
TYPICAL CONNECTION TO COUNCIL DRAINAGE PIPELINE