

## ITEM 6

## REVIEW OF CHAPTERS E13: FLOODPLAIN MANAGEMENT AND E14: STORMWATER MANAGEMENT OF WOLLONGONG DCP

On 15 December 2009 Council endorsed the Wollongong Development Control Plan (DCP) 2009. The DCP came into force on the 3 March 2010, following the commencement of the Wollongong Local Environmental Plan 2009.

The DCP includes Chapters E13: Floodplain Management and E14: Stormwater Management. A review of Chapters E13 and E14 has resulted in proposed amendments. This report recommends Council endorse the reviewed documents for public exhibition.

The changes to the DCP chapters are recommended to provide greater clarity, simplify some modelling processes, ensure consistency with the LEP, and implement recommendations from adopted floodplain risk management plans and coastal zone management plan.

### RECOMMENDATION

- 1 Draft Wollongong Development Control Plan (2009) Chapters E13: Floodplain Management and E14: Stormwater Management be exhibited for a minimum period of 28 days.
- 2 A further report outlining the submissions received from the public exhibition process with recommendations regarding progression of the draft DCP amendments be prepared for Councils consideration.

### REPORT AUTHORISATIONS

Report of: Mike Dowd, Manager Infrastructure Strategy + Planning  
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### ATTACHMENTS

- 1 Draft Chapter E13: Floodplain Management
- 2 Draft Chapter E13: Floodplain Management Change Log
- 3 Draft Chapter E14: Stormwater Management
- 4 Draft Chapter E14: Stormwater Management Change Log

### BACKGROUND

The Wollongong DCP (2009) commenced on 3 March 2010 and includes Chapters E13: Floodplain Management and E14: Stormwater Management. The two chapters have not been reviewed since the commencement of the DCP.

In this period, several Floodplain Risk Management Studies and Plans containing DCP related recommendations have been adopted by Council. These recommendations have been included in the review of E13: Floodplain Management.

Council's Conduit Blockage Policy (2002) was reviewed in 2016, and also contains recommendations to update Chapters E13 and E14. New national guidance following the Australian Rainfall & Runoff (2019) release is also being progressively adopted by Council and partly included in Chapters E13 and E14.

The review of Chapters E13 and E14 is occurring over 2 Stages. This review represents Stage 1.

#### Stage 1

- Amend inconsistent & ambiguous sections;
- Clarify definition of detrimental increases in flood impacts;
- Ensure DCP chapters is consistent with Wollongong Local Environment Plan (2009);
- Clarify Council's 117 direction exemption within DCP;
- Implement DCP related recommendations from Flood Risk Management Studies; and
- Implement recommendations from Coastal Zone Management Plan (2017).

## Stage 2

Council will implement Stage 2 as Floodplain Risk Management Studies are completed (over the next 5 years). Stage 2 will further incorporate Australian Rainfall and Runoff 2019 and update Flood Risk Precincts in line with national guidance.

## PROPOSAL

The reviewed draft DCP Chapters E13: Floodplain Management and E14: Stormwater Management be placed on Public Exhibition for a minimum of 28 days.

## CONSULTATION AND COMMUNICATION

On the 7<sup>th</sup> December 2018, an industry forum was held which outlined the proposed changes to E13 and E14. The review was generally supported. Three submissions were received from local consultants outlining technical matters they would like to see considered in the review.

A Councillor briefing outlining the key changes to the reviewed chapters was held on 4<sup>th</sup> November 2019.

If Council endorses the draft amendment to the DCP for public exhibition, the public exhibition will include:

- Notification in the local newspaper of the exhibition dates;
- Exhibition website with the draft material and opportunity for comment;
- Physical copies available in the Wollongong Library;
- Industry forum to present the changes to local consultants and answer questions.

Following the exhibition period, submissions will be reviewed and reported to Council with further recommendations regarding progression of the DCP chapters.

## PLANNING AND POLICY IMPACT

This report contributes to the delivery of Our Wollongong 2028 goal “We value and protect our environment”. It specifically delivers on the following:

Community Strategic Plan	Delivery Program 2018-2021	Operational Plan 2019-20
Strategy	3 Year Action	Operational Plan Actions
1.1.3 The potential impacts of natural disasters, such as those related to flood and landslips are managed and risks are reduced to protect life, property and the environment	1.1.3.2 Establish effective urban stormwater and floodplain management programs	Develop and implement Floodplain Risk Management Plans

## RISK ASSESSMENT

The revised DCP chapters will provide more clarity to Council and industry regarding Floodplain and Stormwater Management requirements. The exhibition process will allow the community to provide further input to the revised chapters.

## CONCLUSION

The Wollongong DCP Chapters E13: Floodplain Management and E14: Stormwater Management have been reviewed following internal and external consultation. It is recommended that the revised draft DCP chapters be exhibited for community and industry input.

Following the exhibition period and industry forum, submissions will be reviewed and reported to Council with further recommendations regarding the progression of the guiding documents.



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## 1 INTRODUCTION

- a) This chapter of the DCP provides Council's requirements for development upon flood prone land and land below the flood planning level within the City of Wollongong Local Government Area (LGA).
- b) This chapter of the DCP has been developed as an outcome of Floodplain Risk Management Plans (FRMPs) prepared in accordance with the process outlined by the NSW Government Flood Prone Lands Policy and the NSW Floodplain Development Manual (FDM) 2005. In areas where FRMPs have not yet been adopted the planning controls reflect Council Policy and are considered to be consistent with the principles of the State Government Flood Prone Lands Policy and FDM.
- c) The Department of Planning and the Department of Environment and Climate Change (Now Department of Planning Industry and Environment, DPIE) confirmed that there were exceptional circumstances that allowed Wollongong Council to apply flood related controls to residential development above the 1% Annual Exceedance Probability (AEP) flood level (plus freeboard) in accordance with Ministerial Directions outlined in Planning Circular PS-07-003.
- d) Other Chapters of this DCP include flood risk management provisions, which relate to the specific development requirements for specific land uses.

## 2 LAND TO WHICH THE PLAN APPLIES

1. The Plan applies to all floodplains and land below the flood planning level area within the City of Wollongong LGA. Figure 1 shows catchment boundaries within the Wollongong LGA. **Error! Reference source not found.**
2. The extents of adopted catchment wide flood studies and floodplain risk management studies and plans can be viewed at:

<https://www.wollongong.nsw.gov.au/development/maps>

>planning and environment map>Constraints and Planning DCPs layer

Please note the flood information is only viewable at a scale of 1:15000.

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### 3 OBJECTIVES

1. The key objectives of this chapter are to:
  - a) Maintain the existing flood regime and flow conveyance capacity;
  - b) Maintain the function of floodway and flood storage areas;
  - c) Reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone land;
  - d) Reduce private and public losses from flooding;
  - e) Improve public safety with respect to flooding;
  - f) Minimise the potential impact of development and other activity upon the aesthetic, recreational and environmental value of the waterway corridors;
  - g) Increase public awareness of the hazard and extent of land affected by the full range of potential floods;
  - h) Ensure new development must, as far as practical, reduce the existing flood risk, and in no circumstances should the flood risk be worsened;
  - i) Ensure new development (with the exception of waterway crossings) does not encroach within areas susceptible to channel erosion, migration, bank failure and slumping; and
  - j) Deal equitably and consistently with all matters requiring Council approval on flood affected land, in accordance with the principles within the latest version of the NSW Floodplain Development Manual or its update.



Figure 1 Catchments within the Wollongong Local Government Area.

## 4 DEFINITIONS

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

<b>Annual exceedance probability (AEP)</b>	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. Example, if a peak flood discharge of 500 m <sup>3</sup> /s has an AEP of 1%, it means that there is a 1% chance (that is one-in-100 chance) of a 500 m <sup>3</sup> /s or larger event occurring in any one year.
<b>Australian Height Datum (AHD)</b>	Australian Height Datum: National reference datum for level.
<b>Average Recurrence Interval (ARI)</b>	the long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
<b>ARR1987</b>	Australian Rainfall and Runoff: 1987 published by the Institute of Engineers, Australia
<b>ARR2019</b>	Australian Rainfall and Runoff 2019, published by the Commonwealth of Australia (Geoscience Australia).
<b>Basement Car Parking</b>	Refers to a car parking area wholly or partly accommodated underground, below a building. The roof of this space, including any solid walls on the podium, must not exceed 1.2m in height above natural ground level or finished ground level, whichever is the greatest distance.
<b>Deck</b>	An outdoor living area attached to a dwelling, which may be covered or uncovered, and is not capable of being used or adapted for use as habitable floor area.
<b>Enclosed car parking</b>	Car parking that is potentially subject to rapid inundation, which consequently increases danger to human life and property damage (such as basement or bunded car parking areas). The following criteria apply for the purposes of determining what is enclosed car parking: <ul style="list-style-type: none"> <li>(a) Flooding of surrounding areas may raise water levels above the perimeter which encloses the car park (normally the entrance), resulting in rapid inundation of the car park to depths greater than 0.8m, and</li> <li>(b) Drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity</li> </ul>
<b>Extreme flood</b>	An estimate of the probable maximum flood, which is the largest flood likely to ever occur
<b>Filling</b>	Depositing of soil, rock or other material. Filling does not include the depositing of topsoil, or feature rock imported to the lot, that is intended for use in garden landscaping, turf or garden bed establishment or topdressing of lawns.
<b>Flood</b>	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 as defined by the FDM before entering a

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	watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami.
<b>Flood awareness</b>	An appreciation of the likely effects of flooding and a knowledge of the relevant flood warning and evacuation procedures.
<b>Flood compatible building components</b>	A combination of measures incorporated in the design and/or construction and alteration of individual buildings or structures subject to flooding, and the use of flood compatible materials for the reduction or elimination of flood damage.
<b>Flood compatible materials</b>	Those materials used in building which are resistant to damage when inundated. A list of flood compatible materials is attached in Schedule
<b>Flood evacuation strategy</b>	The proposed strategy for the evacuation of areas within effective warning time during periods of flood as specified within any policy of Council, the FRMP, the relevant State Government disaster plan, by advices received from the State Emergency Services (SES) or as determined in the assessment of individual proposals.
<b>Flood Planning Area</b>	The area where flood related development controls apply. It includes land below the flood planning level (FPL) and may extend to include other areas of land where the high consequences in low probability events require additional flood related controls to reduce damages or to not alter the floodway in rarer flood events.
<b>Flood planning levels (FPLs)</b>	<b><i>flood planning level</i></b> In the Wollongong LGA, the FPL is the level of a 1 % AEP flood event plus 0.5 metres freeboard, unless otherwise stated in an adopted Floodplain Risk Management Study and/or Floodplain Risk Management Plan
<b>Flood Prone Land</b>	Land susceptible to flooding by the PMF event. Flood Prone Land is synonymous with flood liable land.
<b>Flood Refuge Area</b>	An onsite refuge above the PMF that provides reasonable shelter for the likely occupants of the development commensurate with the period of time that refuge is likely to be required in floods up to the PMF.  Note: In general, it is not acceptable to rely on a refuge provided by or on other development sites. In all cases where an onsite refuge is provided, it is to be both intrinsically accessible to all people on the site, sheltered and an integrated part of the development (i.e. a second storey with internal stair access). The route to the refuge is to be fail safe, plainly evident and self-directing.
<b>Flood Fringe Areas</b>	The remaining areas of flood prone land after floodway and flood storage areas have been identified
<b>Floodway Areas</b>	Areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked would cause a significant redistribution of flow or a significant increase in flood levels.  Where not mapped in an adopted Flood Study or FRMS floodway areas are defined as areas where the velocity x depth product exceeds 0.4 m <sup>2</sup> /s.
<b>Flood Storage Areas</b>	those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can



increase the severity of flood impacts by reducing natural flood attenuation. Hence, it is necessary to investigate a range of flood sizes before defining flood storage areas.

**Floodplain** Synonymous with **flood liable** and **flood prone land** is the area of land that is subject to inundation by the probable maximum flood (PMF).

**Floodplain Development Manual (FDM)** Floodplain Development Manual (2005) or the latest version.

**Floodplain Risk Management Plan (FRMP)** A plan prepared for one or more floodplains in accordance with the requirements of the FDM.

**Floodplain Risk Management Study (FRMS)** A study prepared for one or more floodplains in accordance with the requirements of the FDM.

**Freeboard** The height above the design flood used, in consideration of local and design factors, to provide reasonable certainty that the risk exposure selected in deciding on a particular design flood is actually provided. It is a factor of safety typically used in relation to the setting of flood levels, levee crest levels and so on. Freeboard compensates for a range of factors including wave action, localised hydraulic behaviour and levee settlement, all of which increase water levels or reduce the level of protection provided. Freeboard should not be relied upon to provide protection for flood events larger than the relevant defined flood event of a design flood.

Freeboard is included in the design flood planning level and therefore used in the derivation of the flood planning area.

**Government Infrastructure Projects** Infrastructure projects undertaken by public authorities.

**Habitable Floor Area**

- In a **residential situation**: a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom;
- In an **industrial or commercial situation**: an area used for offices or to store valuable possessions susceptible to flood damage in the event of a flood.

**Hazard** A source of potential harm or a situation with a potential to cause loss. In relation to this plan, the hazard is flooding which has the potential to cause harm or loss to the community.

**Overland Flow** Runoff from rainfall that flows over the land before entering a watercourse, creek, river, lake or dam. Overland flow can flow down roads, driveways and through homes and buildings. It is typically shallow and fast flowing.

**Merit Approach** An approach, the principles of which are embodied in the Floodplain Development Manual that weighs social, economic, ecological and cultural impacts of land use options for different flood prone areas together with flood damage, hazard and behaviour implications, and environmental protection and wellbeing of the State's rivers and floodplains.



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<b>Outbuilding</b>	A building which is ancillary to a principal residential building and includes sheds, garages, car ports and similar buildings.
<b>Practical</b>	That which in the opinion of Council can be achieved within the design of the development, while not necessitating: <ul style="list-style-type: none"> <li>(a) floor levels to be raised in a way that would unreasonably hinder access to and from existing floor levels or ground levels on the same site or adjacent public areas; and</li> <li>(b) the raising of a structure to a height that would result in unacceptable impacts on the amenity of adjacent residential properties; and</li> <li>(c) the height or presentation of a building that would be inconsistent with the existing or planned streetscape.</li> </ul>
<b>Probable maximum flood (PMF)</b>	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.
<b>Probable maximum precipitation (PMP)</b>	The greatest depth of precipitation for a given duration meteorologically possible over a given size storm area at a particular location at a particular time of the year, with no allowance made for long-term climatic trends (World Meteorological Organisation, 1986). It is the primary input to the estimation of the probable maximum flood.
<b>Probability</b>	A statistical measure of the expected chance of flooding (see ARI).
<b>Reliable access</b>	during a flood means the ability for people to safely evacuate an area subject to imminent flooding within effective warning time, having regard to the depth and velocity of flood waters, the suitability of the evacuation route, and without a need to travel through areas where water depths increase.
<b>Risk</b>	The chance of something happening that will have an impact. It is measured in terms of consequences and probability (likelihood). In the context of this chapter, it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
<b>Survey plan</b>	is a plan prepared by a registered surveyor which shows the information required for the assessment of an application in accordance with the provisions of this Policy.
<b>Suitably Qualified Civil Engineer</b>	A civil engineer who is included in the National Professional Engineers Register, administered by the Institution of Engineers Australia or is eligible for membership of Engineers Australia.

## 5 KEY STEPS IN THE PROCESS

1. Please read this document carefully and seek assistance from Council officers as required.
2. Figure 2 is a summary of the major steps in the Development Application process for any development within a floodplain.
3. If the proposal does not comply with the prescriptive controls, determine whether the performance criteria and objectives are nonetheless achieved.
4. The assistance of Council staff or an experienced floodplain consultant may be required at various steps in the process to ensure that the requirements of this Plan are fully and satisfactorily addressed.

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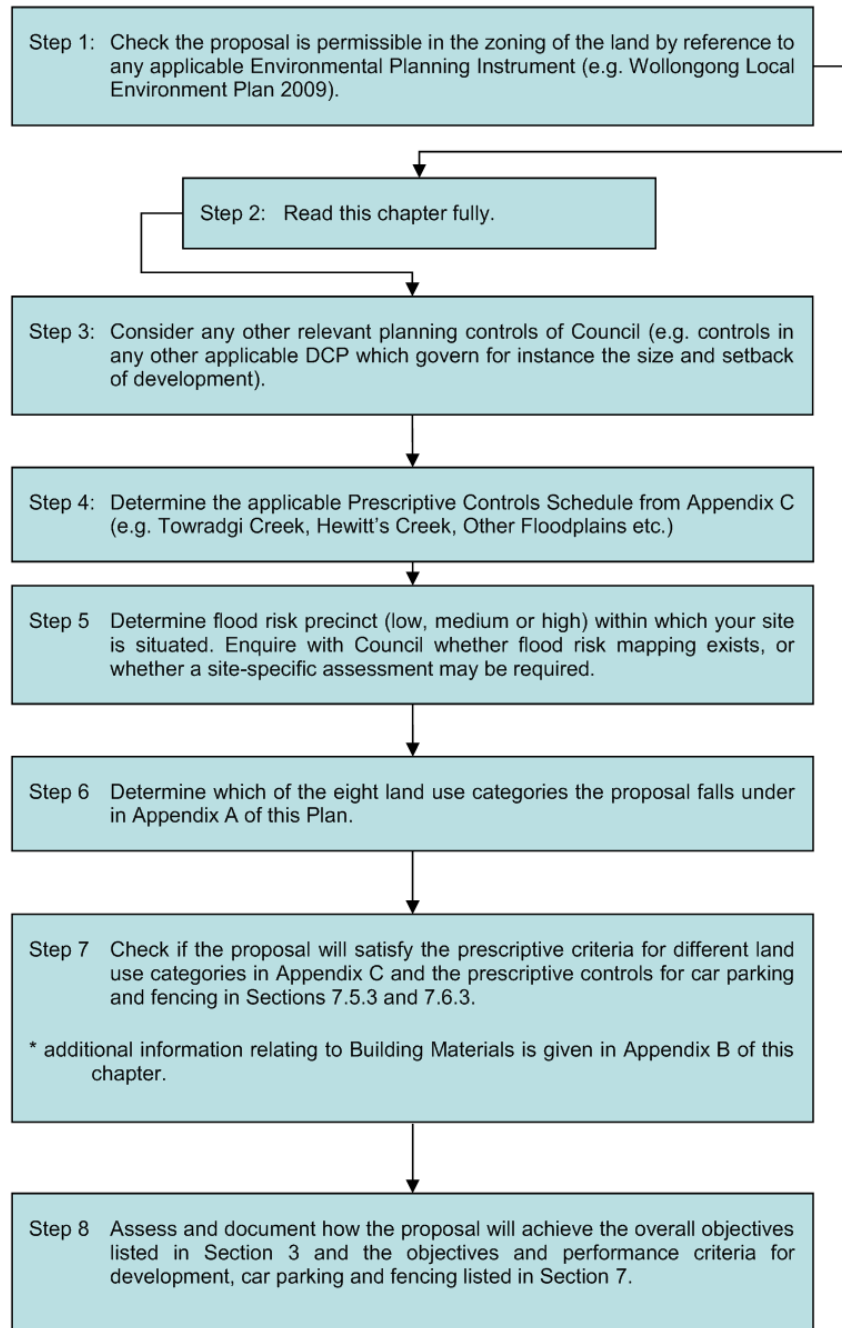


Figure 2: Summary of the major steps in the Development Application process for any development within a floodplain

## 6 FLOOD STUDIES

- a) Flood studies must be prepared by a suitably qualified engineer. The flood study must be prepared in accordance with the relevant sections of this Chapter. The 20% AEP, 1% AEP and PMF flood events must be modelled to assess the flooding impact of a proposed development to property, infrastructure and the environment.
- b) 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.

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 where overland flow is suspected. Section 6.1 details the requirements for hydraulic design; Section 6.2 details requirements for conduit blockage.

Flood studies shall be prepared using a fully dynamic 1 or 2 dimensional computer model unless it can be demonstrated such modelling is not required. 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.

### 6.1 Hydraulic Design and Analysis

- a) An appropriate computer model must be used for hydraulic design and analysis.
- b) The data required for the hydraulic modelling including channel cross sections, hydraulic properties (e.g. roughness), survey and digital elevation models shall be obtained by the developer. This data shall be documented clearly and reflect both the existing and proposed hydraulic characteristics of the creek channel and floodplain. The developer must document any assumptions made.
- c) 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 model extend to a boundary condition at the hydraulic control downstream of the site. Alternatively, where a 2-dimensional hydraulic model is used a suitable grid size shall be adopted to accurately determine flood behaviour and flood impacts for the development at a development specific level
- d) If modifications are required to the creek channel or floodplain or if the proposal involves activities with 40 metres of the top of the creek bank. A controlled Activity Approval under the Water Management Act 2000 may be required.
- e) Council is transitioning to ARR2019 through the completion of Floodplain Risk Management Studies and Plans. During this transition, flow estimates are to use ARR1987 IFDs and hydrologic procedures. The hydrologic techniques used in adopted Council Flood Studies and Floodplain Risk Management Studies will be used to for and development related flood study.

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## 6.2 Conduit Blockage

Blockage of bridges, culverts and other stormwater conduits is a key consideration for Wollongong City Council.

- a) Applicability of this section:
  - i) Blockage applies to all watercourses including creeks, floodways and other trunk drainage systems within the City of Wollongong with the exception of the minor system as defined in Chapter E14 of this DCP. It does not apply to pit blockage. Pit blockage considerations are set out in Section 6.2 of Chapter E14. It does not apply to pipes where the only upstream entry points are from kerb/gutter stormwater inlets (e.g. the minor system).
- b) Conduit Blockage Factors
  - i) The blockage factors in Table 1 are to be applied to structures across all watercourses and overland flow paths for all flood-modelling purposes.

These applications include:

- Estimation of design flood levels, velocities, and depths for flood studies;
  - Determining flood hazard and hydraulic categories, including the delineation of Flood Risk Precincts, Floodways and Flood Storage Areas;
  - Infrastructure design;
  - Structural design of proposed development;
  - Impact assessment of proposed development;
  - Assessing the benefit of proposed flood mitigation works;
  - Estimating flood damages;
  - Assessment of risk to life and evacuation considerations; and
  - Setting Flood Planning Levels (FPLs), such as floor levels for new development.
- c) Peak Flood Envelopes
    - i) Flooding and impacts are to be assessed using the following two scenarios :
      - No Blockage; and
      - Blockage factors.
    - i) Scenarios requiring various combinations of blockage (e.g. no blockage at some culverts, partial blockage at others) are generally not required.
  - d) Overtopping and Cross-Catchment Flow Diversion Investigation
    - i) Where flows exceed the capacity of the structure (applying the relevant blockage factor), flood modelling or other calculations should be undertaken to identify the overtopping flow behaviour. The modelling or calculations must be sufficient to identify where flows will return into the watercourse downstream of the structure, and whether flow will be diverted along other overland flow paths.
    - ii) Modelling or other calculations must be sufficient to identify whether cross catchment flows from other watercourses need to be considered at the site of interest.

e) Design of New Structures

- i) The structure is to be designed using the relevant blockage factor at every stage in the calculations;
- ii) Impacts of the structure on existing flood behaviour (levels, velocity and hazard) are to be quantified for a range of flood events, including larger and smaller events than the design AEP;
- iii) Impacts are to be mitigated in accordance with the guidance specified in Chapter E13: Floodplain Management of this DCP; and
- iv) All aspects of the proposed design with the potential to affect flow behaviour, including ancillary structures such as headwalls, handrails, safety barriers, noise walls, etc., are to be appropriately considered in the flood calculations.

f) Design of detention basins

- i) Basins volumes and low flow outlets to be sized assuming no blockage;
- ii) Basin weirs/spillway sized assuming relevant blockage factors of the outlet;
- iii) Outlets to have debris management structure where blockage affects performance and where there is an identified source of debris upstream.

g) Blockage Factors

- i) Culvert and bridge classifications are defined as follows:
  - **Class 1.** Pipes 1.2 m internal diameter or smaller. Box culverts or bridges with a diagonal opening less than 1.5 m, and a width or height less than 0.9 m.
  - **Class 2.** Pipes greater than 1.2 m internal diameter. Box culverts or bridges with a diagonal opening of more than or equal to 1.5 m, less than 3 m and minimum dimension of 0.9 m for both width and height.
  - **Class 3.** Box culverts or bridges with a diagonal opening of more than or equal to 3 m, less than 6 m, and a minimum dimension of 1.2 m for both width and height.
  - **Class 4.** Box culverts or bridges with a diagonal opening greater than or equal to 6 m, and a minimum dimension of 2.5 m for both width and height.
- ii) For bridges, the dimension refer to the waterway opening between piers, not the total bridge dimensions. When determining the clearance of bridges above a natural channel, a reasonable level representing the long term channel bottom level should be used, using an averaged profile slope. For instance, it is not appropriate to propose localised excavation of the normal channel bed to increase the clearance above 3 m and satisfy the Class 4 requirements.
- iii) The blockage factors are to be applied as a reduction in the effective flow area of the unblocked waterway of the structure. The blockage is to be a consistent effective reduction of the total flow area across the entire cross-section (that is, not bottom-up, top-down, or other selective partial blockage of the waterway area). This will typically involve a consistent reduction of the cross-section width (1D hydraulic models) or computational cell width (2D or 3D hydraulic models) representing the structure. For software packages which



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implement a blockage factor as a parameter for bridges or culverts, this parameter should be used.

- iv) The blockage factors are to be applied to all bridges, culverts and other conduits in the catchment that have the potential to influence the flow behaviour at the point of interest.
- v) The blockage factors are to be applied for all locations within the Wollongong LGA, regardless of current land use or other considerations such as creek slope.
- vi) Fences, rails and barriers which are within the overtopping flow path of a structure are to be modelled with appropriate energy losses (i.e. using the parameter K which represents the energy losses as a factor of dynamic head ( $V^2/2g$ ), to reflect the influence of the rails on upstream flow. Energy losses resulting from the drag and turbulence induced by the form of the embankment between the culvert soffit (top) and the overtopping crest level are to be included where appropriate.

**Table 1 Blockage Factors**

Design AEP	Bridge/Culvert Classification				Debris Blockage of Overtopping Flows
	Class 1	Class 2	Class 3	Class 4	
20% AEP	60%	50%	35%	5%	Must appropriately represent obstructions to flow such as bridge decks, fences, handrails, buildings noise barriers etc. Modelling of pervious structures such as fences and railings above the structure should assume a 75% debris blockage of the unblocked flow area through the obstruction, plus associated energy losses.
Rarer than 20% and more frequent than 2% AEP (e.g. 10%, 5% AEP)	75%	65%	50%	10%	
2% AEP or Greater (e.g. 2%, 1% AEP, PMF)	95%	75%	60%	15%	

### 6.3 Modelling of Buildings

Modelling of proposed and existing buildings will be consistent with the method used in the adopted flood study or FRMS. If the site is not within the extent of an adopted flood study or FRMS, buildings must be represented using a method consistent with those recommended in:

*Australian Rainfall and Runoff Revision Project 15: Two-dimensional simulations in urban areas – Representation of buildings in 2D numerical flood models.*

Representing proposed or existing buildings on piers or suspended slabs using Layered Flow Constrictions in TUFLOW is not permitted as:

- Open areas under the building may become enclosed in the future;
- Open areas under the building may become blocked from stored items and trapped debris; and
- Currently (2019), no research or guidance supports this approach.

## 6.4 Ocean Levels

- a) Flood surface profiles must be determined using the following criteria:
  - i) Adopting a 100 year ARI ocean level of RL 2.9m\* AHD and a 10 year ARI fluvial flood.
  - ii) Adopting an ocean level of RL 1.9m\* AHD and a 1% AEP fluvial flood.
- b) The greater value of the above shall be adopted to determine the minimum habitable floor level.

## 6.5 Modifications to Watercourses

- a) 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
- b) 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 is not be considered justification for waterway 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.

- i) Buildings including decks will not be permitted over watercourses.

## 6.6 Overland Flow

Overland flow is runoff from rainfall which flows over the land before entering a watercourse, creek, river or lake or dam. Overland flow is typically shallow and fast flowing. Where a watercourse has been filled or piped, flooding resulting from overflows from the filled/piped watercourse is considered mainstream flooding and not overland flow.

The flood planning level for overland flow is the 1% AEP plus 0.3m. In an overland flow path, where the difference between the PMF and 1% flood level is greater than 0.3m, freeboard of 0.5m to the 1% flood applies. All other development controls of this chapter and E14 – Stormwater management also apply to overland flow.

In locations where there is uncertainty whether flooding is mainstream or overland flow, Council will decide.

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## 7 WHAT ARE THE KEY CRITERIA FOR DETERMINING APPLICATIONS?

### 7.1 General

1. The criteria for determining applications for proposals potentially affected by flooding are structured in recognition that different controls are applicable to different land uses and levels of potential flood inundation and hazard.
2. The procedure to determine what controls apply to proposed development are:
  - a) Identify the land use category of the development (Appendix: A);
  - b) Determine which floodplain and which part of that floodplain the land is located within (Section 7.3) and relevant flood risk mapping; and
  - c) Applying the controls outlined under Clause 7.4.
3. Sections 7.4, 7.5 and 7.6 provide objectives, performance criteria and prescriptive controls for development, car parking and fencing within the floodplain and flood planning area.
  - **The objectives** represent the outcomes that the Council wishes to achieve from each control.
  - **The performance criteria** represent a means of assessing whether the desired outcomes will be achieved.
  - **The prescriptive controls** are preferred ways of achieving the outcome. While adherence to the prescriptive controls may be important, it is paramount that the objectives and the performance criteria are clearly satisfied.

### 7.2 Land Use Categories

1. Eight major land use categories are defined for floodplain management. The specific uses, as defined by the applicable Environmental Planning Instruments, and other specially defined uses, have been grouped within each of these 8 categories.

### 7.3 Flood Risk Precincts

1. Each of the floodplains within the Wollongong LGA area can be classified based on different levels of potential flood risk. This classification of floodplains into flood risk precincts (FRPs) is achieved by considering the probabilities and consequences of all floods that could potentially occur. The full range of flood events are considered including frequent flooding (e.g. 20% AEP), rare flooding (e.g. the 1% AEP) and extreme flooding (E.g. the PMF).
2. The mapping of FRPs has been undertaken for some floodplains in the Wollongong LGA and some catchments are being reviewed. Studied catchments can be viewed at <https://www.wollongong.nsw.gov.au/development/maps> within the planning and environment map. Note – flood information is within the Constraints and Planning DCPs layer and viewable at a scale of 1:15000.
3. Council has adopted a three tier FRP classification as follows:



- a) **High Flood Risk Precinct** - The High FRP is where high flood damages, potential risk to life and/or evacuation problems would be anticipated or where development would significantly or adversely alter flood behaviour. This area includes floodways. In this precinct, there would be a significant likelihood of flood damages and/or danger to life. The High FRP includes:
  - i) Areas greater than H3 hazard conditions during a 1% AEP flood from Figure 3;
  - ii) Land within 10m from the top of a watercourse bank; and
  - iii) Floodways.
- b) **Medium Flood Risk Precinct** - In this precinct there would be a significant likelihood of flood damage and/or danger to life, but these damages or danger to life can be minimised by the application of appropriate development controls. The Medium FRP includes:
  - i) Includes land below the 1 % AEP level plus 0.5 metres that is not within the High FRP area inundated in a 1% AEP plus freeboard and not classified as High FRP.
- c) **Low Flood Risk Precinct** - This precinct is where the likelihood of damages is low for most land uses. The Low FRP.
  - i) All areas within the floodplain (i.e. within the extent of the PMF) but not identified within either the High FRP or the Medium FRP; and
  - ii) All areas within the 2100 Coastal Zone Inundation Extent not classified Medium Flood Risk or High Flood Risk Precinct.
3. Where the FRP mapping has not been undertaken as part of the FRMS process it may be required as part of a flood study prepared for an individual development application. Such FRP mapping is to be undertaken by a suitably qualified engineer.
4. The NSW FDM (2005) is currently being reviewed (October 2019). The Australian Institute for Disaster Resilience (ADR, 2017) recommends the use of Flood Planning Constraint Categories (FPCCs) rather than Flood Risk Precincts. Should the future versions of the NSW FDM also recommend the use of FPCC, council will transition to FPCCs through the review of relevant floodplain risk management studies and plans.

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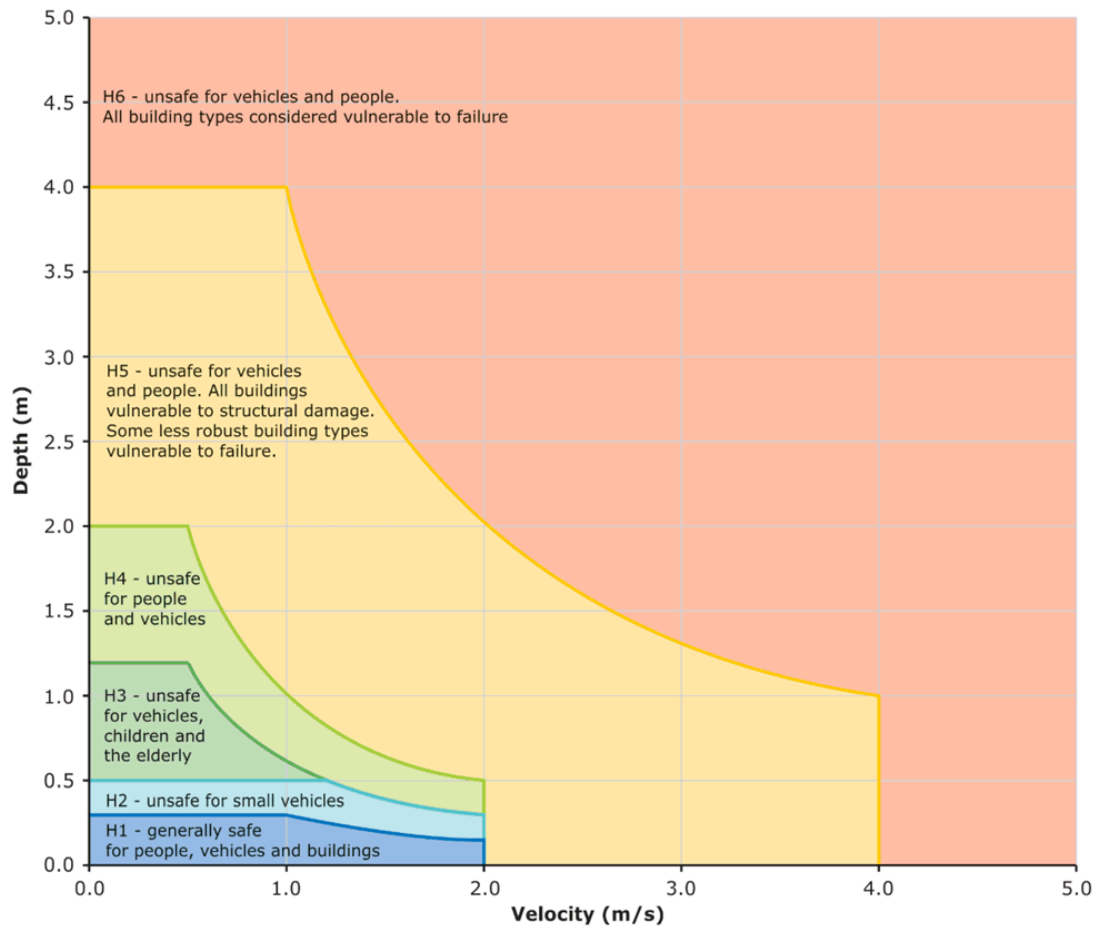


Figure 3: Combined Flood Hazard Curves (Smith et al., 2014)

## 7.4 Which controls apply to proposed developments?

1. The development controls apply to all land within a Flood Risk Precinct. The controls are graded relative to the severity and frequency of potential floods.
2. If no such study or plan exists, a site specific flood study may be required in accordance with Chapters E13 and E14 of this DCP.
3. The categories applicable to each floodplain are depicted on the planning matrices contained in the following schedules at Appendix C:

**Note:** Council is to insert controls for other floodplains as FRMPs are prepared and become adopted. Numbering of schedules takes into account studies yet to be completed. Schedule numbers shown relate to those which have been adopted by Council and included in Appendix C.

- Schedule 1 –Towradgi Creek Floodplain;
- Schedule 2 – Hewitts/Slacky/Woodlands/Tramway/ Thomas Gibson Creeks Floodplain;

- Schedule 3 – Minnegang Creek Floodplain;
- Schedule 4 – Allan's Creek Floodplain;
- Schedule 5 – Fairy and Cabbage Tree Creeks Floodplain;
- Schedule 6 – Mullet/Brooks Creeks Floodplain;
- Schedule 7 – Wollongong City Floodplain;
- Schedule 8 - Whartons, Collins, Farrahars Creeks, Bellambi Gully and Bellambi Lake Floodplains ;
- Schedule 9 – Lake Illawarra Floodplain;
- Schedule 9a – Lake Illawarra - Windang Peninsula; and
- Schedule 10 – All other floodplains.

#### 7.4.1 Objectives

- a) To ensure the proponents of development and the community in general are fully aware of the potential flood hazard and consequent risk associated with the use and development of land within the floodplain;
- b) To require developments with high sensitivity to flood risk (e.g. critical public utilities) be sited and designed such that they are subject to no or minimal risk from flooding and have reliable access;
- c) Allow development with a lower sensitivity to the flood hazard to be located within the floodplain, subject to appropriate design and siting controls, provided that the potential consequences that could still arise from flooding remain acceptable having regard to the State Government's Flood Policy and the likely expectations of the community in general;
- d) To prevent any intensification of the use of High Flood Risk Precinct or floodways, and wherever appropriate and possible, allow for their conversion to natural waterway corridors;
- e) To ensure that design and siting controls required to address the flood hazard do not result in unreasonable impacts upon the amenity or ecology of an area; and
- f) To minimise the risk to life during flooding.

#### 7.4.2 Performance Criteria

- a) The proposed development should not result in any increased risk to life;
- b) Development should not detrimentally increase the potential flood affectation on other development or properties either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain;
- c) Development should not result in impacts upon the amenity of an area by way of unacceptable overshadowing of adjoining properties, privacy impacts (e.g. by unsympathetic house-raising) or by being incompatible with the streetscape or character of the locality;
- d) The proposal must not have an adverse impact upon the ecological value of the waterway corridors, and where possible, should provide for their enhancement. Proposed development must be consistent with ESD principles; and



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- e) The geomorphic stability of a waterway corridor does not impose additional risk to human life or property.

### 7.4.3 Prescriptive Controls

- a) Appendix C (Schedules 1 – 10) outlines the prescriptive controls that apply to each of the floodplains to which this Plan applies;
- b) Table 2 provides permissible impacts for various development types for flood events up to the 1% AEP flood;
- c) Flood impacts in the PMF will be assessed on merit and will consider:
  - i) Impacts to evacuation routes and onsite refuge service levels;
  - ii) Additional flood affected allotments;
  - iii) Flood warning times; and
  - iv) Changes to above yard and above floor flooding.

**Table 2. Permissible Flood Impacts**

Development/ Project Type	Allowable Impact (mm)					
	Critical Uses and Facilities	Sensitive Uses and Facilities	Residential	Commercial or Industrial	Tourist Related Development	Recreation or Non-urban Uses
Individual Property	10	10	20	20	20	20
Multi Lot Subdivision	10	10	20	50	50	50
Government Infrastructure Projects	20	20	100	150	150	150

New development must not increase the frequency of over floor flooding for residential, commercial or industrial buildings in a 20%, 1% or PMF event.

## 7.5 Car Parking – Flood Related Requirements

### 7.5.1 Objectives

- a) To minimise the damage to motor vehicles from flooding;
- b) To ensure that motor vehicles do not become moving debris during floods;
- c) To minimize damage to garages and their contents from flooding; and
- d) To minimise the risk to human life resulting from the inundation of car parking, or driveway areas.

### 7.5.2 Performance Criteria

- a) The proposed car parking should not result in any increased risk to vehicle damage;
- b) The proposed garage should not detrimentally increase the potential flood affectation on other development;
- c) The parking should be designed considering the hazard curves in Figure 3;
- d) The proposed parking or driveway area must not increase the risk to life from flooding; and
- e) The parking should be designed to ensure that vehicles will not be transported by floodwaters.

### 7.5.3 Prescriptive Standards

- a) Open car parking – open car parking subject to inundation should be designed giving regard to vehicle stability in terms of depths and velocity during inundation by floodwaters, ensuring that each car parking space is within hydraulic hazard category H1 in Figure 3 during a 1 % AEP flood.
- b) Garage addition or open car parking to an existing house – the minimum floor level should be as high as practical but shall be no lower than 300mm above adjacent finished ground levels. Refer to Schedule 1 for the maximum floor areas within the various FRPs.
- c) Garage as part of new development and redevelopment;
  - i) Not permitted within a floodway;
- d) Basement car parks – are to be protected from inundation during a 1 % AEP flood, ensuring all vehicular access, doors and ventilation points are a minimum of 0.2 metres above the 1 % AEP flood level.

## 7.6 Fencing – Flood Related Requirements

### 7.6.1 Objectives

- a) To ensure that fencing does not result in the undesirable obstruction of the free flow of floodwaters;
- b) To ensure that fencing does not become unsafe during floods and potentially become moving debris which threatens the integrity of structures or the safety of people; and
- c) To ensure that fencing does not obstruct connectivity and the movement of fauna along riparian corridors.

### 7.6.2 Performance Criteria

- a) Fencing is to be constructed in a manner which does not affect the flow of floods so as to detrimentally increase flood affectation on surrounding land;
- b) Ability to be certified by a suitably qualified engineer, that the proposed fencing is adequately constructed so as to withstand the forces of floodwaters, or collapse in a controlled manner to prevent impediment to flood waters; and
- c) Where fencing is required across riparian corridors, the fencing is to be of the type that will not harm or obstruct the movement of native fauna.

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### 7.6.3 Prescriptive Standards

- a) Fencing within a floodway or High FRP will not be permissible except for security/ permeable/ open type/safety fences of a type approved by Council.
- b) Council requires a Development Application for all new solid (non-porous) and continuous fences above 0.6m high, in the High and Medium FRP's.
- c) An applicant must demonstrate that the fence would not impede flow or flood water. Appropriate fences must satisfy the following:
  - i) An open collapsible hinged fence structure of pool fence type;
  - ii) Brick or other masonry type fence (which will generally not be permitted) or;
  - iii) A fence type and citing criteria prescribed by Council.

Council will consider other forms of fencing subject to compliance with the performance criteria.

## 8 FILLING OF THE FLOODPLAIN

1. Filling in flood prone areas is not permitted unless:
  - A FRMP for the catchment has been adopted which allows filling to occur; or
  - a report from a suitably qualified engineer is submitted to Council that satisfies the requirements of items 2 and 3 below and certifies that the development, in combination with similar filling of developable sites in the area, will not increase flood affectation elsewhere
2. Filling of individual sites in isolation without consideration of the cumulative effects is not permitted. A case by case decision making approach cannot take into account the cumulative impact on flooding behaviour and associated risks caused by individual developments. Any proposal to fill a site must be accompanied by an analysis of the effect on flood levels of similar filling of developable sites in the area.
3. This analysis would form part of a flood study prepared in accordance with Chapters E13 and E14 of this DCP.
4. There is to be no net increase in fill in the floodplain. Compensatory excavation may be used to offset fill, however the compensatory excavation must be taken from an adjacent area of similar flood function that is lower in the floodplain (i.e. at a lower AEP inundation extent) than the proposed fill areas. Cut and fill drawings and volume calculations must be supplied to Council.

## 9 OTHER CONSIDERATIONS

1. When assessing proposals for development or other activity within the area to which this Policy applies, Council will take into consideration the following specific matters.
  - a) The proposal does not have a significant direct or cumulative detrimental impact on:
    - i) Water quality;
    - ii) Native bushland vegetation;

- iii) Riparian vegetation;
  - iv) Estuaries, wetlands, lakes or other water bodies;
  - v) Aquatic and terrestrial ecosystems;
  - vi) Indigenous flora and fauna; and
  - vii) Fluvial geomorphology.
- b) Development pursued to mitigate the potential impact of flooding (e.g. house raising) must be undertaken in a manner which minimises the impact upon the amenity and character of the locality.
  - c) The proposal must not constrain the orderly and efficient utilisation of the waterways for multiple purposes.
  - d) Proposals for house raising must provide appropriate documentation including a report from a suitably qualified engineer to demonstrate the raised structure will not be at risk of failure from the forces of floodwaters and the provision of details such as landscaping and architectural enhancements which ensure that the resultant structure will not result in significant adverse impacts upon the amenity and character of an area.
  - e) Requirements for Concessional Development as listed in Appendix A.

## 10 WHAT INFORMATION IS REQUIRED WITH AN APPLICATION TO ADDRESS THIS CHAPTER?

1. Applications must include information which addresses all relevant controls listed above, and the following matters as applicable.
2. Applications for Concessional Development (see Appendix A) to an existing dwelling on Flood Prone Land shall be accompanied by documentation from a registered surveyor confirming existing floor levels to AHD.
3. Development Applications affected by this plan shall be accompanied by a survey plan showing:
  - a) The position of the existing building/s or proposed building/s
  - b) The existing ground levels to Australian Height Datum around the perimeter of the building and contours of the site; and
  - c) The existing or proposed floor levels to Australian Height Datum.
4. Applications for earthworks, filling of land and subdivision shall be accompanied by a survey plan (with a contour interval of 0.25m) showing levels in AHD and design plan showing design surface levels (also in AHD with 0.25m contour intervals).
5. For large scale developments, or developments in critical situations, particularly where an existing catchment based flood study is not available, a flood study using a fully dynamic one or two dimensional computer model is required. For smaller developments consideration may be given to the use of the existing flood study if available and suitable (e.g. it contains sufficient local detail), or otherwise a flood study prepared in a manner consistent with the Australian Rainfall and Runoff 1987 publication, Chapters E13 and E14 of this DCP and the Floodplain Development Manual

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(FDM), will be required. From this study, the following information shall be submitted in plan form for the pre-developed and post-developed scenarios:

- a) Catchment plan;
  - b) Hydrologic calculations/analysis including model input and results files;
  - c) 2D model domain, grid size, boundary conditions, roughness layers;
  - d) Hydraulic structures and blockage factors applied
  - e) Survey data
  - f) Results (including depths, levels, FRP, hydraulic categories, velocity and hazard)
  - g) Impact maps
  - h) Water surface contours;
  - i) Velocity vectors;
  - j) Velocity and depth product contours;
  - k) Delineation of flood risk precincts relevant to individual floodplains; and
  - l) Flood profiles for the full range of events for total development including all structures and works (such as revegetation /enhancements).
6. Where the controls for a particular development proposal require an assessment of structural soundness during potential floods, the following impacts must be addressed:
- a) Hydrostatic pressure;
  - b) Hydrodynamic pressure;
  - c) Impact of debris; and
  - d) Buoyancy forces.
7. Foundations need to be included in the structural analysis.

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## Appendix: A LAND USE CATEGORIES – WLEP(2009)

Essential Community Facilities	Critical Utilities	Subdivision	Residential
Emergency services facilities; public administration building that may provide an important contribution to the notification or evacuation of the community during flood events (e.g. SES Headquarters and Police Stations); Hospitals.	Community facility; telecommunications facility; institutions; educational establishments; child care centre; liquid fuel depot; public utility undertaking (including electricity generating works; sewerage treatment plant; sewerage system; telecommunications facility; utility installations and water treatment facility) which are essential to evacuation during periods of flood or if affected would unreasonably affect the ability of the community to return to normal activities after flood events; residential care facility; group home; school and seniors housing.	Earthworks; excavation; subdivision of land which involves the creation of new allotments with potential for further development.	Affordable housing; attached dwelling; backpackers' accommodation; caravan park (with permanent occupants i.e. other than short term sites)(1); dual occupancy; dwelling; dwelling house; exhibition home; farm stay accommodation; home business; home industry; home occupancy; home occupation (sex services); hostel; hotel or motel accommodation; moveable dwelling; multi dwelling housing; neighbourhood shop; permanent group home; residential accommodation; residential flat building; rural worker's dwelling; secondary dwelling; semi-detached dwelling; serviced apartments; tourist and visitor accommodation and transitional group home.

- (1) As defined by the Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005

Note: Where the Environmental Planning Instrument (EPI) land use definition is not used, the bracketed text refers to the EPI land use definition.



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**Appendix: A LAND USE CATEGORIES (cont.)**

Commercial or Industrial	Tourist Related Development	Recreation or Non-urban Uses	Concessional Development
<p>Agricultural produce industry; air transport facility; airport; amusement centre; brothel; bulky goods premises; business premises; car park; cellar door premises; community facility (other than critical and sensitive uses and facilities); correctional centre; crematorium; depot; entertainment facility; exhibition village; feed lot, food and drink premises; freight transport facility; function centre; funeral chapel; funeral home; hazardous industry; hazardous storage establishment; health care professional; health consulting rooms; health services facility; heavy industry; heliport; highway service centre; industrial retail outlet; industry; light industry; liquid fuel depot; livestock processing industry; market; medical centre; mixed use development; mortuary; offensive industry; offensive storage establishment; office premises; passenger transport facility; place of public worship; pub; public administration building (other than critical uses and facilities); recreation facility (major); registered club; restaurant; restricted dairy; restricted premises; retail premises; rural industry; rural supplies; sawmill or log processing works; self-storage units; service station; sex services premises; shop; shop top housing; storage premises; take away food or drink premises; timber and building supplies; transport depot; truck depot; vehicle body repair workshop; vehicle repair station; vehicle sales or hire premises; veterinary hospital; warehouse or distribution centre; waste disposal facility; waste management facility; waste or resource management facility; waste or resource transfer stations; and wholesale supplies.</p>	<p>Camp site and caravan site – short term sites (1) only.</p>	<p>Agriculture; airstrip; animal boarding or training establishment; aquaculture; biosolid waste application; biosolids treatment facility; boat launching ramp; boat repair facility; boat shed; caravan park (with non-permanent occupants); charter and tourism boating facility; dairy (pasture based), environmental facility; environmental protection works; extensive agriculture; extractive industry; farm building; horticulture; helipad; information and education facility; intensive livestock agriculture; intensive plant agriculture; kiosk; jetty; landscape and garden supplies; marina; mine; mining; natural water-based aquaculture; port facilities; pond-based aquaculture; public utility undertaking (other than critical uses or facilities); recreation area; recreation facility (indoor); recreational facility (outdoor); research station; resource recovery facility; restriction facilities; roadside stall; stock and sale yard; tank-based aquaculture; turf farming; utility installations (other than critical uses and facilities); viticulture; water recreation structure; water recycling facility; and water storage facility.</p>	<p>(a) Redevelopment for the purposes of substantially reducing the flood risk to the existing building and its occupants;</p> <p>(b) Redevelopment within the existing footprint of approved structures. Existing elevated footings or crawl space must be maintained to allow floodwaters to flow beneath the structure.</p> <p>(c) Council may consider the construction of a single dwelling up to 250m<sup>2</sup> (external) within the high flood risk precinct on vacant land. Vacant land refers to residential allotments which was zoned residential and vacant prior to 2009.</p> <p>(d) In relation to an existing dwelling:</p> <ul style="list-style-type: none"> <li>(i) additions or alterations to the dwelling; and/or</li> <li>(ii) garages or outbuildings; and/or</li> <li>(iii) decks;</li> </ul> <p>provided that the total of:</p> <ul style="list-style-type: none"> <li>• the gross floor area from (i); and</li> <li>• the area of garages from (ii); and</li> <li>• the area of decks from (iii),</li> </ul> <p>approved since 7 February 2005, does not exceed:</p> <ul style="list-style-type: none"> <li>• 40m<sup>2</sup> in the Medium Flood Risk Precinct; or</li> </ul>



			<ul style="list-style-type: none"> <li>• 20m<sup>2</sup> in the High Flood Risk Precinct.</li> </ul> <p>(Note that for the purposes of this clause, the area of garages and the area of decks referred to above means the plan area measured to the external edge of the structure).</p>
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- (1) As defined by the Local Government (Caravan Park and Camping Grounds) Transitional Regulation 1993.

Note: Where the Environmental Planning Instrument (EPI) land use definition is not used, the bracketed text refers to the EPI land use definition.

## APPENDIX: A LAND USE CATEGORIES - TEMPORARY EVENTS

Temporary public events include markets, circuses music festivals, outdoor cinema's etc. When such events include temporary structures, public congregation areas or car parking areas within the 1% AEP flood extent, an event specific flood risk assessment and management plan is required. The risk assessment and management plan must be prepared by a suitably qualified engineer with relevant experience in floodplain management.

The risk assessment must include the depth, velocity and timing of inundation in a 20% and 1% event. The management plan must demonstrate how the flood risk will be managed.

In areas of flash flooding, which includes the majority of the Wollongong LGA (except Lake Illawarra floodplain), it is often not possible to provide an appropriate flood response during an event due to the fast rate of rise of floodwaters and limited response time. Therefore, the only way to mitigate the flood risk in flash flood areas is to include provisions in the event management plan that require monitoring of weather forecasts in the days leading up to the event, and a requirement that the event be cancelled if there is a risk of flooding and/or a forecast for heavy or prolonged rainfall.

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## Appendix: B FLOOD COMPATIBLE MATERIALS

BUILDING COMPONENT	FLOOD COMPATIBLE MATERIAL
<b>Flooring and Sub-floor</b>	<ul style="list-style-type: none"> <li>Concrete slab-on-ground monolith construction.</li> </ul>
<b>Structure</b>	<ul style="list-style-type: none"> <li>Suspended reinforced concrete slab.</li> </ul>
<b>Floor Covering</b>	<ul style="list-style-type: none"> <li>Clay tiles.</li> <li>Concrete, precast or in situ.</li> <li>Concrete tiles.</li> <li>Epoxy, formed-in-place.</li> <li>Mastic flooring, formed-in-place.</li> <li>Rubber sheets or tiles with chemical-set adhesives.</li> <li>Silicone floors formed-in-place.</li> <li>Vinyl sheets or tiles with chemical-set adhesive.</li> <li>Ceramic tiles, fixed with mortar or chemical-set adhesive.</li> <li>Asphalt tiles, fixed with water resistant adhesive.</li> </ul>
<b>Wall Structure</b>	<ul style="list-style-type: none"> <li>Solid brickwork, blockwork, reinforced, concrete or mass concrete.</li> </ul>
<b>Roofing Structure</b> (for Situations Where the Relevant Flood Level is Above the Ceiling)	<ul style="list-style-type: none"> <li>Reinforced concrete construction.</li> <li>Galvanised metal construction.</li> </ul>
<b>Doors</b>	<ul style="list-style-type: none"> <li>Solid panel with water proof adhesives.</li> <li>Flush door with marine ply filled with closed cell foam.</li> <li>Painted metal construction.</li> <li>Aluminium or galvanised steel frame.</li> </ul>
<b>Wall and Ceiling Linings</b>	<ul style="list-style-type: none"> <li>Fibro-cement board.</li> <li>Brick, face or glazed.</li> <li>Clay tile glazed in waterproof mortar.</li> <li>Concrete.</li> </ul>

BUILDING COMPONENT	FLOOD COMPATIBLE MATERIAL
	<ul style="list-style-type: none"> <li>Concrete block.</li> <li>Steel with waterproof applications.</li> <li>Stone, natural solid or veneer, waterproof grout.</li> <li>Glass blocks.</li> <li>Glass.</li> <li>Plastic sheeting or wall with waterproof adhesive.</li> </ul>
<b>Insulation</b>	<ul style="list-style-type: none"> <li>Foam (closed cell types).</li> </ul>
<b>Windows</b>	<ul style="list-style-type: none"> <li>Aluminium frame with stainless steel rollers or similar corrosion and water resistant material.</li> </ul>
<b>Nails, Bolts, Hinges and Fittings</b>	<ul style="list-style-type: none"> <li>Brass, nylon or stainless steel.</li> <li>Removable pin hinges.</li> <li>Hot dipped galvanised steel wire nails or similar.</li> </ul>
<b>Electrical and Mechanical Equipment</b>	<p>For dwellings constructed on land to which this chapter applies, the electrical and mechanical materials, equipment and installation should conform to the following requirements.</p> <ul style="list-style-type: none"> <li>Main power supply</li> </ul> <p>Subject to the approval of the relevant authority the incoming main commercial power service equipment, including all metering equipment, shall be located above the relevant flood level. Means shall be available to easily disconnect the dwelling from the main power supply.</p> <ul style="list-style-type: none"> <li>Wiring</li> </ul> <p>All wiring, power outlets, switches, etc., should, to the maximum extent possible, be located above the relevant flood level. All electrical wiring installed below the relevant flood level should be suitable for continuous submergence in water and should contain no fibrous components. Earth core leakage systems (or safety switches) are to be installed. Only submersible-type splices should be used below the relevant flood level. All conduits located below the relevant designated flood level should be so installed that they will be self-draining if subjected to flooding.</p> <ul style="list-style-type: none"> <li>Equipment</li> </ul> <p>All equipment installed below or partially below the relevant flood level should be capable of disconnection by a single plug and socket assembly.</p> <ul style="list-style-type: none"> <li>Reconnection</li> </ul>

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BUILDING COMPONENT	FLOOD COMPATIBLE MATERIAL
	<ul style="list-style-type: none"><li>Should any electrical device and/or part of the wiring be flooded it should be thoroughly cleaned or replaced and checked by an approved electrical contractor before reconnection.</li></ul>

## **Appendix: C    PRESCRIPTIVE STANDARDS - SPECIFIC FLOODPLAINS**

- Schedule 1 – Towradgi Creek Floodplain;
- Schedule 2 – Hewitts/Slacky/Woodlands/Tramway/ Thomas Gibson Creeks Floodplain;
- Schedule 3 – Minnegang Creek Floodplain;
- Schedule 4 – Allan's Creek Floodplain;
- Schedule 5 – Fairy and Cabbage Tree Creeks Floodplain;
- Schedule 6 – Mullet/Brooks Creeks Floodplain;
- Schedule 7 – Wollongong City Floodplain;
- Schedule 8 - Whartons, Collins, Farrahars Creeks, Bellambi Gully and Bellambi Lake Floodplains ;
- Schedule 9 – Lake Illawarra Floodplain;
- Schedule 9a – Lake Illawarra - Windang Peninsula; and
- Schedule 10 – All other floodplains.



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**SCHEDULE 1: PRESCRIPTIVE CONTROLS – TOWRADGI CREEK FLOODPLAIN**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk								Medium Flood Risk								High Flood Risk ( & Interim Riverine Corridor)							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level		3										2,7	2 or 5	2	1	2,4 6							1	2,4 6
Building Components		2										1	1	1	1	1							1	1
Structural Soundness		3		2		3						2	2	3	2	2							1	1
Flood Affection		2	2		2	2					1	1 or 2	1	1	1	2							1	1
Evacuation		2, 4	5	3, 4	4	3, 4					5	3,4	1,4	3,4	1								1	
Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5	2,3 5							2,3 5	2,3 5
Not Relevant		Unsuitable Land Use																						

**Note:**

- Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- Freeboard** equals an additional height of 500mm.

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### Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP flood level plus freeboard unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP flood level plus freeboard.
- 3 All Floor Levels to be equal to or greater than the *PMF flood* level plus *freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the flood planning level, more than 30% of the floor area to be above the flood planning level or premises to be flood proofed below the flood planning level.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 100 year *flood* level plus *freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF* level plus *freeboard*.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood level plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood level plus freeboard , *PMF* plus *freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood* plus *freeboard*.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.

### Evacuation

- 1 *Reliable access* or *refuge* required during a 100 year *flood*.

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- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

## SCHEDULE 2: PRESCRIPTIVE CONTROLS – HEWITTS CREEK FLOOPLAIN

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk								Medium Flood Risk								High Flood Risk ( & Interim Riverine Corridor)							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level		3										2, 7	2 or 5	2	1	2, 4, 6							1	2, 4, 6
Building Components		2										1	1	1	1	1							1	1
Structural Soundness		3		3		3						3	2	3	2	2							1	1
Flood Affection		2	2		2	2					1	1 or 2	2	2	2	2							1	1
Evacuation		2, 4	5	3, 4	4	3, 4					5	3, 4	1, 4	3, 4	1								1	
Management & Design		4, 5	1								1		2, 3, 5	2, 3, 5	2, 3, 5	2, 3, 5							2, 3, 5	2, 3, 5
	Not Relevant	Unsuitable Land Use																						

**Note:**

- a. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- b. For the Hewitt's Catchments it is recommended that filling in floodplain areas east of the Main South Coast Railway embankment be permitted, provided that the applicant can demonstrate there are no local hydraulic impacts on adjoining property as a result of this filling. Filling in floodplain areas west of the Main South Coast Railway is not to be permitted unless an Engineers report is provided that certifies that the development will not increase flood affectation elsewhere.
- c. Terms in *italics* are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- d. **Freeboard** equals an additional height of 500mm.

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### Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level plus freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 100 year *flood level plus freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level plus freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level plus freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level plus freeboard*.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood plus freeboard*.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
  2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.
- 

### Evacuation

- 1 *Reliable access or refuge required during a 1% AEP flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
  - 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.
  - 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

#### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.



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**SCHEDULE 3: PRESCRIPTIVE CONTROLS – MINNEGANG CREEK FLOODPLAIN**

		Flood Risk Precincts (FRP's)																								
		Low Flood Risk								Medium Flood Risk								High Flood Risk (and Interim Riverine Corridor)								
Planning Consideration		Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
	Floor Level		3										2,6	2 or 5	2,6	1	2,4								1	2,4
	Building Components		2										1	1	1	1	1								1	1
	Structural Soundness		3		2		3						2	2	2	2	2								1	1
	Flood Affection		2	2		2	2					1	2	2	2	2	2								1	1
	Evacuation		2, 4	*	3, 4	4	3, 4					*	3, 4	1,4	3,4	1									1	
	Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5,	2,3 5								2,3 5	2,3 5
	Not Relevant		Unsuitable Land Use							*	Refer to 'Management & Design' planning consideration for subdivision															

**Notes:**

1. Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
2. Terms in italics are defined in the glossary of this Plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.

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### Floor Level

- 1 All floor levels to be equal to or greater than the 5% AEP *flood* level plus *freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood* level plus *freeboard*.
- 3 All floor levels to be equal to or greater than the *PMF flood* level plus *freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical and no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area is to be above the *flood planning level* or premises to be flood-proofed below the *flood planning level*.
- 6 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components and Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood* level plus *freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF flood* level plus *freeboard*.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP *flood* plus *freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP *flood* plus *freeboard*.
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a *PMF flood* plus *freeboard*.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere.
- 2 The impact of the development on flooding elsewhere to be considered.

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**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
  2. Changes in *flood* levels and velocities caused by alteration of conveyance of *flood* waters.
- 

### Evacuation

- 1 *Reliable access or refuge* required during a 1% AEP *flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

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- 3 *Reliable access* for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF flood* level, or a minimum of 40% of the gross floor area of the dwelling to be above the *PMF flood* level.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.

Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with this Plan.
- 2 Site Emergency Response Flood plan required (except for single- dwelling houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood* level plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF flood* level plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

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**SCHEDULE 4: PRESCRIPTIVE CONTROLS – ALLANS CREEK FLOODPLAIN**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk^								Medium Flood Risk^								High Flood Risk^ (& Interim Riverine Corridor)							
	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Planning Consideration																								
Floor Level		3										2, 6	1, 2 or 5	2,6	1	2,4					1		1	2,4 6
Building Components		2										1	1	1	1	1					1		1	1
Structural Soundness		3		3		3						3	2	3	2	2					1		1	1
Flood Affection		2	2		2	2					1	1	1	1	1	2					1		1	1
Evacuation		2, 4	*	3, 4	4	3, 4					*	3, 4	1,4	3,4	1						*		1	
Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5,6	2,3 5					2,3 5		2,3 5	2,3 5

	Not Relevant		Unsuitable Land Use		*	Refer to 'Management & Design' planning consideration for subdivision		Industrial Only, Commercial Not Permitted
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### Floor Level

- 1 For industrial land use only – All Floor Levels to be equal to or greater than the 1% AEP flood unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 0.5m (freeboard).
- 3 All Floor Levels to be equal to or greater than the PMF flood level plus 0.5m (freeboard).
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components & Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus 0.5m (freeboard).
- 2 All structures to have flood compatible building components below or at the PMF level plus 0.5m (freeboard).

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus freeboard, or a PMF plus freeboard if required to satisfy evacuation criteria (*see below*).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF flood plus freeboard.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere, includes medium and high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

### Evacuation

- 1 Reliable access or refuge required during a 1% AEP flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF flood.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20sqm of the dwelling/premises to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.

- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with this chapter.
  - 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the PMF.
  - 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 0.5m (freeboard).
  - 4 Applicant to demonstrate that area is available to store goods above the PMF plus 0.5m (freeboard).
  - 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.
- \* adapted from this chapter for Towradgi Creek and modified for the Allan's Creek Floodplain.
- ^ Flood Risk Precinct Definitions for Allan's Creek – see Section 3.

Any proposed development will also need to be consistent with other Council requirements.



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**SCHEDULE 5: PRESCRIPTIVE CONTROLS – FAIRY CABBAGE TREE CREEK**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk								Medium Flood Risk								High Flood Risk (& Interim Riverine Corridor)							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level		3										2,7	2 or 5	2	1	2,4 6							1	2,4 6
Building Components		2										1	1	1	1	1							1	1
Structural Soundness		3		2		3						2	2	3	2	2							1	1
Flood Affection		2	2		2	2					1	1 or 2	1	1	1	2							1	1
Evacuation		2, 4	5	3, 4	4	3, 4					5	3, 4	1, 4	3, 4	1								1	
Management & Design		4, 5	1								1		2, 3 5	2, 3 5	2, 3 5	2, 3 5							2, 3 5	2, 3 5
Not Relevant	Unsuitable Land Use																							

**Note:**

- Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- Terms in *italics* are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- Freeboard** equals an additional height of 500mm.

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### Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP flood level plus freeboard unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus freeboard.
- 3 All Floor Levels to be equal to or greater than the PMF flood level plus freeboard.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components & Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF level plus freeboard.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP flood plus freeboard, PMF plus freeboard if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a PMF flood plus freeboard.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

**Note:** When assessing *flood* affection the following must be considered:

1. Loss of net storage of flood waters in the *floodplain*. Compensatory cut to fill earthworks in the floodplain may be a means to ensure no net loss of flood water storage.
2. Changes in *flood* levels and velocities caused by alteration of conveyance of *flood* waters.

### Evacuation

- 1 Reliable *access or refuge* required during a 1% AEP flood.
- 2 Reliable *access* for pedestrians and vehicles required during an PMF flood.

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- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20sqm of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus freeboard.
- 4 Applicant to demonstrate that area is available to store goods above the PMF level plus freeboard.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

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**SCHEDULE 6: PRESCRIPTIVE CONTROLS – MULLET AND BROOKS CREEK**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk								Medium Flood Risk								High Flood Risk ( & Interim Riverine Corridor)							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level	3											2,7	2 or 5	2	1	2,4 6							1	2,4 6
Building Components	2											1	1	1	1	1							1	1
Structural Soundness	3		2		3							2	2	3	2	2							1	1
Flood Affection	2	2		2	2						1	1 or 2	1	1	1	2							1	1
Evacuation	2, 4	5	3, 4	4	3, 4						5	3,4	1,4	3,4	1								1	
Management & Design	4, 5	1									1		2,3 5	2,3 5	2,3 5	2,3 5							2,3 5	2,3 5
Not Relevant	Unsuitable Land Use																							

**Note:**

- Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- Freeboard** equals an additional height of 500mm.

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### Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level plus freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood level plus freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level plus freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level plus freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level plus freeboard*.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*, *PMF plus freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood plus freeboard*.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.

### Evacuation

- 1 *Reliable access or refuge required during a 1% AEP flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

#### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.



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**SCHEDULE 7: PRESCRIPTIVE CONTROLS – WOLLONGONG CITY FLOODPLAIN**

	Flood Risk Precincts (FRP's)																								
	Low Flood Risk								Medium Flood Risk								High Flood Risk (& Interim Riverine Corridor)								
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	
Floor Level		3		8	8	8		8				2 , 7	1,2 or 5	2	1	2,4								1	2,4 6
Building Components		2										1	1	1	1	1								1	1
Structural Soundness		3		3		3						3	2	3	2	2								1	1
Flood Affection		2	2		2	2					1	1	1	1	1	2								2	1,2
Evacuation		2, 4	*	3, 4	4	3, 4					*	3 , 4	1,4	3,4	1	4								1	4
Management & Design		4, 5	1								1		2,3 5	2,3 5	2,3 5,6	2,3 5								2 , 3 5	2,3 5

	Not Relevant	Unsuitable Land Use	*	Refer to 'Management & Design' planning consideration for subdivision
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**Note:**

- Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- Freeboard** equals an additional height of 500mm

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## Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level plus freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood level plus freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level plus freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).
- 8 Habitable flood level to be a minimum of 300mm above finished adjacent ground level.

## Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level plus freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level plus freeboard*.

## Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*, *PMF plus freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood plus freeboard*.

## Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the *floodplain*.
2. Changes in *flood* levels & velocities caused by alteration of conveyance of *flood* waters.

## Evacuation

- 1 *Reliable access or refuge required during a 1% AEP flood.*

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- 2     *Reliable access* for pedestrians and vehicles required during a *PMF flood*.
- 3     Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4     The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.

Management and Design

- 1     Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2     *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3     Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4     Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5     No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

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**SCHEDULE 8: PRESCRIPTIVE CONTROLS – COMBINED CATCHMENTS OF WHARTONS, COLLINS AND FARRAHARS CREEKS, BELLAMBI GULLY AND BELLAMBI LAKE FLOODPLAINS**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk								Medium Flood Risk								High Flood Risk ( & Interim Riverine Corridor)							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level		3									2, 7	2 or 5	2	1	2, 4 6								1	2, 4 6
Building Components		2									1	1	1	1	1								1	1
Structural Soundness		3		3		3					2	2	3	2	2								1	1
Flood Affection		2	2		2	2				1	1 or 2	1	1	1	1	2							1	1
Evacuation		2, 4	*	3, 4	4	3, 4				*	3, 4	1, 4	3, 4	1									1	
Management & Design		4, 5	1							1		2, 3 5	2, 3 5	2, 3 5	2, 3 5								2, 3 5	2, 3 5

	Not Relevant		Unsuitable Land Use	*	Refer to 'Management & Design' planning consideration for subdivision
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**Notes:**

\*

- Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications..
- Terms in italics are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- Freeboard equals an additional height of 500mm.

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### Floor Level

- 1 All Floor Levels to be equal to or greater than the 5% AEP *flood level plus freeboard* unless justified by site specific assessment.
- 2 *Habitable floor* levels to be equal to or greater than the 1% AEP *flood level plus freeboard*.
- 3 All Floor Levels to be equal to or greater than the *PMF flood level plus freeboard*.
- 4 Floor levels to be as close to the flood planning level as practical & no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components & Method

- 1 All structures to have *flood compatible building components* below or at the 1% AEP *flood level plus freeboard*.
- 2 All structures to have *flood compatible building components* below or at the *PMF level plus freeboard*.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a 1% AEP *flood plus freeboard*, *PMF plus freeboard* if required to satisfy evacuation criteria (see below).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris & buoyancy up to & including a *PMF flood plus freeboard*.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase *flood* affection elsewhere, includes medium & high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

**Note:** When assessing *flood* affection the following must be considered:

1. Loss of storage in the floodplain.
2. Changes in *flood* levels & velocities caused by alteration of conveyance of flood waters.

### Evacuation

- 1 *Reliable access or refuge required during a 1% AEP flood*.
- 2 *Reliable access* for pedestrians and vehicles required during a *PMF flood*.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest *habitable floor* level to an area of refuge above the *PMF level*, or a minimum of 20sqm of the dwelling to be above the *PMF level*.
- 4 The development is to be consistent with any relevant *flood evacuation strategy* or similar plan.

#### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 *Site Emergency Response Flood plan* required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP *flood level* plus *freeboard*.
- 4 Applicant to demonstrate that area is available to store goods above the *PMF level* plus *freeboard*.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any *flood*.

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**SCHEDULE 9: PRESCRIPTIVE CONTROLS – LAKE ILLAWARRA**

	Flood Risk Precincts (FRP's)																							
	Low Flood Risk								Medium Flood Risk								High Flood Risk (& Interim Riverine Corridor)							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level		3										2,6 or 7	2 or 5	2	1	2,4 6							1	2,4 6
Building Components		2		2								2	1	2	1	1							1	1
Structural Soundness		3		3		3						3	2	3	2	2							1	1
Flood Affection		2,3			2,3	2,3						2,3	2,3	2,3	2,3	2							1,3	1,3
Evacuation		2,4		3,4	4	3,4						3,4	1,4	3,4	3,4								1	
Management & Design		4,5											2,3 5	2,3 5	2,3 5	2,3 5							2,3 5	2,3 5
	Not Relevant		Unsuitable Land Use					Concessional development to use the 1% AEP including Medium Sea Level Rise (0.4m), all other development to use the 1% AEP including High Sea Level Rise (0.91m).																

**Floor Level**

- All floor levels to be equal to or greater than the 5% AEP *flood* level plus freeboard unless justified by site specific assessment.
- Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 0.5m freeboard.
- All floor levels to be equal to or greater than the PMF.
- Floor levels to be as close to the flood planning level as practical and no lower than the existing floor level when undertaking alterations or additions.
- Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- Garage floor level to be no lower than 300mm above finished adjacent ground.
- Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).



### Building Components and Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 3 Engineers report to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF event.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere.
- 2 The impact of the development on flooding elsewhere to be considered.
- 3 No wholesale filling of sites around the foreshore of the lake is permitted, unless supported by a sensitivity analysis indicating that there is no significant impact on flood levels. Also, filling that impacts on active flow areas in the stream networks feeding Lake Illawarra will not be supported. However, filling within existing building areas is permitted. Filling of depressions outside of the existing building areas may be permitted subject to it being demonstrated that there is no loss of flood storage across the site in all events up to the PMF.

### Evacuation

- 1 Reliable access or refuge required during a 1% AEP flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF event.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF, or a minimum of 20m<sup>2</sup> of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 0.5m freeboard.

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- 4 Applicant to demonstrate that area is available to store goods above the PMF.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

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**SCHEDULE 9a: PRESCRIPTIVE CONTROLS – LAKE ILLAWARRA – WINDANG PENINSULA**

	Flood Risk Precincts (FRP's)																															
	Low Flood Risk								Medium Flood Risk								High Flood Risk ( & Interim Riverine Corridor)								Isolation Risk -Applies to the entire Windang Peninsula as shown in Figure 9a. -These controls apply in addition to those applied in flood risk precincts.							
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	
Floor Level		3										2,6 or 7	2 or 5	2	1	2,4 6								1	2,4 6							
Building Components		2		2								2	1	2	1	1								1	1							
Structural Soundness		3		3		3						3	2	3	2	2								1	1							
Flood Affection		2,3			2,3	2,3						2,3	2,3	2,3	2,3	2								1,3	1,3							
Evacuation		2,4		3,4	4	3,4						3,4	1,4	3,4	3,4									1					3,4	4	3,4	
Management & Design		4,5											2,3 5	2,3 5	2,3 5	2,3 5								2,3 5	2,3 5				1		1	
	Not Relevant	Unsuitable Land Use							Concessional development to use the 1% AEP including medium level sea level rise, all other development to use the 1% AEP including high sea level rise.																							

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### Floor Level

- 1 All floor levels to be equal to or greater than the 5% AEP *flood* level plus freeboard unless justified by site specific assessment.
- 2 Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 0.5m freeboard.
- 3 All floor levels to be equal to or greater than the PMF.
- 4 Floor levels to be as close to the flood planning level as practical and no lower than the existing floor level when undertaking alterations or additions.
- 5 Floor levels of shops to be as close to the flood planning level as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components and Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 0.5m freeboard.
- 3 Engineers report to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF event.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere.
- 2 The impact of the development on flooding elsewhere to be considered.
- 3 No wholesale filling of sites around the foreshore of the lake is permitted, unless supported by a sensitivity analysis indicating that there is no significant impact on flood levels. Also, filling that impacts on active flow areas in the stream networks feeding Lake Illawarra will not be supported. However, filling within existing building areas is permitted. Filling of depressions outside of the existing building areas may be permitted subject to it being demonstrated that there is no loss of flood storage across the site in all events up to the PMF.

### Evacuation

- 1 Reliable access or refuge required during a 1% AEP flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF event.

- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF, or a minimum of 20m<sup>2</sup> of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.

#### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.
- 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 0.5m freeboard.
- 4 Applicant to demonstrate that area is available to store goods above the PMF.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

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**SCHEDULE 10: PRESCRIPTIVE CONTROLS – OTHER FLOODPLAINS**

	Flood Risk Precincts (FRP's)															
	Low Flood Risk						Medium Flood Risk						High Flood Risk (& Interim Riverine Corridor)			
Planning Consideration	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development	Essential Community Facilities	Critical Utilities	Subdivision	Residential	Commercial & Industrial	Tourist Related Development	Recreation & Non-Urban	Concessional Development
Floor Level	3											2, 7	2 or 5	2	1	2, 4 6
Building Components	2											1	1	1	1	1
Structural Soundness	3		2		3							2	2	3	2	2
Flood Affection	2	2		2	2					1	1 or 2	1	1	1	1	2
Evacuation	2, 4	5	3, 4	4	3, 4					5	3, 4	1, 4	3, 4	1		
Management & Design	4, 5	1								1		2, 3 5	2, 3 5	2, 3 5	2, 3 5	2, 3 5
Not Relevant	Unsuitable Land Use															

**Note:**

- Filling of the site, where acceptable to Council, may change the FRP considered to determine the controls applied in the circumstances of individual applications.
- Terms in *italics* are defined in the glossary of this plan and Schedule 2 specifies development types included in each land use category. These development types are generally as defined within Environmental Planning Instruments applying to the local government area.
- Freeboard** equals an additional height of 500mm.

**Floor Level**

- All floor levels to be equal to or greater than the 5% AEP *flood* level plus freeboard unless justified by site specific assessment.
- Habitable floor levels to be equal to or greater than the 100 year flood level plus freeboard.
- All floor levels to be equal to or greater than the PMF flood level plus freeboard.
- Floor levels to be as close to the *flood planning level* as practical and no lower than the existing floor level when undertaking alterations or additions.

- 5 Floor levels of shops to be as close to the *flood planning level* as practical. Where below the *flood planning level*, more than 30% of the floor area to be above the *flood planning level* or premises to be flood proofed below the *flood planning level*.
- 6 Garage floor level to be no lower than 300mm above finished adjacent ground.
- 7 Garage and all other non-habitable internal flood levels to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).

### Building Components and Method

- 1 All structures to have flood compatible building components below or at the 1% AEP flood level plus freeboard.
- 2 All structures to have flood compatible building components below or at the PMF level plus freeboard.

### Structural Soundness

- 1 Engineers report to certify that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100 year flood plus freeboard.
- 2 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a 100 year flood plus freeboard, or a PMF plus freeboard if required to satisfy evacuation criteria (*see below*).
- 3 Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF flood plus freeboard.

### Flood Affection

- 1 Engineers report required to certify that the development will not increase flood affection elsewhere, includes medium and high density residential proposals.
- 2 The impact of the development on flooding elsewhere to be considered, includes low density residential.

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**Note:** When assessing flood affection the following must be considered:

1. Loss of storage in the floodplain.
  2. Changes in flood levels and velocities caused by alteration of conveyance of flood waters.
- 

### Evacuation

- 1 Reliable access for pedestrians required during a 100 year flood.
- 2 Reliable access for pedestrians and vehicles required during a PMF flood.
- 3 Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20m<sup>2</sup> of the dwelling to be above the PMF level.
- 4 The development is to be consistent with any relevant flood evacuation strategy or similar plan.
- 5 Applicant to demonstrate that evacuation of potential development as a consequence of a subdivision proposal can be undertaken in accord with this Plan.



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### Management and Design

- 1 Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accord with this plan.
- 2 Site Emergency Response Flood plan required (except for single dwelling-houses) where floor levels are below the *flood planning level*.
- 3 Applicant to demonstrate that area is available to store goods above the 100 year flood level plus freeboard.
- 4 Applicant to demonstrate that area is available to store goods above the PMF level plus freeboard.
- 5 No external storage of materials below the *flood planning level* which may cause pollution or be potentially hazardous during any flood.

Section	Change	Comment
1 Introduction	Consistent with 2012 review (which was not complete or adopted)	
2 Land to which the plan applies	The Plan applies to all floodplains and land below the flood planning area within the City of Wollongong LGA.	Removed reference to flood panning maps. Not all flood planning maps are in LEP. Also, LEP has not been updated with latest mapping
3. Objectives	<ul style="list-style-type: none"> <li>a) Maintain the existing flood regime and flow conveyance capacity;</li> <li>b) Maintain the function of floodway and flood storage areas;</li> <li>c) Reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property;</li> <li>d) Reduce private and public losses from flooding;</li> <li>e) Improve public safety with respect to flooding;</li> <li>f) Minimise the potential impact of development and other activity upon the aesthetic, recreational and environmental value of the waterway corridors;</li> <li>g) Increase public awareness of the hazard and extent of land affected by the full range of potential floods;</li> <li>h) Ensure development must, as far as practical, reduce the existing flood risk, and in no circumstances should the flood risk be worsened;</li> <li>i) Control development within floodplains susceptible to channel erosion, migration, bank failure and slumping; and</li> <li>j) Deal equitably and consistently with all matters requiring Council approval on flood affected land, in accordance with the principles within the latest version of the NSW Floodplain Development Manual or its update.</li> </ul>	More consistent with LEP. More focus on safety and flooding rather than environmental outcomes which are included in E15 - WSUD and E23 - Riparian Management.
4. Definitions	<b>AEP</b> The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. Example, if a peak flood discharge of 500 m <sup>3</sup> /s has an AEP of 1%, it means that there is a 1% chance (that is one-in-100 chance) of a 500 m <sup>3</sup> /s or larger event occurring in any one year. Annual Exceedance Probability: The probability of a rainfall or flood event of given magnitude being equalled or exceeded in any one year.	Consistent with FDM (2005)

4. Definitions	<b>Deck</b> is an outdoor living area attached to a dwelling, which may be covered or uncovered, and is not capable of being used or adapted for use as habitable floor area .	Added following 2012 review
4. Definitions	<b>Enclosed car parking</b> means car parking that is potentially subject to rapid inundation, which consequently increases danger to human life and property damage (such as basement or bunded car parking areas). The following criteria apply for the purposes of determining what is enclosed car parking: a) Flooding of surrounding areas may raise water levels above the perimeter which encloses the car park (normally the entrance), resulting in rapid inundation of the car park to depths greater than 0.8m, and b) Drainage of accumulated water in the car park has an outflow discharge capacity significantly less than the potential inflow capacity.	Added following 2012 review
4. Definitions	<b>Filling</b> means the depositing of soil, rock or other material, Filling does not include the depositing of topsoil, or feature rock imported to the lot, that is intended for use in garden landscaping, turf or garden bed establishment or topdressing of lawns.	
4. Definitions	<b>Floodway Areas</b> Areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked would cause a significant redistribution of flow or a significant increase in flood levels. Where not mapped in an adopted Flood Study or FRMS floodway areas are defined as areas where the velocity x depth product exceeds 0.4 m <sup>2</sup> /s.	
4. Definitions	<b>Freeboard</b> The height above the design flood used, in consideration of local and design factors, to provide reasonable certainty that the risk exposure selected in deciding on a particular design flood is actually provided. It is a factor of safety typically used in relation to the setting of flood levels, levee crest levels and so on. Freeboard compensates for a range of factors including wave action, localised hydraulic behaviour and levee settlement, all of which increase water levels or reduce the level of protection provided by levees, Freeboard should not be relied upon to provide protection for flood events larger than the relevant defined flood event of a design flood.	

4. Definitions	<p><b>Practical</b> means that which in the opinion of Council can be achieved within the design of the development, while not necessitating:</p> <p>a) floor levels to be raised in a way that would unreasonably hinder access to and from existing floor levels or ground levels on the same site or adjacent public areas; and</p> <p>b) the raising of a structure to a height that would result in unacceptable impacts on the amenity of adjacent residential properties; and</p> <p>c) the height or presentation of a building that would be inconsistent with the existing or planned streetscape.</p>	Added following 2012 review. May allow some flexibility in assessment
4. Definitions	<p><b>Suitably Qualified Civil Engineer</b> A civil engineer who is included in the National Professional Engineers Register, Australia administered by the Institution of Engineers Australia or is eligible for membership of Engineers Australia.</p>	Council engages consultants who are not on the NER for flood studies and stormwater designs
6. Flood Studies	Moved from E14	More relevant in E13
6.1 Hydraulic Design - Estimation of Design flood level	Moved from E14	More relevant in E13
6.2 Conduit Blockage	Modified from Policy 2016. Only including the "Risk Management" factors	See EMC Report
6.3 Modelling of Buildings	Many different methods are being applied by industry.	

6.7 Overland Flow	<p>Overland flow is runoff from rainfall which flows over the land before entering a watercourse, creek, river or lake or dam. Overland flow is typically shallow and fast flowing. Where a watercourse has been filled or piped, flooding resulting from overflows from the filled/piped watercourse is considered mainstream flooding and not overland flow. The flood planning level for overland flow is the 1% AEP plus 0.3m. In an overland flow path, where the difference between the PMF and 1% flood level is greater than 0.3m, freeboard of 0.5m to the 1% flood applies. All other development controls of this chapter and E14 – Stormwater management also apply to overland flow. In locations where there is uncertainty whether flooding is mainstream of overland flow, Council will decide.</p>	Aims to clarify Councils position regarding overland flow.
7.3 Flood Risk Precincts	<p><b>High Flood Risk Precinct</b> - The High FRP is where high flood damages, potential risk to life and/or evacuation problems would be anticipated or where development would significantly or adversely alter flood behaviour. This area includes floodways. In this precinct, there would be a significant likelihood of flood damages and/or danger to life. The High FRP includes:</p> <ul style="list-style-type: none"> <li>i) Areas greater than H3 hazard conditions during a 1% AEP flood from Figure 3;</li> <li>ii) Land within 10m from the top of a watercourse bank; and</li> <li>iii) Floodways.</li> </ul>	H3 better aligns with current best practice flood hazard mapping. Floodways not previously captured
7.3 Flood Risk Precincts	<p><b>Low Flood Risk Precinct - i)</b> All areas within the floodplain (i.e. within the extent of the PMF) but not identified within either the High FRP or the Medium FRP; and</p> <p><b>ii)</b> All areas within the 2100 Coastal Zone Inundation Extent not classified Medium Flood Risk or High Flood Risk Precinct.</p>	Added: All areas within the 2100 Coastal Zone Inundation Extent not classified Medium Flood Risk or High Flood Risk Precinct. Recommended in the Wollongong Coastal Zone Management Plan (2017)

7.4 Which controls apply to proposed developments?	<p>Included:</p> <ul style="list-style-type: none"><li>• Schedule 5 – Mullet/Brooks Creeks Floodplain;</li><li>• Schedule 6 – Fairy and Cabbage Tree Creeks Floodplain;</li><li>• Schedule 7 – Wollongong City Floodplain;</li><li>• Schedule 8 - Whartons, Collins, Farrahars Creeks, Bellambi Gully and Bellambi Lake Floodplains</li><li>• Schedule 9 – Lake Illawarra Floodplain; and</li></ul>																																			
7.4.2 Performance Criteria	a) The proposed development should not result in any increased risk to life;	Supports objectives																																		
7.4.3 Prescriptive Controls	<p><b>Table 2. Permissible Flood Impacts</b></p> <table><tr><th rowspan="2">Development/ Project Type</th><th colspan="6">Allowable Impact (mm)</th></tr><tr><th>Critical Uses and Facilities</th><th>Sensitive Uses and Facilities</th><th>Residential</th><th>Commercial or Industrial</th><th>Tourist Related Development</th><th>Recreation or Non-urban Uses</th></tr><tr><td>Individual Property</td><td>10</td><td>10</td><td>20</td><td>20</td><td>20</td><td>20</td></tr><tr><td>Multi Lot Subdivision</td><td>10</td><td>10</td><td>20</td><td>50</td><td>50</td><td>50</td></tr><tr><td>Government Infrastructure Projects</td><td>20</td><td>20</td><td>100</td><td>150</td><td>150</td><td>150</td></tr></table> <p>New development must not increase the frequency of over floor flooding for residential, commercial or industrial buildings in a 20%, 1% or PMF event.</p>	Development/ Project Type	Allowable Impact (mm)						Critical Uses and Facilities	Sensitive Uses and Facilities	Residential	Commercial or Industrial	Tourist Related Development	Recreation or Non-urban Uses	Individual Property	10	10	20	20	20	20	Multi Lot Subdivision	10	10	20	50	50	50	Government Infrastructure Projects	20	20	100	150	150	150	Allowable impact in events up to the 1% AEP flood. PMF impacts merit based.
Development/ Project Type	Allowable Impact (mm)																																			
	Critical Uses and Facilities	Sensitive Uses and Facilities	Residential	Commercial or Industrial	Tourist Related Development	Recreation or Non-urban Uses																														
Individual Property	10	10	20	20	20	20																														
Multi Lot Subdivision	10	10	20	50	50	50																														
Government Infrastructure Projects	20	20	100	150	150	150																														

8. Filling of the Flood Plain	<p>1. Filling in flood prone areas is not permitted unless:</p> <ul style="list-style-type: none"> <li>• A FRMP for the catchment has been adopted which allows filling to occur; or</li> <li>• a report from a suitably qualified engineer is submitted to Council that certifies that the development will not increase flood affectation elsewhere.</li> </ul> <p>2. Filling of individual sites in isolation without consideration of the cumulative effects is not permitted. A case by case decision making approach cannot take into account the cumulative impact on flooding behaviour and associated risks caused by individual developments. Any proposal to fill a site must be accompanied by an analysis of the effect on flood levels of similar filling of developable sites in the area.</p> <p>3. This analysis would form part of a flood study prepared in accordance with Chapters E13 and E14 of this DCP.</p> <p>4. There is to be no net loss of floodplain storage. Compensatory cuts maybe used to offset loss of floodplain storage. Cut areas must be taken form lower in the floodplain than fill areas. Cut and fill drawings must be supplied to Council.</p> <p>5. No net loss of flood storage is permitted in any flood event up to and including the PMF unless identified as permissible in a FRMS/P. Cut and fill plans must demonstrate no net loss of floodplain storage. Cut areas must be taken from lower in the floodplain than fill areas.</p>	
Appendix A - Land Use Categories	From WLEP (2009)	
Appendix A - Land Use Categories	<p><b>Concessional Development.</b></p> <p>Redevelopment within the existing footprint of approved structures. Existing elevated footings or crawl space must be maintained to allow floodwaters to flow beneath the structure.</p>	Allow knockdown rebuilds
Appendix A - Land Use Categories	Council may consider the election of a single dwelling up to 250m2 (external) within the high flood risk precinct on vacant land. Vacant land refers to residential allotments which existed prior to 2009 .	In place of the Special Considerations - Section 8.1.f) - To allow for land zoned residential prior to 2009 DCP.



Appendix: A LAND USE CATEGORIES - TEMPORARY EVENTS	<p><b>Temporary public events</b> include markets, circuses music festivals, outdoor cinema's etc. When such events include temporary structures, public congregation areas or car parking areas within the 1% AEP flood extent, an event specific flood risk assessment and management plan is required. The risk assessment and management plan must be prepared by a suitably qualified engineer with relevant experience in floodplain management.</p> <p>The risk assessment must include the depth, velocity and timing of inundation in a 20% and 1% event. The management plan must demonstrate how the flood risk will be managed.</p> <p>In areas of flash flooding, which includes the majority of the Wollongong LGA (except Lake Illawarra floodplain), it is often not possible to provide an appropriate flood response during an event due to the fast rate of rise of floodwaters and limited response time. Therefore, the only way to mitigate the flood risk in flash flood areas is to include provisions in the event management plan that require monitoring of weather forecasts in the days leading up to the event, and a requirement that the event be cancelled if there is a risk of flooding and/or a forecast for heavy or prolonged rainfall.</p>	Clarify Councils position
All Schedules	Garage and <u>all other non-habitable internal flood levels</u> to be no lower than the 1% AEP flood level minus 300mm or 300mm above finished adjacent ground (whichever is the greater).	Added <u>all other non-habitable internal flood level</u>
All Schedules	Removed requirement for evacuation/refuge for concessional development	Concessional development is not considered an intensification



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## 1 INTRODUCTION

1. This chapter of the DCP details Council's requirements for stormwater drainage design and on-site stormwater detention for all developments within the City of Wollongong Local Government Area (LGA). 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:
  - a) Wollongong Local Environmental Plan;
  - b) Wollongong City Council DCP Chapter E13: Floodplain Management;
  - c) Wollongong City Council DCP Chapter E15: Water Sensitive Urban Design;
  - d) Australian Rainfall and Runoff (1987 and 2019 versions);
  - e) Sydney Water Guidelines for Building over or Adjacent to Stormwater Assets;
  - f) Austroads; and
  - g) Other relevant local and state guidance.
3. This chapter of the DCP embraces the concept of the "Major/Minor" approach. The minor system includes the gutter and underground pipe network. 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.

### 1.1 OBJECTIVES

1. The 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.

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## 2 DEFINITIONS / TECHNICAL TERMS

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

<b>Absorption Trench</b>	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.
<b>Annual exceedance probability (AEP)</b>	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. Example, if a peak flood discharge of 500 m <sup>3</sup> /s has an AEP of 1%, it means that there is a 1% chance (that is one-in-100 chance) of a 500 m <sup>3</sup> /s or larger event occurring in any one year.
<b>AHD</b>	Australian Height Datum: National reference datum for level.
<b>Alluvium</b>	Material eroded, transported and deposited by streams.
<b>Antecedent</b>	Pre-existing conditions (e.g. wetness of soils).
<b>Areal</b>	Variation over an area of a particular parameter.
<b>Average Recurrence Interval (ARI)</b>	The long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods with a discharge as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event.
<b>ARR1987</b>	Australian Rainfall and Runoff: 1987 published by the Institute of Engineers, Australia
<b>ARR2019</b>	Australian Rainfall and Runoff 2019, published by the Commonwealth of Australia (Geoscience Australia).
<b>Backwater Profile</b>	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.
<b>Basement Car parking</b>	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.
<b>Catchment</b>	Area draining into a particular creek system, typically bounded by higher ground around its perimeter.
<b>Conveyance</b>	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.
<b>Cover</b>	Type and distribution of vegetation on catchment.
<b>Critical Depth</b>	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

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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.

<b>Critical Flow</b>	The state of flow where the water depth is at the critical depth and when the inertial and gravitational forces are equal. When Froude $N^0 = 1.0$ .
<b>Culvert</b>	An enclosed conduit (typically pipe or box) that conveys stormwater below ground.
<b>Discharge</b>	The flow rate of water.
<b>DPIE</b>	Department of Planning Infrastructure and Environment
<b>Escarpment</b>	A cliff or steep slope, of some extent, generally separating two level or gently sloping areas.
<b>Flood</b>	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 tsunamis.
<b>Freeboard</b>	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.
<b>Froude <math>N^0</math></b>	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).
<b>Geotechnical</b>	Relating to Engineering and the materials of the earth crust.
<b>Gradient</b>	Slope or rate of fall of land/pipe/stream.
<b>Gully</b>	Narrow ravine, small valley.
<b>Headwall</b>	Wall constructed around inlet or outlet of a culvert.
<b>Hydrology</b>	A term given to the study of rainfall and runoff processes as relates to the derivation of flood discharges.
<b>Hyetograph</b>	A graph of rainfall intensity against time.
<b>Hydrograph</b>	A graph of flood flow against time.
<b>Hydraulic</b>	A term given to the study of water flow, as relates to the evaluation of flow depths, levels and velocities.
<b>Ha</b>	Hectare. (Area = 10,000m <sup>2</sup> )
<b>IFD</b>	Intensity - Frequency – Duration Rainfall parameters used to describe rainfall at a particular location.



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<b>Isohyets</b>	Lines joining points of equal rainfall.
<b>FSL</b>	Flood Surface Level.
<b>FPL</b>	Flood Planning Level
<b>FPDM</b>	Floodplain Development Manual: Guidelines for the management of flood liable land published by NSW State Government, April 2005.
<b>Km</b>	Kilometre. (1 km distance = 1,000m)
<b>M</b>	Metre.
<b>M<sup>2</sup></b>	Square Metre.
<b>M<sup>3</sup>/sec</b>	Cubic Metre per Second.
<b>Major/Minor Stormwater System</b>	Refer under GENERAL.
<b>Manning's n</b>	A measure of channel or pipe roughness.
<b>Minor Development</b>	Developments discharging less than 55L/S and discharging to kerb.
<b>Normal Depth</b>	The depth that would exist if the flow were uniform.
<b>NWC</b>	Natural Water Course: A small creek or channel in its natural condition.
<b>Orographic</b>	Pertaining to changes in relief, i.e. mountains.
<b>Orthophoto</b>	Aerial photograph with land contours, boundaries or reference grids added.
<b>Pluviograph</b>	An instrument that records rainfall collected as a function of time.
<b>PMF</b>	Probable Maximum Flood: Flood calculated to be the maximum ever likely to occur.
<b>PMP</b>	Probable Maximum Precipitation: Rainfall calculated to be the maximum ever likely to occur.
<b>Receiving Waters</b>	A river, lake or the ocean.
<b>RCP</b>	Reinforced Concrete Pipe.
<b>Run-off</b>	Stormwater running off a catchment during a storm on the catchment.
<b>Scour</b>	Erosion of soil in the banks or bed of a creek, typically occurring in areas of high flow velocities and turbulence.
<b>Siltation</b>	The filling or rising up of the bed of a watercourse or channel by deposited silt.



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<b>Spurs</b>	Secondary ridges typically occurring at right angles to a main ridgeline, formed by stream erosion of the slopes of the main ridge.
<b>Stormwater</b>	Surface runoff generated from rainfall events.
<b>Stratigraphy</b>	Depositional sequence of deposited sand, clays rocks and other material.
<b>Sub-critical Flow</b>	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.
<b>Surcharge Flow</b>	Unable to enter a culvert or exiting from a pit because of inadequate capacity.
<b>Supercritical Flow</b>	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.
<b>Suitably Qualified Civil Engineer</b>	A civil engineer who is included in the National Professional Engineers Register, Australia administered by the Institution of Engineers Australia or is eligible for membership of Engineers Australia.
<b>Topography</b>	The natural surface features of a region.
<b>Transpiration Pit</b>	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.
<b>Trunk Drainage</b>	High capacity channels or networks which carry runoff from local street drainage systems to receiving waters and forms part of the major system as defined in ARR2019 Book 9.
<b>Urbanisation</b>	The change in land use from natural to developed state.
<b>Watercourse</b>	Any river, creek, stream or chain of ponds, whether artificially modified or not, in which water usually flows, either continuously or intermittently, in a defined bed or channel, but does not include a waterbody (artificial).
<b>Yr</b>	Year.
<b>Zone of Influence (ZOI)</b>	The area around an asset (both at ground level and below the ground) that may impact on an asset

### 3 AVERAGE RECURRENCE INTERVAL

#### 3.1 Minor System ARI

1. The design average recurrence interval for the gutter and piped stormwater (minor) system is:

- a) Road Drainage (Longitudinal)

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 7 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

For all land use types including rural residential, urban residential, commercial and industrial, the ARI must be 10 years. Section 10 details the requirements for on-site detention (OSD).

#### 3.2 Major System ARI

1. The major system includes “escape routes” or overland flow routes for flows in excess of the piped system capacity must be designed and or checked to a 100 year ARI event. The major system includes the road profile, overland flow paths and trunk drainage networks. The major system aims to ensure the safety of pedestrians and vehicle traffic whilst avoiding property damage and risk to life.

##### 3.2.1 Trunk Drainage

1. Trunk drainage networks must be designed to a 100 year ARI. Spillways of detention basins must be designed to safely pass the PMF.

##### 3.2.2 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 depths and velocity are within H2 in a 100 year event as shown in Figure 3.
  - b) The appropriate blockage factor is applied in accordance with Chapter E13 Section 6.2.
  - c) The road section must be able to withstand such overtopping without scour.

### 4 PRELIMINARY LAYOUT OF PROPOSED STORMWATER SYSTEM

1. A field survey is required to determine stormwater paths. Existing stormwater systems must be analysed using either reliable work-as-executed plans or alternatively, if these are not available, a site and field survey.

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2. A proposed stormwater layout is plotted taking into account rainfall data applicable to the site, times of concentration, gutter and pit capacities.
3. A procedure for locating pits is detailed in Section 6 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 HYDROLOGY

### 5.1 Design rainfall intensities

- a) Council is transitioning to ARR2019 through the completion of Floodplain Risk Management Studies and Plans. During this transition, flow estimates are to use ARR1987 IFDs and hydrologic procedures unless an adopted Floodplain Risk Management Study recommends otherwise.

### 5.2 Estimating Flows

- a) Figure 1 indicates the likely range of effectiveness for different hydrologic models against flood magnitude and model scale. The applicant must justify the appropriateness of any selected hydrologic model selected for the estimation of minor and major system flows.

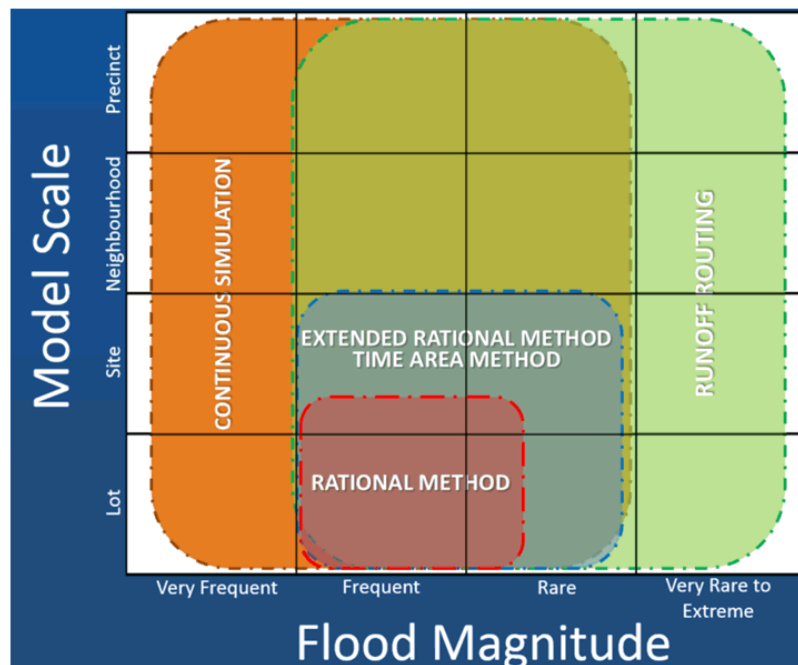


Figure 1 Types of Urban Hydrologic Models and their Application Range (ARR2019, Book 9, Chapter 6)

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### 5.3 Conveyance

- Overland flow times must be determined using the Kinematic Wave Equation or an appropriate computer model.
- Table 1 shows the retardance coefficient “n\*” to be used in the calculation of overland flow time times when using the Kinematic Wave Equation. Note the retardance coefficient “n\*” is not to be confused with Manning’s “n”.

Table 1: Surface Retardance Coefficients

Land Use	Retardance Coefficients (n*)
Road/Paved Areas	0.01
Parkland – Grassed	0.17
Open Space (Natural Bushland)	0.30

### 5.4 Runoff Coefficient

- The runoff coefficient to be adopted for design must be determined from Figure 2.
- The runoff coefficient must be estimated separately for each land use. Table 2 estimates the percentage impervious area for various types of land uses. Actual percentages of impervious area may be used as long as they take into account the ultimate development of the site.

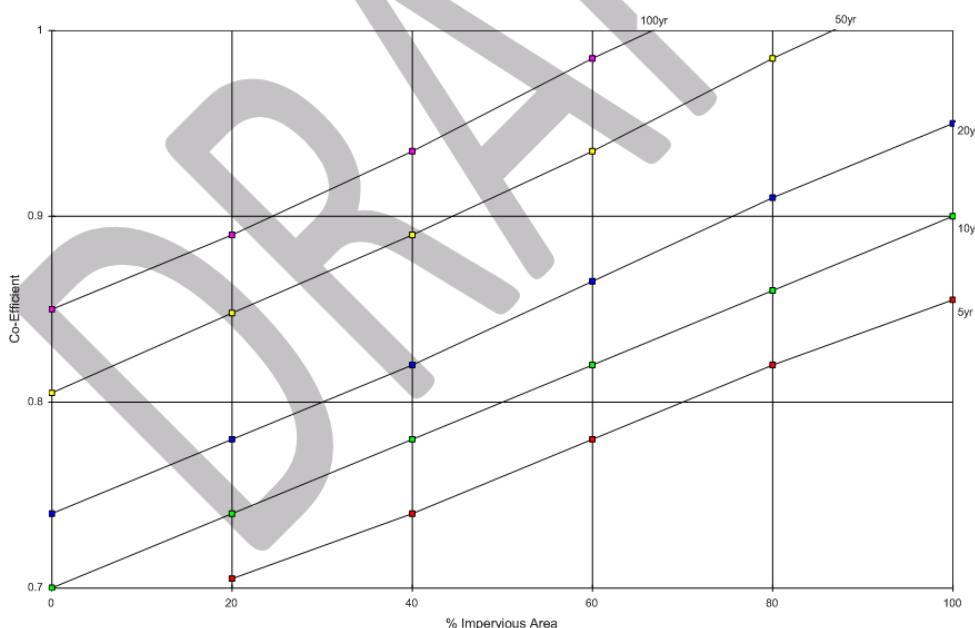


Figure 2: Determination of Runoff Coefficient

**Table 2: Percentage Impervious Area for Land use type**

Land Use	Percentage Impervious Area
Normal Residential Lots	60%
Half Width Road Reserve	95%
Medium Density Residential Lots	80%
Commercial Areas	100%
Industrial Areas	100%
Public Recreation Areas	25%

## 6 MINOR SYSTEM

### 6.1 Pit Location

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

- At the upstream tangent point of the kerb return (i.e. at an intersection);
- Where the gutter flow width exceeds 2.5 metres;
- Where the gutter flow depth exceeds the top of kerb;
- 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;
- Clear of driveways, access ways and pedestrian pram ramps;
- Where spacing between pits exceeds 80m;
- In line with common lot boundaries;
- 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.

### 6.2 Inlets and their Capacities

- The capacity of any type of inlet involves determining the quantities and characteristics of the flow approaching the inlet.
- The blockage factors to be used in the analysis of pits are:
  - Sag pits – 50%
  - On grade pits – 20%
- All new work must use combined galvanised grates with lintels. For slopes greater than 5%, deflectors shall be incorporated into the design

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### 6.3 Hydraulic Design – Minor System

1. The hydraulic design of the minor system must be carried out using the hydraulic grade analysis in accordance with Chapter 5 of Book 9 ARR2019. Suitable computer software (e.g. Drains, 12D) should be used. For simple systems, (e.g. less than 10 pits) hand or spreadsheet calculations are accepted.
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

Table 3 provides the recommended pipe friction coefficients.

**Table 3: Recommended Pipe Friction Coefficients**

Pipe Material	Manning's "n"	Colebrook-White "k" (mm)
Concrete	0.012	0.6
Fibre Reinforced Concrete	0.01	0.15
UPVC	0.009	0.05

b) Downstream Control Points

For the design 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 tail water level must be RL 1.28m AHD. This level is based on the 1-year ARI storm surge tide that 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

$$\text{Control point} = \frac{d_c + D}{2}$$

where  $d_c$  = critical depth in pipe, and  $D$  = diameter of pipe.

- v) If a new system connects to an existing system, the existing system must be checked to assess its adequacy in carrying the increased discharge. The proponent must also consider the potential of other new connections to the existing system and demonstrate the existing system can maintain its current (2019) service level.



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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 head losses 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  $D_o/4$  ( $D_o$  = 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 head losses 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". Table 4 also provides minimum cover for pipes (excluding pipes discarding to the kerb).
- 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.



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**Table 4: Minimum Cover Over Pipes**

Location	Minimum cover (mm)	
	Rigid type pipes e.g. concrete, FRC	Flexible type pipes e.g. plastic, thin metal
Residential private property, and parks not subject to traffic	300	450
Private property and parks subject to occasional traffic	450	450
Footpaths	450	600
Road pavements and under kerb and channel	600	600

- For special cases, and with the agreement of Council, cover can be reduced by using a higher-class pipe, special bedding, concrete protection or a combination of these.
- Where pipes are to be laid under the footpath consideration should be given to the possibility of future road widening, both in respect of the reduced cover that might result from the widening and vehicle loading.

k) Hydraulic Design Calculations

Technical Note 9 of ARR 1998 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. Council may also request the electronic model files input and results files.

## 7 MAJOR SYSTEM

- Major system flows are flows in excess of the minor system capacity. 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 (i.e. escape routes) shall have a capacity to carry major system flows up to the 100 year ARI flow.
- The following overland flow paths may be used to act as major system flow routes:
  - Roadways including footpath;
  - Pathways; and
  - Parkland or open space.

### 7.2 Major System Flows - Continuity

- 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 cross fall to facilitate the overland flow. Other obstructions, such as fences, must not traverse these flow paths.
- Consideration should also be given to low points near kerb returns. 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.

### 7.3 Road Reserve Flow Capacity

- a) The capacity of the roadway must be determined and the results showing all relevant information must be submitted with the application.

### 7.4 Trunk Drainage

- a) Trunk drainage carries runoff from local street drainage systems to receiving waters. Trunk drains and networks include the following elements:
  - i) Natural watercourses or artificial open channels. For the purpose of this document, the term “natural watercourse” is considered a defined path which stormwater follows and includes channels and any overbank flow path. The provision of channel lining or enclosure by pipes or channel filling etc. does not in any way diminish the fact that the flow path is a natural route for water. In areas of uncertainty, Council will determine if a flow path is a watercourse.
  - ii) Culverts and road crossings exceeding 900 mm in diameter or 0.6m<sup>2</sup>;
  - iii) Naturally occurring ponds and lakes exceeding 1000 m<sup>3</sup> capacity;
  - iv) Artificial detention/retention storages exceeding 1000m<sup>3</sup> capacity.

#### 7.4.2 Detention/Retention Basins

Detention/retention basins must be designed to cater for the 1% AEP event. The basin spillway must be designed to cater for the PMF event. The appropriate blockage factor must be applied to the outlet in accordance with Chapter E13 Section 6.2.

### 7.5 Watercourses and Open Channels

#### 7.5.1 Hydraulic Design - Estimation of Design Flood Level

- a) An appropriate computer model must be used for hydraulic design and analysis.
- b) 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 watercourse of open channel. All assumptions must be documented.
- c) 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 flow behaviour. This would normally require that the model extend to a boundary condition at the hydraulic control downstream of the site.
- d) 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. The proponent must liaise with the NSW Department of Industry (Former NSW Office of Water) if modifications are required to the creek channel or floodplain or if the proposal involves activities with 40 metres of the top of the creek bank. A controlled Activity Approval under the Water Management Act 2000 may be required.

#### 7.5.2 Flow Velocities

- a) 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

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which would not obstruct overtopping flow, must be provided for the length of the open channel where supercritical flow occurs.

### 7.5.3 Scour Protection

- a) 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.

### 7.5.4 Batter Slopes

- a) Side slopes of grassed channels and detention basins should be relatively flat. The desirable batter slope must not be greater than 1 vertical to 6 horizontal. However 1 vertical to 4 horizontal may be considered where scour and erosion can be managed.

### 7.5.5 Modifications to Watercourses

- a) 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
- b) 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.

- c) Buildings will not be permitted over watercourses.

## 8 SAFETY IN DESIGN

1. The design of minor and major system flow paths and structures must consider how public safety and risk will be managed. The following will be considered in assessment of proposals. This list is not exhaustive and requirements will vary from site to site:
  - a) Overland flow paths must be designed with consideration to with the flood hazard categories shown in Figure 3. The anticipated public use of the flow path (e.g. roadway, public reserve, no public access etc.) must consider the food hazard curves shown in Figure 3. The design of the flow path shall ensure that flow characteristics within the flow path are within the safe range for the anticipated potential users of the flow path (e.g. vehicles, people, children, elderly, etc.). Where flow characteristics are proposed that are unsafe for potential end users, details shall be provided of how access to those users will be prevented (e.g. fencing, signage, etc.).

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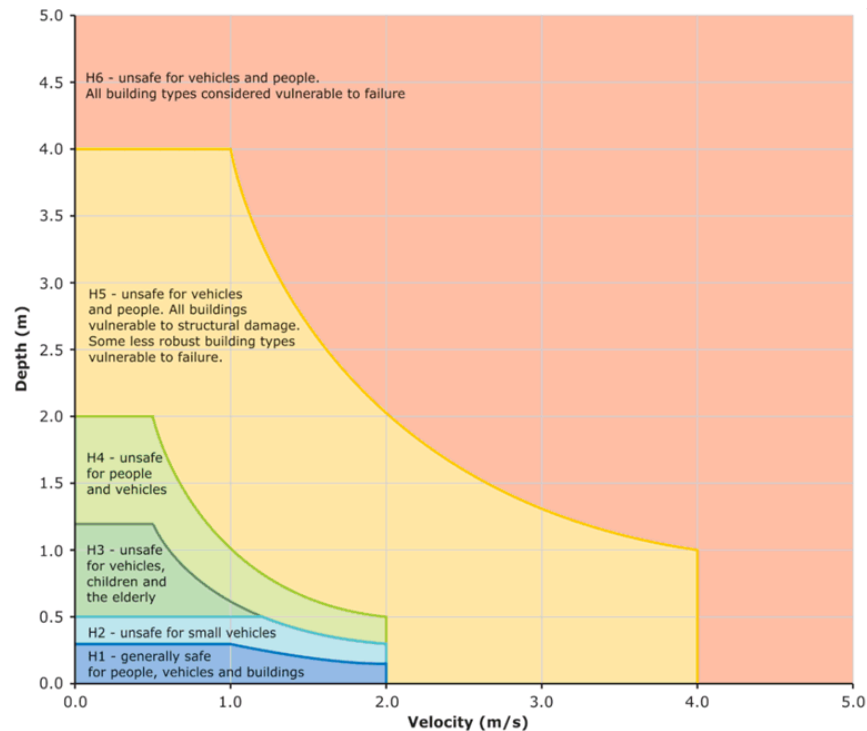


Figure 3: Combined Flood Hazard Curves (Smith et al., 2014)

- b) Underground pipe and pit systems which are large enough for children to enter must be designed using a risk based framework to determine if inlet/outlet screening is required. The risk based framework should follow the procedures detailed in the Queensland Urban Drainage Manual (QUDM).
- c) Safer by Design and Crime Prevention through Environmental Design principles and Protocols must also be considered. System elements and vegetation which may provide opportunities for concealment adjoining pedestrian areas must be avoided.

## 9 MANAGEMENT OF STORMWATER FROM DEVELOPMENT

### 9.1 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.



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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.

## 9.2 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 where OSD is not required.

## 9.3 Disposal of Stormwater from Development Sites

### 9.3.1 Control of Peak Discharge

- a) 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.
- b) One of the methods adopted by Council to alleviate the problem is to require developers to include detention storage in developments.
- c) 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 10 of this chapter outlines Council's requirements for on-site stormwater detention.

### 9.3.2 Amplification of Council's Stormwater Drains

- a) The capacity of the stormwater system into which stormwater from the development discharges into must be checked in accordance with Section 6.3. 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.

### 9.3.3 Discharge of Stormwater to a Watercourse

- a) 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.
- b) 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.

### 9.3.4 Discharge of Stormwater to the Kerb

- a) 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

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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.

### 9.3.5 Discharge of Stormwater to Council's Drains

- a) 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 and include a junction pit.
- b) 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.

### 9.3.6 Discharge of Stormwater through Downstream Properties

- a) 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.
- b) Table 5 provides minimum widths required for drainage easements.

**Table 5** Minimum Width of Drainage Easements

Nominal Pipe Diameter (mm)	Easement Width (m)
150 & 225	1.0
300 to 400	1.5
525	2.5
>525	Width required for maintenance, but not less than the width of conduit plus 2m

- c) The minimum diameter of pipe to be placed within the easement is 150mm.
- d) Evidence that the easement has been created must to be submitted to the Principal Certifying Authority prior to the activation of the Development Application consent.
- e) 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.
- f) 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.

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### 9.3.7 Discharge of Stormwater into Swales

- a) In 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. Discharge into swales is only permitted for small developments including single developments and dual occupancies.

### 9.3.8 Interallotment Drainage

- a) 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 sections 9.3.3 and 9.3.5
- b) 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.
- c) 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.

### 9.3.9 Discharge of Stormwater through Public Reserves

- a) 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, an easement issued by Council must be applied for under section 46 (1) of the Local Government Act.
- b) 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 9.3.12 for further details on absorption and transpiration pits.

### 9.3.10 Discharge of Stormwater to the Ocean

- a) 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.

### 9.3.11 Pump Systems

- a) 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



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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.

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

### 9.3.12 Absorption and Transpiration Disposal Systems

- a) 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.
- b) 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.
  - i) Note: Absorption disposal systems shall not to be used as storage facilities to control peak discharge of stormwater from development sites.
- c) 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.
- d) Further information on absorption disposal systems can be sourced from Council's website: <https://www.wollongong.nsw.gov.au/development/planning-and-development-policies/flooding-stormwater-and-development/domestic-stormwater-drainage-systems>
- e) 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 inter-allotment drainage pipeline and where an absorption system is not otherwise considered suitable.
- f) 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.
- g) The minimum offset between an absorption/transpiration system and a new building may be reduced if the footings of the new building are designed to ensure they will not be impacted by the adjacent absorption/transpiration disposal system. Structures must not be built over the absorption or level spreader system.
- h) 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.
- i) Absorption and transpiration disposal systems will not be permitted for developments, with the exception of single residential dwellings, detached garages, and/or granny flats, in older subdivisions or the provisions of Section 9.3.9
- j) Absorption systems on unstable land must take into consideration the recommendations of a geotechnical report.

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### 9.3.13 Minimum Pipe Size Connecting to Council's Drains

- a) 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.

### 9.3.14 Method of Connection to Council's Drains

- a) Where connection is to be made to Council's underground stormwater system, the type of connection to be used must be as shown in Council's Engineering Standard Drawings, available on Council's website.
- b) 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.

### 9.3.15 Drainage Work in Footpath/Carriageway

- a) Any drainage works proposed within the footpath or carriageway must comply with Section 138 of the Roads Act 1993 and will be at the expense of the developer.
- b) Prior to undertaking the works, the developer shall obtain a permit and arrange inspections with Council.

### 9.3.16 Services

- a) 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.

### 9.3.17 Flow from Adjacent Properties

- c) 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.
- d) 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.

### 9.3.18 Sumps and Inlet Pits

- a) 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 Council
- b) Heavy-duty cast iron or galvanised and lockable steel grates must be provided on all surface inlet pits in areas with vehicular traffic.
- c) The base of pits must be graded or benched to the outlet pipe. Weepholes in the base of pits are not permitted unless a suitably qualified engineer provides written evidence that justifies the suitability of the site for this system.
- d) 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.

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- e) Where affected by proposed driveways, existing kerb inlets must be replaced. The existing lintel must be removed and replaced with a new lintel, within the property frontage, upslope if possible at the developer's expense.
- f) 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.

## 9.4 Conditions for Building over Common Stormwater Lines and Stormwater Easements

### 9.4.1 General

- a) This section provides Council's requirements for the erection of buildings/structures over and adjacent to common stormwater lines and stormwater easements.

### 9.4.2 Definitions

<b>Common Stormwater Line</b>	A conduit that is located within an allotment and conveys stormwater from one or more other allotments.
<b>Common Stormwater Easement</b>	<p>An easement that is registered over an allotment in favour of one or more other allotments for the installation, conveyance, or maintenance of stormwater drainage serving those allotments, including but not limited to:</p> <ul style="list-style-type: none"> <li>• easement to drain water;</li> <li>• drainage easement;</li> <li>• easement for drainage;</li> <li>• easement for drainage and detention storage; and</li> <li>• any other easement that relates to stormwater/drainage installation, maintenance, access, conveyance, overflow, overland flow, and/or detention storage.</li> </ul>

**Owner** Means registered owner of a property or registered body corporate.

### 9.4.3 Common Stormwater Lines/Easements

Council requires the following conditions to be met in the construction of buildings over common stormwater lines/easements:

- (a) Encroachments
  - i) 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 Council.
  - ii) In such cases, written approval is required by all owners benefited by the common stormwater line or easement on the upstream side of the proposed encroachment.
  - iii) No encroachment will be permitted where that encroachment occurs within an overflow path
- (b) Loads on Conduit

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- i) 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. Any building and footings must be constructed outside of the Zone of Influence (ZOI). See Sydney Water (2015) for further information.
- ii) Where required by Council, the building is to be supported on stable foundations carried at least to the invert level of the pipeline.
- (c) Design of Adjacent Footings
  - i) The footings and floor slabs required by (b) above must be designed by a Structural Engineer and submitted to Council for approval.
- (d) 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 Council.
- (e) Access Pits
  - i) 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.
  - ii) Pits are to conform to Wollongong City Council Standards or an approved alternative.
- (f) Obstruction of Free Flow
  - i) 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.
  - ii) Joints on Easement Boundary.
- (g) 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.

**9.4.4 Building Over or Adjacent to Council's Easement**

- 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 Council.
- 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.
- d) Any building must be constructed outside of the ZOI. See Sydney Water (2015) for further information.
- e) Footings Close to an Easement
  - i) Where it is proposed to construct footings or foundations near a stormwater easement, Council may impose such conditions, as it considers necessary to protect the structural stability of the existing or proposed stormwater infrastructure.
  - ii) 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.
  - iii) There must be no loss of support of the land contained within the drainage easement as a result of excavation within the site.



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- iv) No part of the structure, including footings, eaves and gutter overhang will be permitted to encroach into the easement to drain water / drainage easement.
- f) Concrete Slabs Over Easement
  - i) 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 9.4.3.
- g) Structural Design
 

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.

## 10 ON-SITE STORMWATER DETENTION

### 10.1 Application of On-Site Stormwater Detention

#### 10.1.1 Developments to which OSD Applies

- a) 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 10.2.2).
- b) Developments covered by this Policy include the following:
  - i) Development as follows (unless the development meets the exclusion criteria of section 10.1.2):
    - Subdivisions – it is recommended that wherever practicable, the OSD system be a single storage unit, either as a tank or an above-ground "community basin";
    - Single dwellings including extensions, additions and improvements to existing dwellings;
    - Dual occupancies; Townhouses, villas, residential flat building development;
    - Tennis courts;
    - Roads, carpark and other sealed areas;
    - Public buildings; and
    - Any other development not listed in and Section 10.1.2
- c) The methodology for calculating PSD and SSR values stipulated in Section 10.2.4 of this chapter is not appropriate for tributary areas exceeding 2ha. OSD facilities for tributary areas exceeding 2ha must be designed using an appropriate runoff routing hydrologic and hydraulic analyses in accordance with the relevant sections of this chapter and Chapter E13 of this DCP

#### 10.1.2 Developments to Which OSD Does Not Apply

- a) The OSD policy does not apply to:
  - i) Development that increases the impervious surface area of a site by less than 100m<sup>2</sup>. No more than one such application for exclusion shall be permitted on a particular lot.
  - ii) Development that lies within the 5 year ARI flood extents (Refer Section 10.2.2).

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- iii) Subdivisions of existing dual occupancies where no increase in the impervious surface area is proposed.
- iv) Boundary adjustments and consolidations of allotments where no additional lots are created.
- v) Change of use where no increase in the impervious surface area is proposed.
- vi) Building additions or internal alterations where they lie within the footprint (plan area) of the existing dwelling.
- vii) New developments in subdivisions where OSD has already been provided for the entire subdivision.
- viii) Buildings in rural/non-urban areas including RU1, RU2, RU3, RU4, RU6, E2, E3 and E4.
- ix) 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.
- x) 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 Councils Drainage Duty Officer for clarification.

### 10.1.3 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 cannot 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.

## 10.2 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 6: Percentage Impervious Area for Land Use Type**

Land Use	Percentage Impervious Area
Normal Residential Lots	60%
Half Width Road Reserve	95%
Medium Density Residential Lots	80%
Commercial Areas	100%
Industrial Areas	100%
Public Recreation Areas	25%

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 that 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. 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.



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### 10.2.1 Freeboard – Above OSD

- a) Table 7 provides the minimum freeboard for the floors of any new structures above 100 Year ARI water surface level or water storage level in the OSD facility.

**Table 7: Minimum Freeboard**

Minimum Freeboard	
Dwelling/commercial (habitable floors)	+300mm
Garage Floors	+100mm
Industrial Floors	at 100YR ARI water level

- a) The proposed drainage works shall not reduce the freeboard of any adjacent buildings.
- b) Where roof storage is proposed, freeboard requirements are not applicable.
- c) 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 .

### 10.2.2 Flood Prone Land

- a) 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.
- b) 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.

### 10.2.3 Design Basis

- a) 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 not 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<sup>3</sup>). 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.
- b) Two PSD and SSR values are used to describe a particular facility. PSD5 represents the peak discharge permissible in a 5 year ARI storm event and SSR5 the associated storage volume of the basin at that discharge. PSD100 represents the peak discharge in a 100 year event and SSR100 the corresponding basin volume at that discharge. Note SSR100 includes SSR5.
- c) High early discharge pits (HED) are not permitted under this policy.

### 10.2.4 Determination of PSD and SSR for a Developing Site

- a) The method described in this section is only applicable to tributary areas smaller than 2 Ha. For tributary areas exceeding 2 Ha, OSD must be designed using hydrologic and hydraulic analysis in accordance with Section 7 **Error! Reference source not found.** of this chapter and Section 6 of Chapter E13.

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- b) As set out in section 10.1.3, 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:

- 100% of the impervious site area determined from Table 6 or detail plans for the development proposed on the site,  
plus
- 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

Calculation of OSD requirements for a developing site is a two-step process involving:

- **Step 1:** The OSD requirements for a site transitioning from the existing condition to the post development condition are calculated.
- **Step 2:** Step 2 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 calculated in Step 1 are reduced by the SSR calculated in Step 2.

- c) In detail these steps involve:

#### STEP 1

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

$$PSD_5 = F1_5 \times F2 \times 2.67 \times (Area/10,000) \times I_1^{50} \quad (l/sec) \quad eq \ 1.4.4.1$$

$$PSD_{100} = F1_{100} \times F2 \times 4.67 \times (Area/10,000) \times I_1^{50} \quad (l/sec) \quad eq \ 1.4.4.2$$

Where *PSD<sub>5</sub>* is the permitted peak discharge from the basin in a 5Yr ARI event

*PSD<sub>100</sub>* is the permitted peak discharge from the basin in a 100Yr ARI event

*I<sub>1</sub><sup>50</sup>* (mm/hr) is the one hour 50Yr ARI rainfall intensity at the site (refer App A2)

*F1<sub>5</sub>* and *F1<sub>100</sub>* 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)

*Area* (m<sup>2</sup>) is the tributary area draining to the OSD basin

Note both *F1<sub>5</sub>* and *F1<sub>100</sub>* will be 1.00 if the existing tributary area is wholly

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*Undeveloped*

- c) The SSR volumes (m<sup>3</sup>) for the basin are then calculated from the above PSD values as follows.

$$SSR_5 = F3 \times F4 \times 2.25 \times PSD_5 / F2 \quad (m^3) \quad \text{eq 1.4.4.3}$$

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

Where:

*SSR<sub>5</sub>* is the facility storage at a discharge of PSD<sub>5</sub>

*SSR<sub>100</sub>* is the facility storage at a discharge of PSD<sub>100</sub>

*F3* is the factor reflecting post development impervious cover (refer App A5)

*F4* is the factor reflecting variations in area from the 1Ha base (refer App A6)

- d) If there are no existing impervious surfaces in the tributary area, this completes the basin sizing calculations.

## STEP 2

(Only required if there are existing impervious surfaces in the tributary area)

- 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 F1 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
- The PSD's and SSR's for this scenario are then calculated as in STEP 1
- 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.

### 10.2.5 Internal Drainage System

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

### 10.2.6 Discharge Control

- 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<sub>5</sub> level in a PSD<sub>5</sub> discharge event and to the SSR<sub>100</sub> level in a PSD<sub>100</sub> discharge event. The first stage is controlled by an orifice, the maximum diameter of which is to be sized using the value of PSD<sub>5</sub> when under a head of SSR<sub>5</sub> m<sup>3</sup> 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<sub>100</sub> when subject to a head of SSR<sub>100</sub> m<sup>3</sup> of stored water.

#### 10.2.7 Safety Fences

- a) 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.

#### 10.2.8 Standardised Products

- a) Where practical, use may be made of precast or prefabricated items to reduce the cost.

### 10.3 Implementation of OSD requirements

#### 10.3.1 Development Approvals for Subdivisions

- a) In general, the OSD requirements are imposed at the subdivision stage as shown below:
- b) Development Application – submission and approval of a concept layout of the OSD system. (Stormwater Concept Plan)
- c) Submission of Engineering Plans – submission and approval of the detailed design including calculations and construction plans and details.
- d) 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.

#### 10.3.2 Development Approvals and Construction Certificates

- a) When the OSD requirements are implemented through the development approval and construction certificate process, the approval is in three stages as follows:
- b) Development Application – submission and approval of a concept layout of the OSD system (Stormwater Concept Plan)
- c) Construction Certificate – submission and approval of the detailed design including calculations and construction plans and details
- d) 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

Figure 4 summarises the steps involved in the process.

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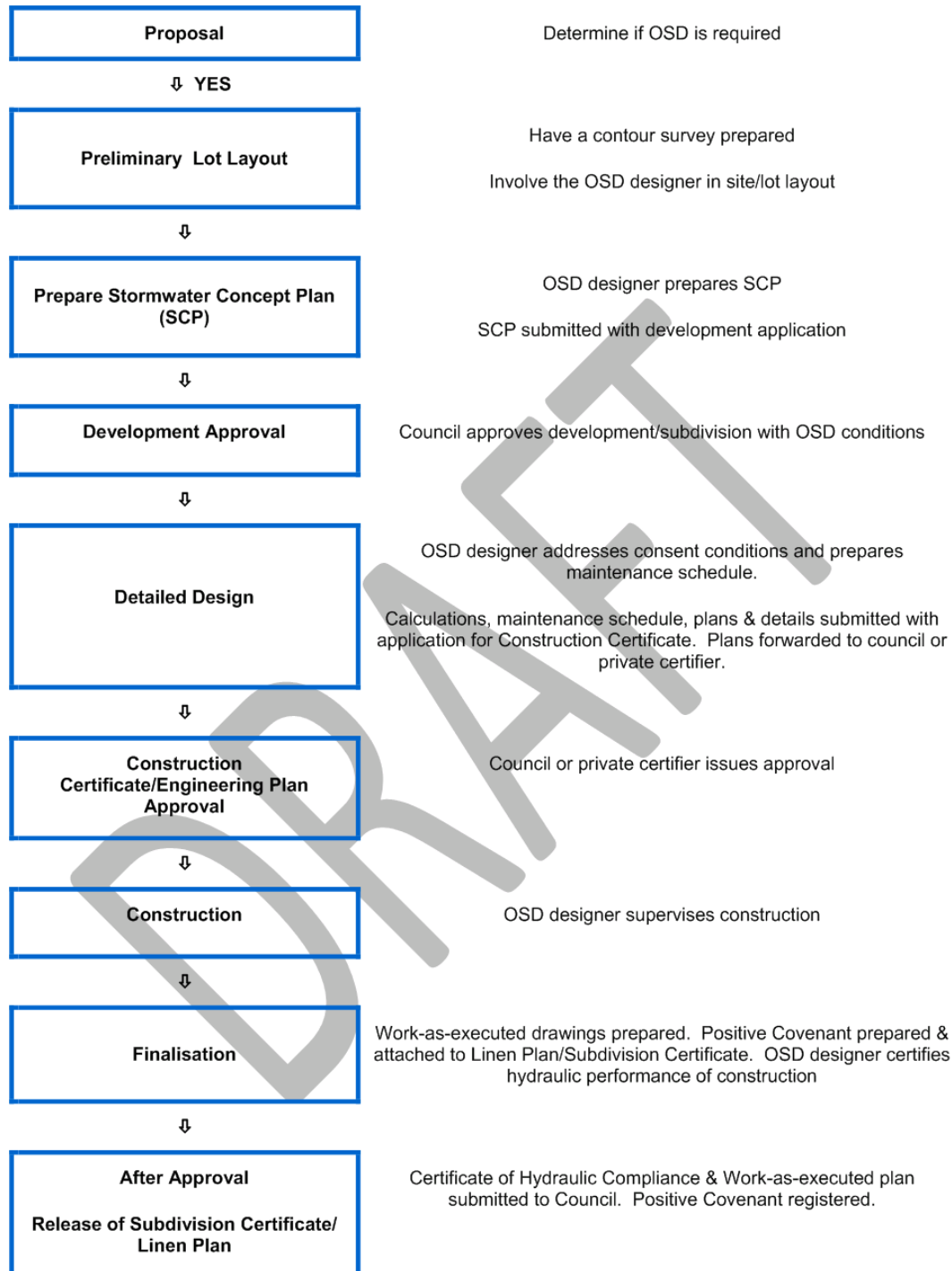


Figure 4: OSD Approval Process



## 10.4 Development Approval Process

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.

### 10.4.1 Stormwater Concept Plan

- a) The objectives of the Stormwater Concept Plan (SCP) are to:
  - i) Emphasise that the OSD and drainage requirements need to be considered in the initial planning stages of the development;
  - ii) Simplify the detailed design by identifying adequate storage areas, surface flow paths and treatments, easements (if required) and site constraints in the planning stage;
  - iii) Reduce project costs by maximising the use of proposed landscape and architectural features as part of the OSD system;
  - iv) Allow the cost of development consent conditions relating to OSD to be determined at the planning stage; and
  - v) In the case of larger developments, assist in addressing the concerns of the local community regarding drainage and flooding issues.

### 10.4.2 Detailed Design

- a) The objectives of a detailed OSD design are to:
  - i) Ensure that all components of the OSD system are functional;
  - ii) Simplify construction of OSD systems by providing detailed design plans;
  - iii) Increase owner awareness and improve maintenance standards by simply outlining the necessary maintenance practices; and
  - iv) Encourage storages to be accessible and maintainable.

### 10.4.3 Minimum data requirements

- a) The following information must be included in a detailed design submission:
  - iii) Calculations for each storage, finalising the storage volumes and discharge rates;

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- iv) Calculations verifying that flow paths/floodways and internal drainage systems have sufficient capacity (if necessary);
- v) Design plans and details which include the:
  - Location and extent of each storage;
  - Locations and details of each discharge control device;
  - Catchment area draining to each storage;
  - Maximum water surface levels in each storage;
  - Overflow structures and surcharge paths;
  - Levels and location of the discharge points for each storage;
  - Internal drainage system;
  - Existing contours and final design levels;
  - Final site/lot layout; and
  - Location and extent of any floodway/flow path.
- b) Cross-sections through the storages.
- c) 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.
- d) Structural certification for components of the OSD system (if necessary).
- e) Completed Detailed Design checklist (refer Appendix 2).
- f) 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).

#### 10.4.4 Free Discharge from an Outlet Pit

- a) The orifice discharge equation is:

$$Q = CA (2gh)^{0.5}$$

Where Q is the discharge in m<sup>3</sup>/sec

C is the coefficient of discharge

A is the orifice area in m<sup>2</sup>

g is the acceleration due to gravity

h is the depth of water above the centre of the orifice in metres

- b) This equation relies on:

A circular sharp edged orifice; and free discharge from the orifice.



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- c) 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.

#### 10.4.5 Storages

- a) Where possible, storages should be achieved through surface storage. Underground storages are:
- (i) more difficult to inspect for silt and debris accumulation;
  - (ii) more difficult to maintain; and
  - (iii) can be dangerous to work in and may be unsafe for property owners to maintain.

#### 10.4.6 Surface storages

- a) 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.
- b) In the interests of safety and amenity, ponded water depths are not to exceed:

	<u>Maximum</u>
Parking/Paved Areas	0.2 m
Landscaping	0.6 m
Covered/Fenced Storage	No Limit
Roof Area	As required by structural integrity

- c) 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.
- d) 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.

#### 10.4.7 Underground storages

- a) The following design considerations must be taken into account for underground storages:
- (i) 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.
  - (ii) 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)
  - (iii) 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.
  - (iv) 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.

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

#### 10.4.8 Overflow

- a) 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.

#### 10.4.9 Orifice plates

- a) 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.

#### 10.4.10 Debris control

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

#### 10.4.11 Identification System

- a) 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:
  - (i) The structure is an OSD facility, part of the stormwater drainage network;
  - (ii) Its Identification Number, provided as part of the Development Approval process ;
  - (iii) It is not to be tampered with; and
  - (iv) Any specialist maintenance requirements e.g. confined spaces warning.

#### 10.4.12 Maintenance

- a) 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 10.4.21). 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.
- b) This schedule should contain information on the following issues:

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- (i) Where the storages are located;
- (ii) Which parts of the system need to be accessed for cleaning and how access is obtained;
- (iii) A description of any equipment needed (such as keys and lifting devices) and where they can be obtained;
- (iv) The location of grates/covers and how they can be removed for cleaning;
- (v) Who should do the maintenance; and
- (vi) How often should it be done?
- c) An example of such a schedule is attached to this policy (Appendix 4).
- d) OSD systems should be designed such that specialist personnel (e.g., confined spaces certified) are not required to perform ongoing maintenance.

#### 10.4.13 Construction and Final Approval

- a) The objectives of the construction supervision and certification arrangements are to:
  - (i) Encourage supervision of critical stages of construction by the OSD designer to improve construction standards;
  - (ii) Minimise delays and additional expenditure on rectification works by ensuring adequate construction supervision;
  - (iii) Increase community acceptance of OSD by eliminating nuisances created by poor construction; and
  - (iv) Enable Council to inspect and insist on essential maintenance of the system.

#### 10.4.14 Supervision

- a) 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.

#### 10.4.15 Work-as-Executed plans

- a) 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.

#### 10.4.16 Storage

- a) The following details of the OSD storage should be provided:
  - (i) Type of storage - roof, above ground, below ground or combination;
  - (ii) Detailed calculations of the actual volume achieved for each storage;

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- (iii) The diameter of the orifice plate and verification that it has been fitted correctly;
- (iv) Verification that a screen has been fitted, as well as its location, dimensions and the minimum distance from the orifice;
- (v) Level and location of any overflow structures (e.g. spillways, weirs);
- (vi) 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;
- (vii) Any changes to storage depth or top water level and whether the orifice size is affected; and
- (viii) Internal diameter of the outlet pipe.

#### 10.4.17 Internal drainage

- a) The following information on the internal drainage system is to be included:
  - (i) Pit surface levels;
  - (ii) Invert levels and diameters of pipes;
  - (iii) Location and levels of any floodways and/or overland flowpaths; and
  - (iv) Sufficient spot levels to show site gradings and extent of areas not draining to the storage(s).

#### 10.4.18 Freeboards

- a) 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.

#### 10.4.19 Certificates of Hydraulic Compliance

- a) 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.
- b) 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.
- c) 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:
  - (i) State that the system will function in accordance with the approved designs, subject to satisfactory maintenance;
  - (ii) Identify any variations from the approved design; and
  - (iii) State that these variations will not impair the performance of the OSD system.
- d) 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.
- e) 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



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the Certificate will be based on the WAE plans, the OSD designer will need to inspect the site to check critical design features.

- f) Some of the important considerations to be addressed when certifying hydraulic compliance are:
- (i) Storage:
    - Actual storage volumes achieved are adequate;
    - A plate with a sharp-edged orifice of the correct diameter and the specified material has been securely fitted;
    - The orifice is screened and the screen is properly fixed, located and able to be removed for cleaning;
    - Outlet pipes from the discharge outlet pit are the correct size, level and grade to ensure there is free discharge through the orifice;
    - The levels of the top water surface and storage invert are such that the design discharge from the storage is achieved;
    - 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;
    - The base of the storage is well graded and drains to the discharge outlet pit; and
    - Spillways and overflow paths are the correct level and free from obstructions.
  - (ii) Internal drainage:
    - Site gradings are correct;
    - The internal drainage lines are of a sufficient size, level and grade to convey flows to the storage;
    - 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;
    - 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;
    - Flowpaths designed to divert upstream flows around the basin have been properly constructed and will function as designed; and
    - General workmanship is adequate to prevent long-term failure of the system.
  - (iii) Freeboards
    - 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
    - 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.
- g) Sample Standard Certificate of Hydraulic Compliance Forms and Outstanding Works forms are attached in Appendix 5.

#### 10.4.20 Structural certification

- a) 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

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certification should be provided by a qualified, practising structural engineer, except where the components match the standard designs.

b) 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.

c) 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.

d) Underground storages

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

#### 10.4.21 Legal Protection of OSD Systems

- a) 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.
- b) 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.
  - F.5 A copy of Information Bulletin No 14 (dated September 1998), prepared by the Land Titles Office,
  - *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.



## 10.5 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;
  - f) Details and location of maintenance schedules; and
  - 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.

## 10.6 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.

## 11 INFORMATION REQUIREMENTS (TO BE SUBMITTED BY APPLICANT)

### 11.1 Development Application Stage

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;

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- e) SID
  - f) 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;
  - g) 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;
  - h) Details, dimensions and location of pits, grates, on-site detention storage, weirs, orifice plates, outlet structures and scour protection;
  - i) The location and extent of any floodways, flowpaths or stormwater concentrations affecting the site;
  - j) Flood study if applicable;
  - k) Proposed point/s of discharge;
  - l) Fencing location and type;
  - m) Written agreement from downstream property owners to provide an easement to drain water if applicable;
  - n) 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;
  - o) Plan (1:100 scale) showing proposed and existing floor, ground and pavement levels to AHD;
  - p) Plans of any proposed earth works including cut and fill drawings. Cut and fill drawings to be at shown at 0.25m contours.
- 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.

## 11.2 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.

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- 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 Section 10 for the information required.

### 11.3 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 10.4.15 and 10.4.16 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.

### 11.4 At Development Application Stage (Where No 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) 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.

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- (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.
- (viii) 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.

### 11.5 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.

### 11.6 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.
3. Where a computer program has been used for stormwater analysis, a copy of the model input files and results output may need to be provided to Council for assessment.

## 12 REFERENCES

Australian Rainfall and Runoff. A Guide to Flood Estimation (1998) Institution of Engineers, Australia.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) Australian Rainfall and Runoff: A Guide to Flood Estimation, © Commonwealth of Australia (Geoscience Australia), 2019.

Coombes, P., and Roso, S. (Editors), 2019 Runoff in Urban Areas, Book 9 in Australian Rainfall and Runoff - A Guide to Flood Estimation, Commonwealth of Australia, © Commonwealth of Australia (Geoscience Australia), 2019.

Floodplain Development Manual. (2005) New South Wales Government.

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

Smith, G.P., Davey, E.K. and Cox, R.J. (2014), Flood Hazard UNSW Australia Water Research Laboratory Technical Report 2014/07 30 September 2014.

Sydney Water (2015). Building Over or Adjacent to Sydney Water Stormwater Assets.

## APPENDIX 1 - OSD DESIGN

### CONTAINING:

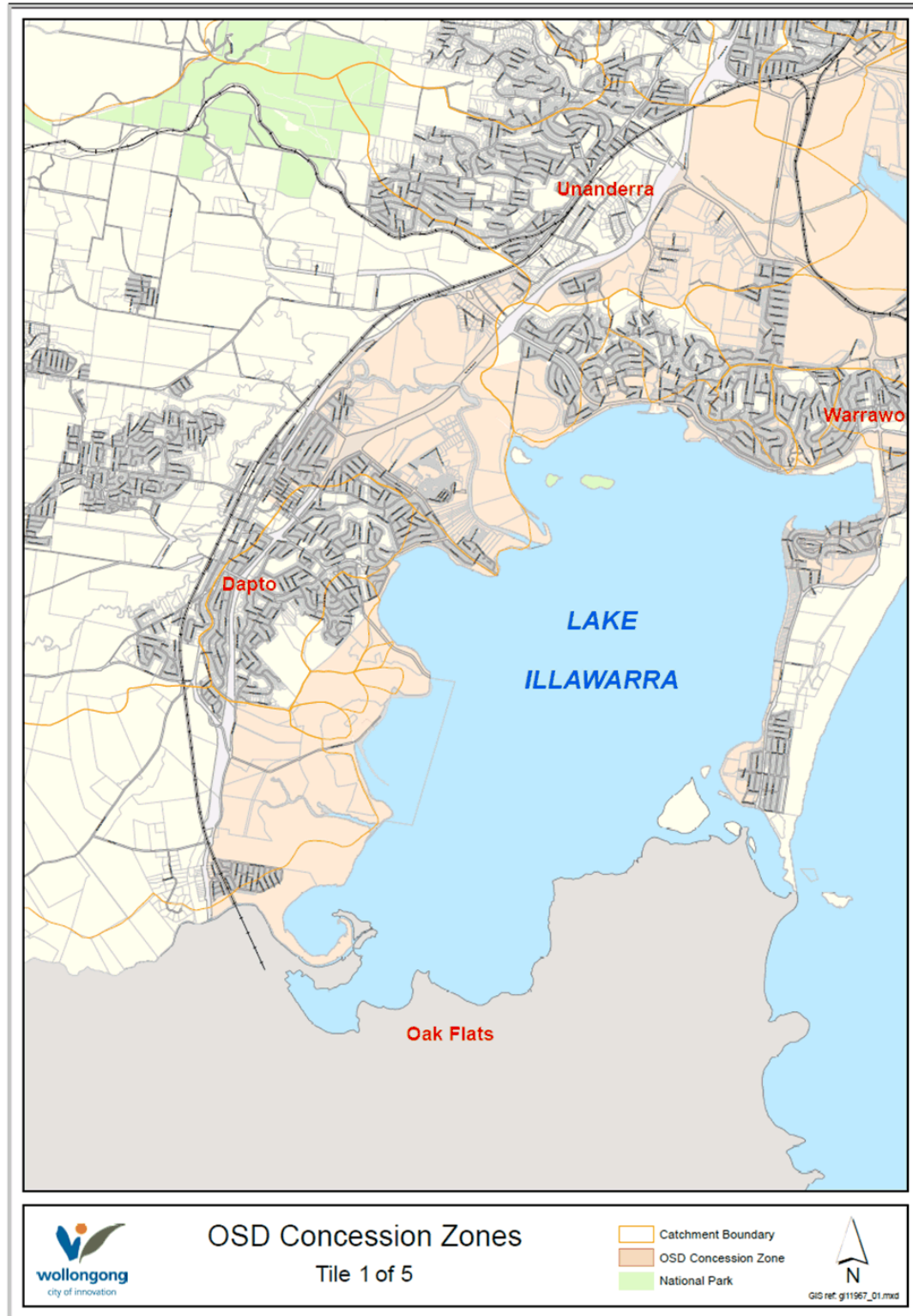
- (i) Appendix A1. Concessional OSD Zones
- (ii) Appendix A2. Wollongong Rainfall Isohyets
- (iii) Appendix A3. F1 –v- %imp
- (iv) Appendix A4. F2 –v- Area
- (v) Appendix A5. F3 –v- %imp
- (vi) Appendix A6. F4 –v- Area
- (vii) Appendix A7. OSD Basin Sizing Examples

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## **APPENDIX 1A: Concessional OSD Zones**

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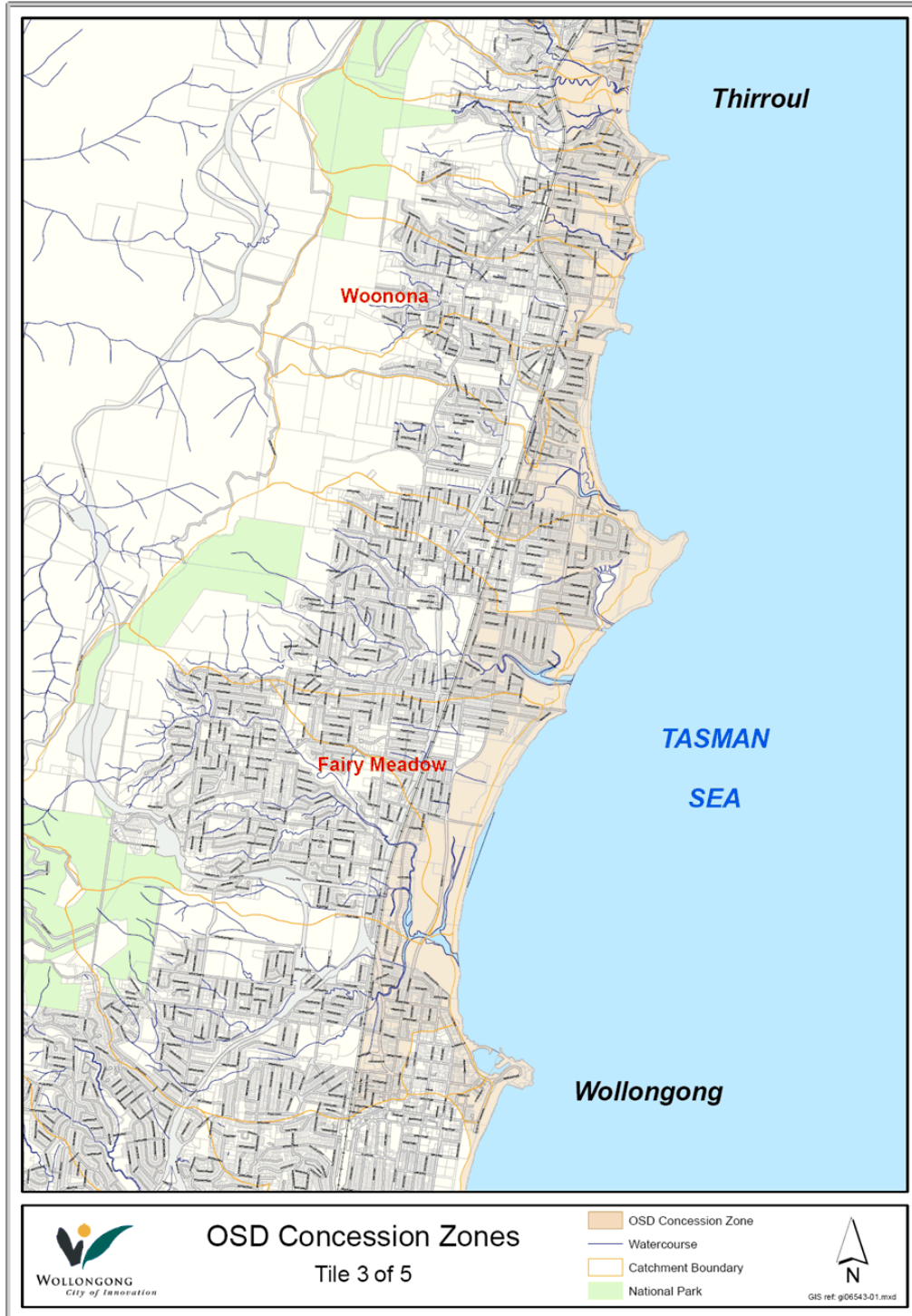


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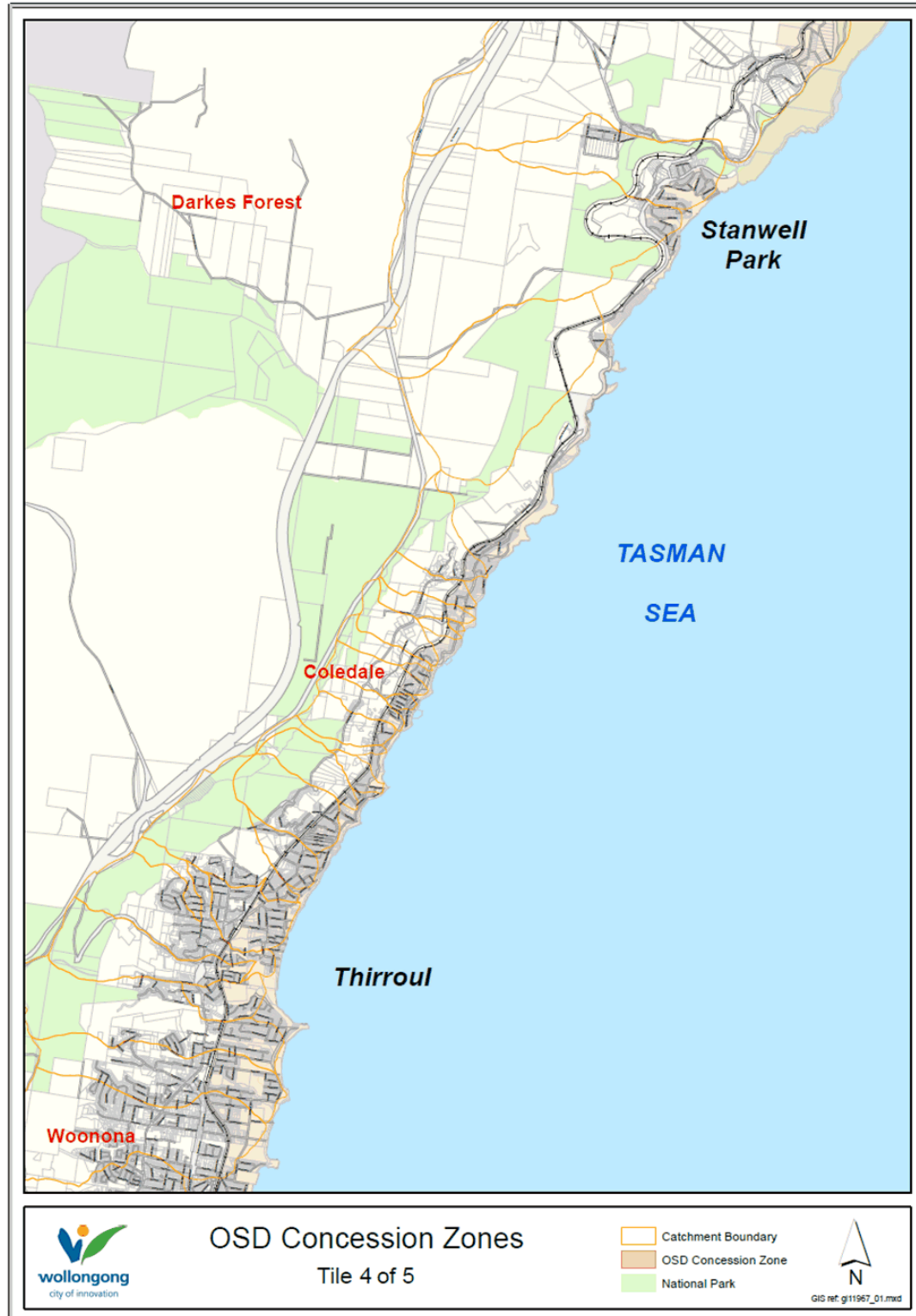




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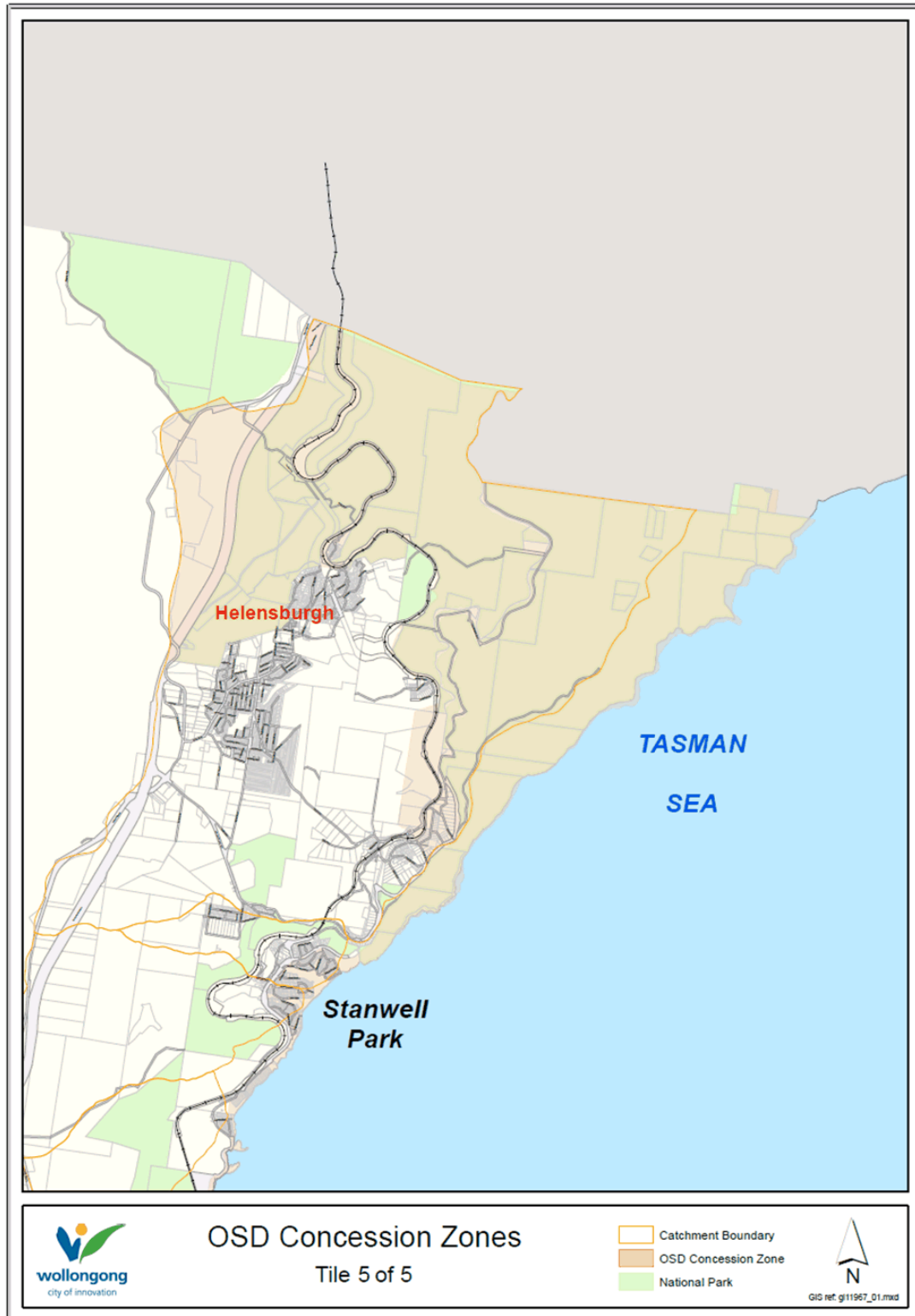


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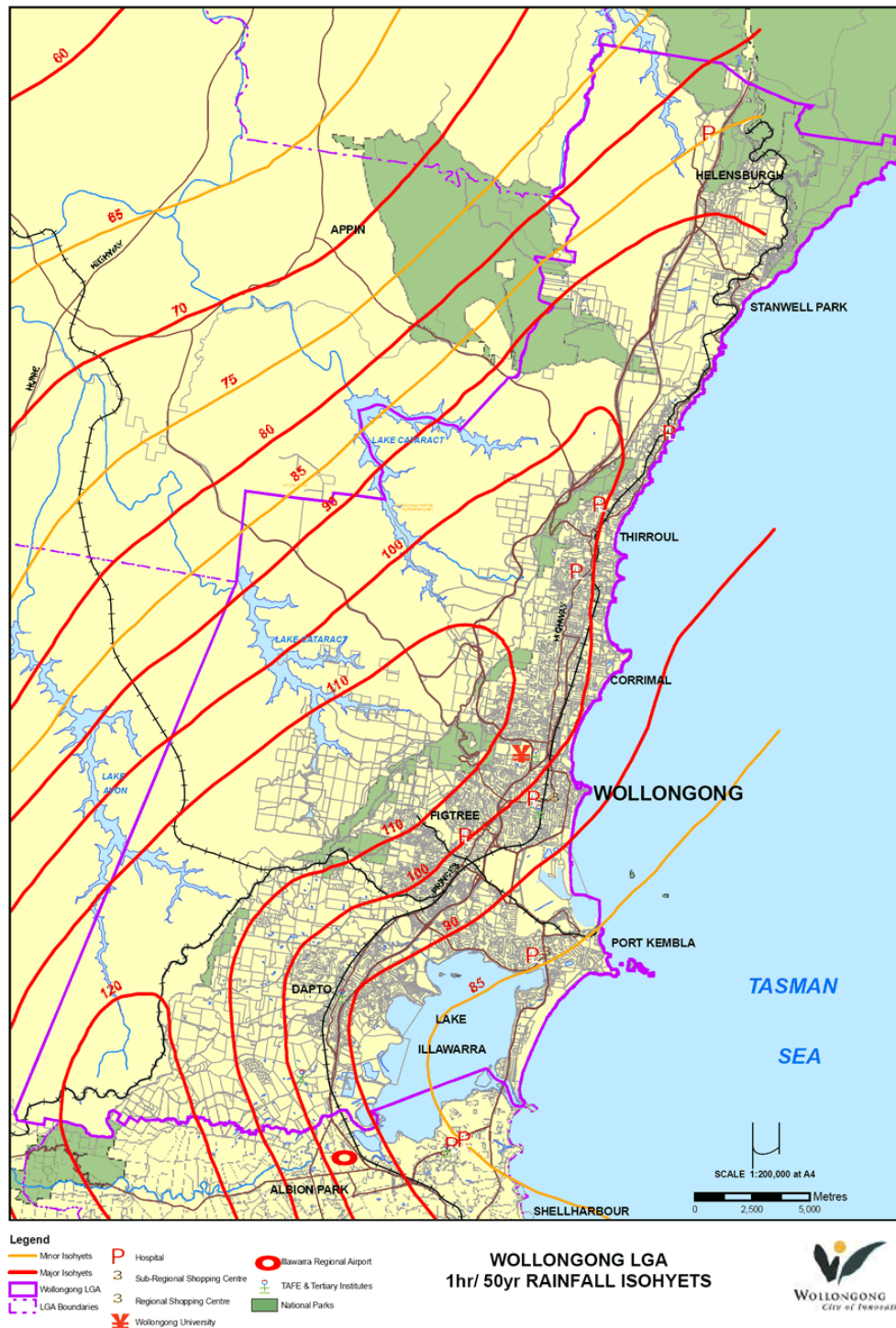


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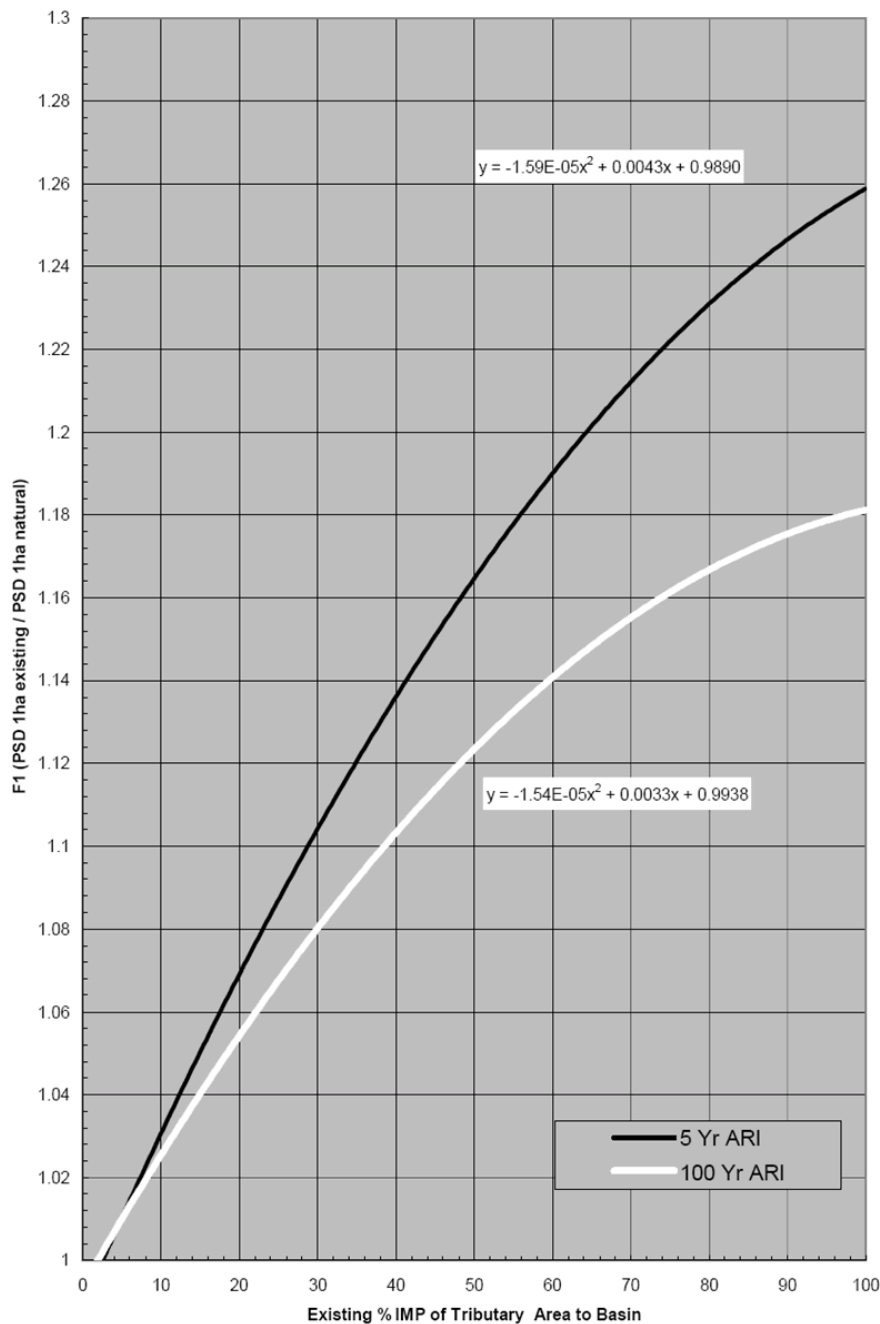
**APPENDIX A2: Wollongong Rainfall Isohyets**



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APPENDIX A3: F1 –v- %Imp

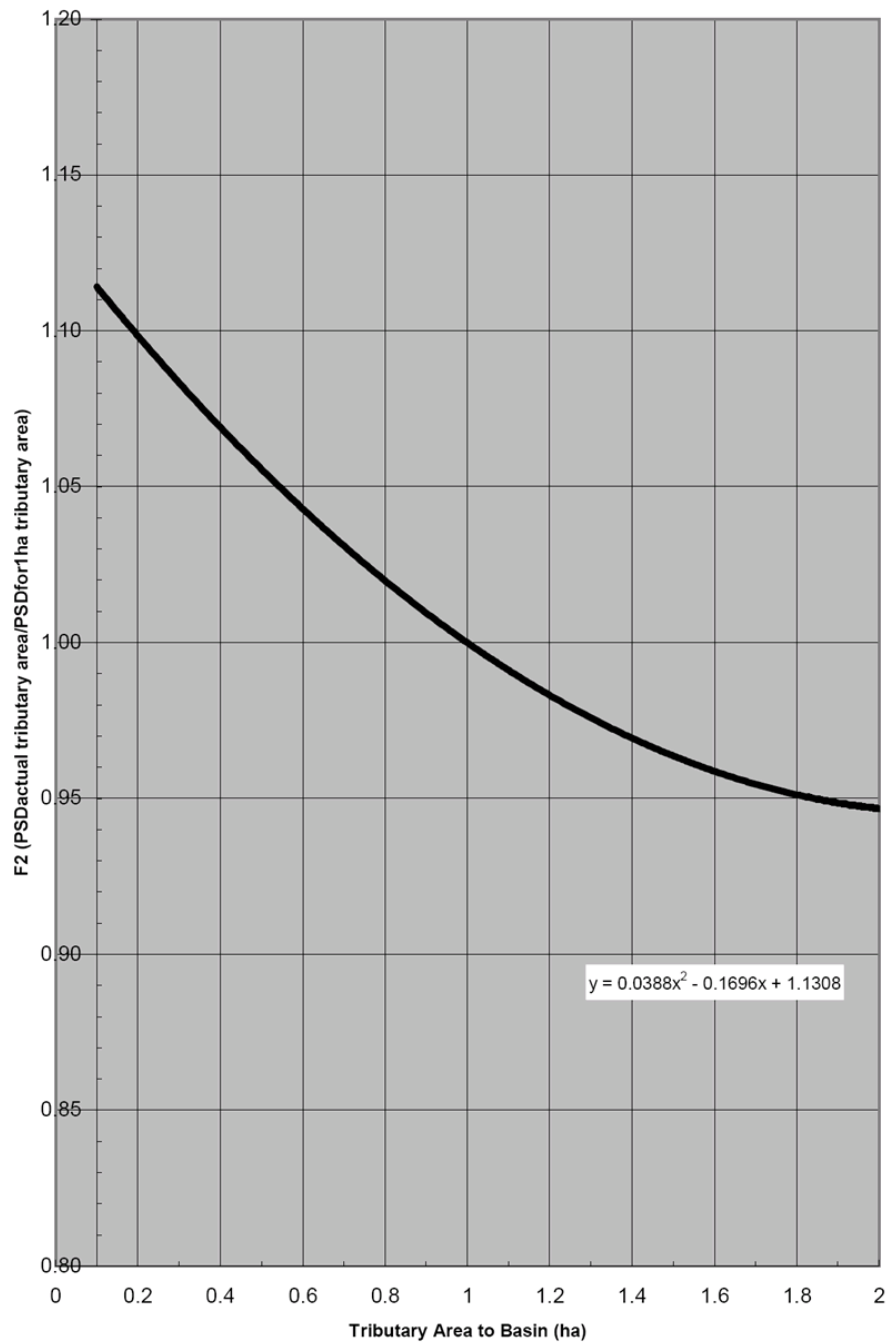
Appendix A3 - Factor F1 vs Existing % IMP  
1Ha Tributary Area To Basin - Wollongong LGA



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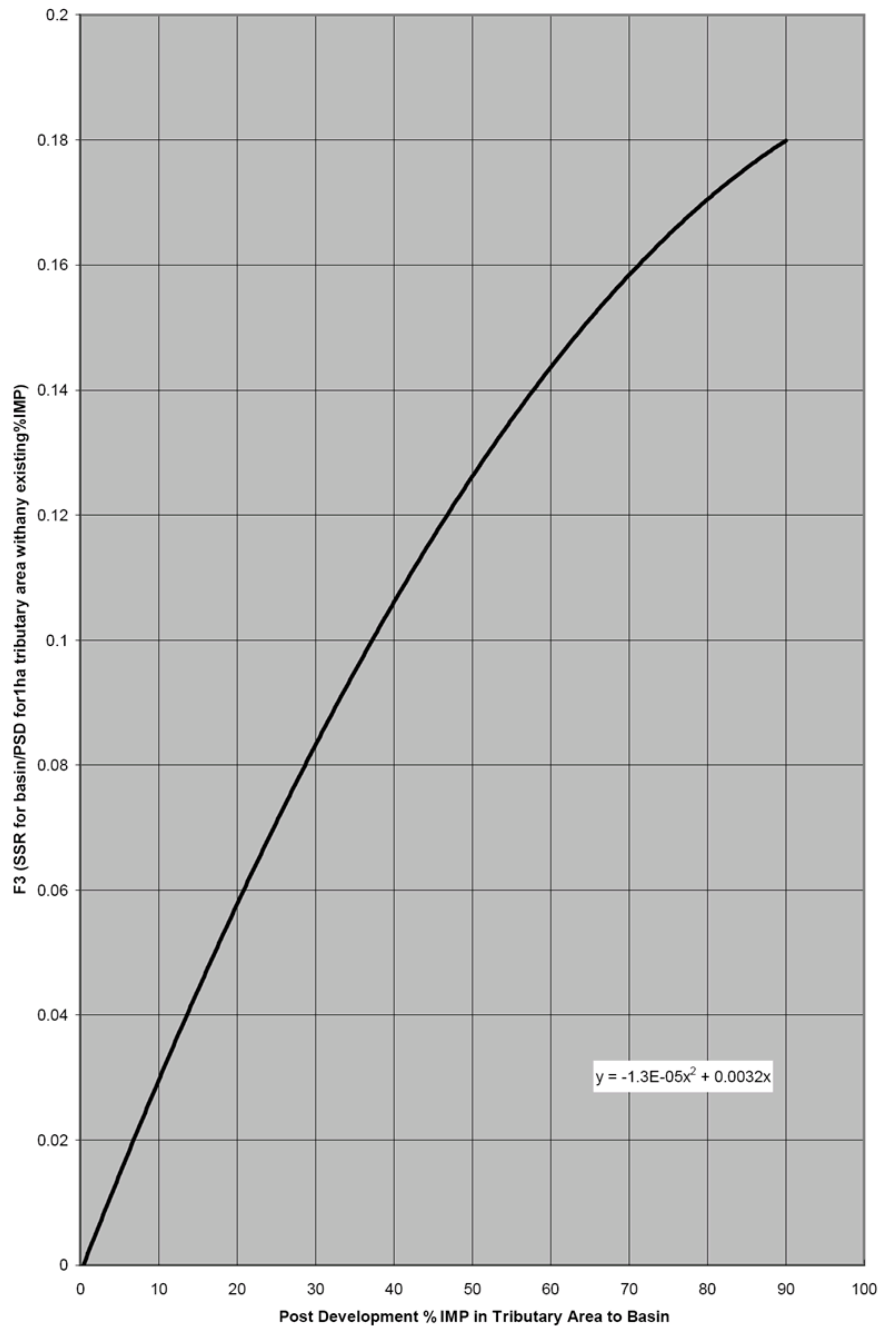
## APPENDIX A4 F2 –v- Area

Appendix A4 - Factor F2 vs Tributary Area  
 0.1 to 2Ha Tributary Area To Basin- Wollongong LGA



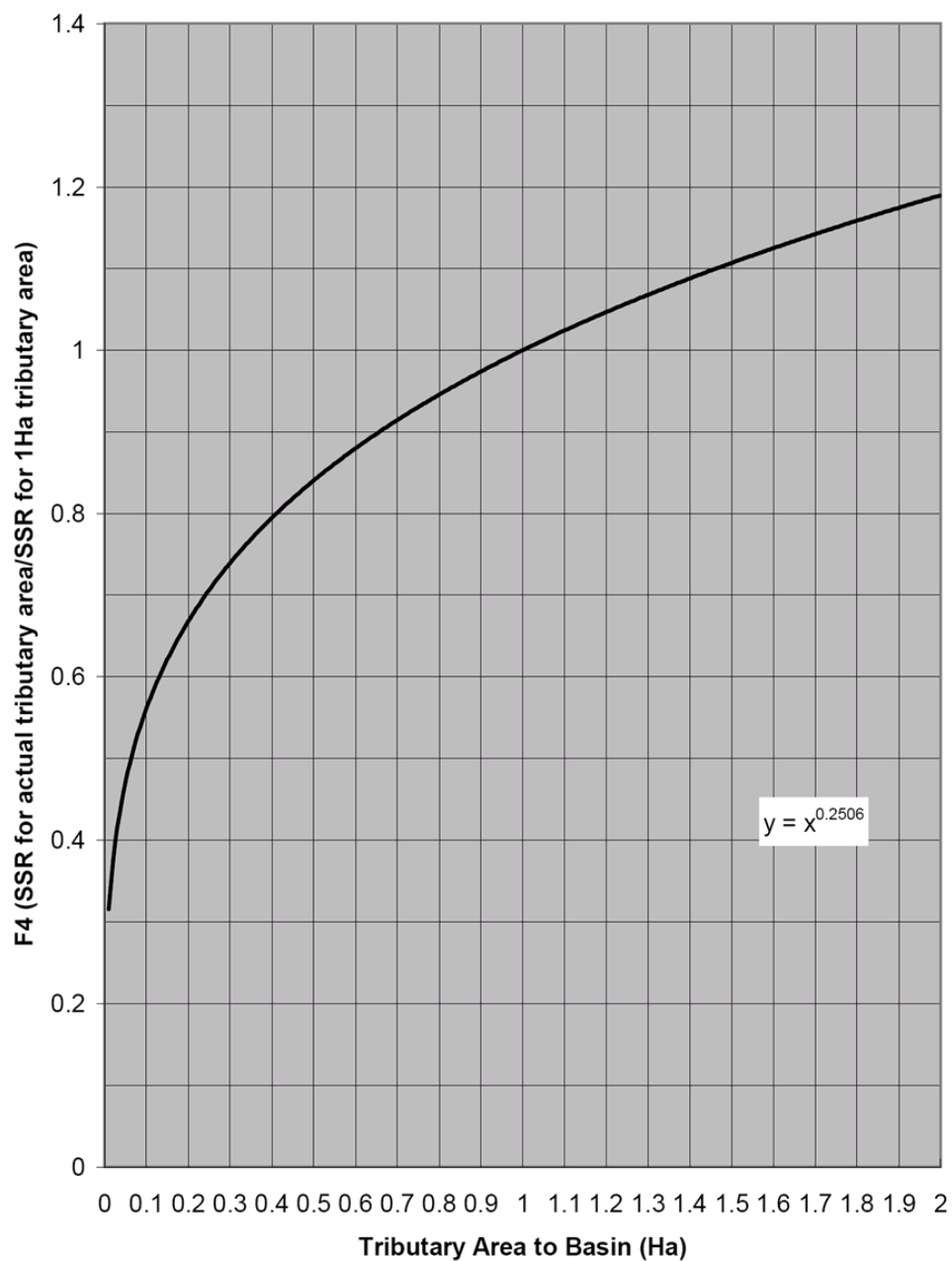
## APPENDIX A5: F3 –v- %Imp

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



## APPENDIX A6: F4 –v- Area

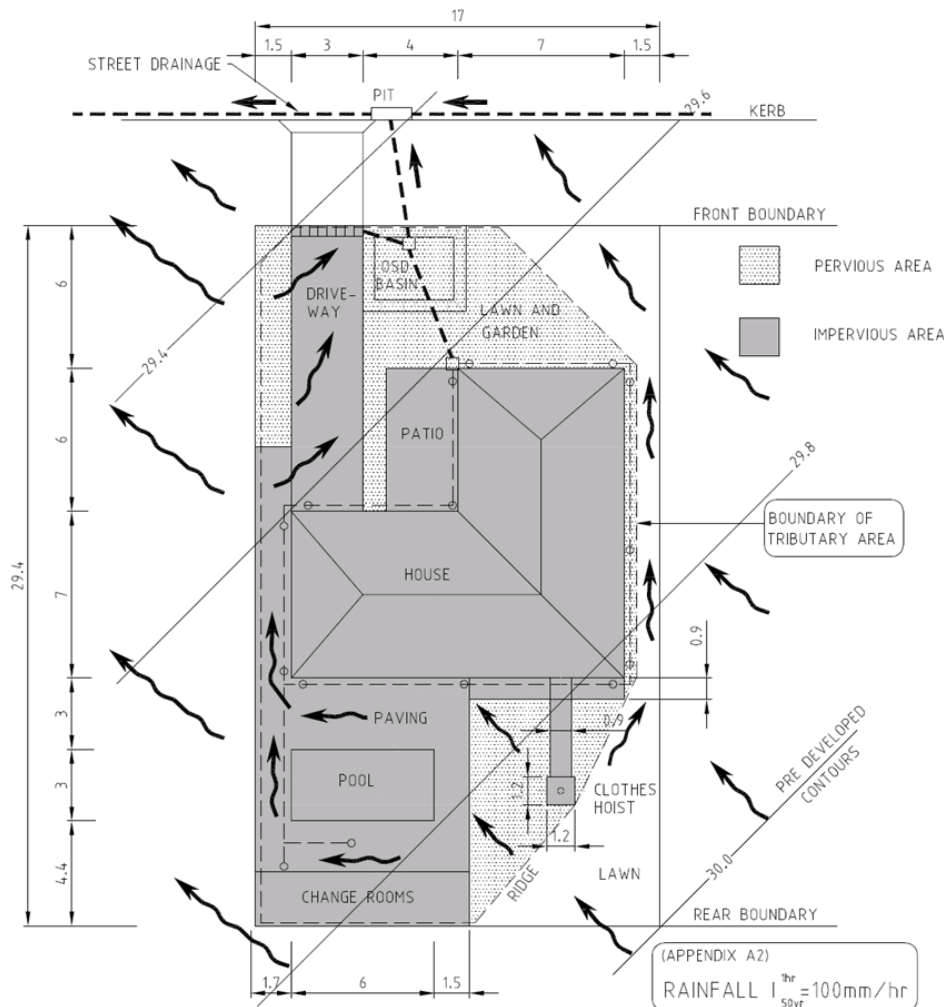
**Appendix A6 - Factor F4 vs Tributary Area**  
**0.1 to 2 Ha Tributary Area To Basin - Wollongong LGA**





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APPENDIX A7: Examples



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

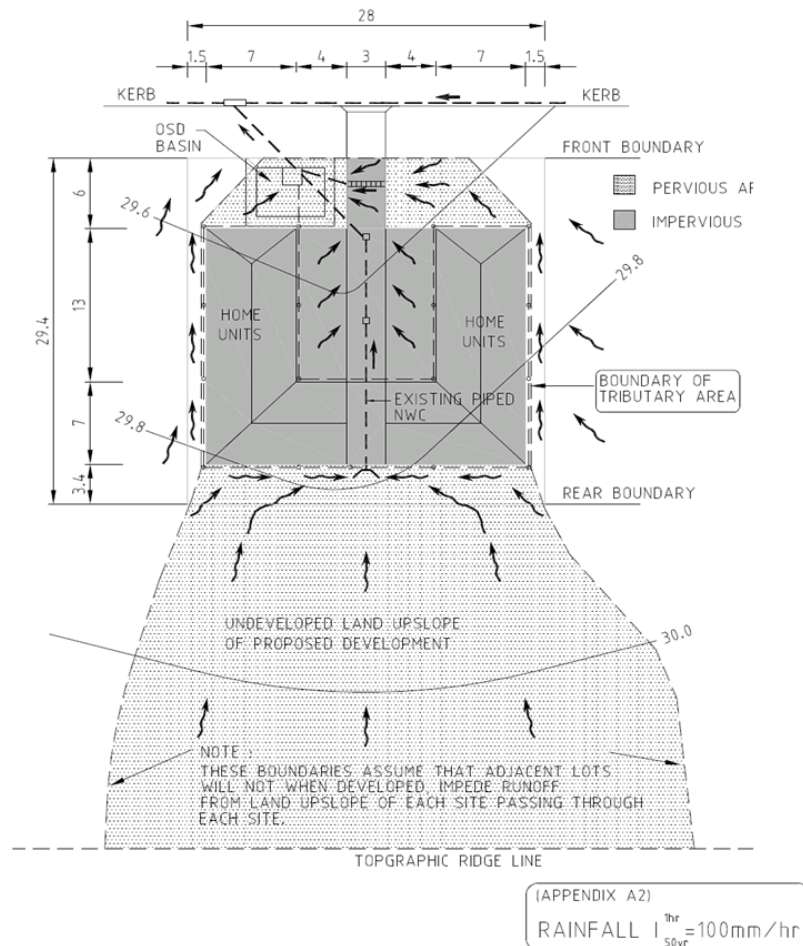
PLAN DATA	
SITE AREA (m <sup>2</sup> )	500
TRIBUTARY AREA (m <sup>2</sup> )	414
EX. IMPERVIOUS AREA (m <sup>2</sup> )	0
DEV. IMPERVIOUS AREA (m <sup>2</sup> )	316

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

GRAPHS	
(APPENDIX A3) F1 <sub>5</sub>	1.00
(APPENDIX A3) F1 <sub>100</sub>	1.00
(APPENDIX A4) F2	1.12
(APPENDIX A5) F3	0.17
(APPENDIX A6) F4	0.45

OSD REQD	
(1x1.12x2.67x(414/10,000)x100)	(EQ 1.4.4.1.)
PSD <sub>5</sub> (l/sec)	12.4
(1x1.12x4.67x(414/10,000)x100)	(EQ 1.4.4.2.)
PSD <sub>100</sub> (l/sec)	21.7
(0.17x0.45x2.25x12.4/1.12)	(EQ 1.4.4.3.)
SSR <sub>5</sub> (m <sup>3</sup> )	1.91
(0.17x0.45x2.25x21.7/1.12)	(EQ 1.4.4.4.)
SSR <sub>100</sub> (m <sup>3</sup> )	3.33

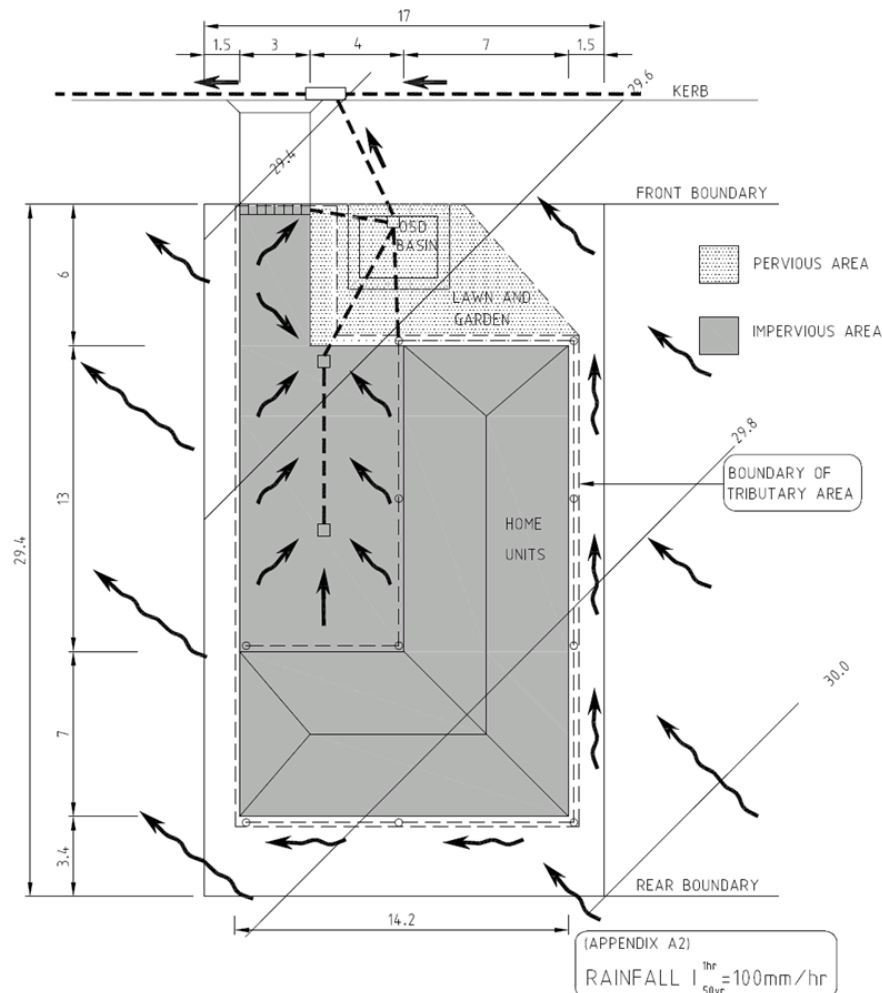
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EXAMPLE 2 – NEW UNITS ON UNDEVELOPED SITE  
(TRIBUTARY AREA BEYOND SITE)

PLAN DATA		GRAPHS		OSD REQD	
SITE AREA (m <sup>2</sup> )	823	(APPENDIX A3) F1 <sub>s</sub>	1.00	(1x1.10x2.67x(1901/10,000)x100)	(EQ 1.4.4.1.)
TRIBUTARY AREA (m <sup>2</sup> )	1901	(APPENDIX A3) F1 <sub>100</sub>	1.00	PSD <sub>s</sub> (l/sec)	55.8
EX. IMPERVIOUS AREA (m <sup>2</sup> )	0	(APPENDIX A4) F2	1.10	(1x1.10x4.67x(1901/10,000)x100)	(EQ 1.4.4.2.)
DEV. IMPERVIOUS AREA (m <sup>2</sup> )	518	(APPENDIX A5) F3	0.08	PSD <sub>100</sub> (l/sec)	97.7
NOTE : EXISTING CONDITION OF THE TRIBUTARY AREA IS 'NATURAL' (F1 = 1)		(APPENDIX A6) F4	0.66	(0.08x0.66x2.25x55.8/1.10)	(EQ 1.4.4.3.)
				SSR <sub>s</sub> (m <sup>3</sup> )	6.03
				(0.08x0.66x2.25x97.7/1.10)	(EQ 1.4.4.4.)
				SSR <sub>100</sub> (m <sup>3</sup> )	10.55

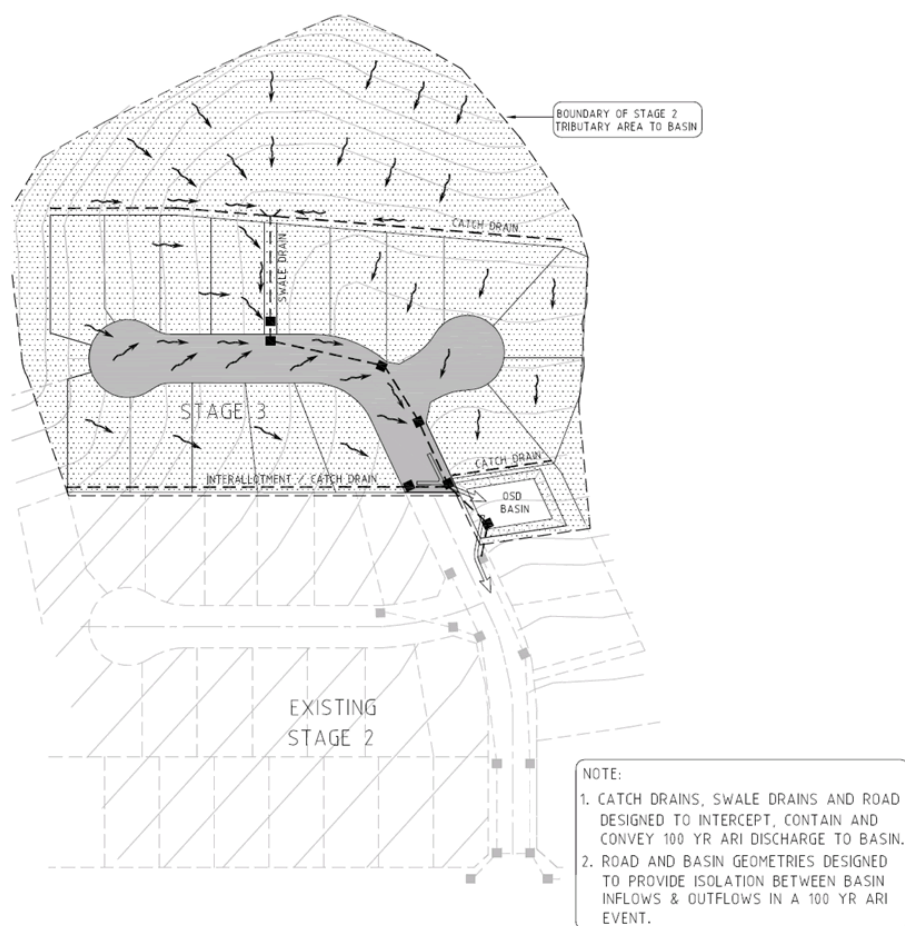
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EXAMPLE 3 (fig 1) - NEW UNITS ON PREVIOUSLY DEVELOPED SITE  
(TRIBUTARY AREA WITHIN SITE) (STEP 1)

PLAN DATA		GRAPHS		FINAL OSD REQD	
SITE AREA (m <sup>2</sup> )	500	(APPENDIX A3) F1 <sub>s</sub>	1.12	(1.12x1.12x2.67x(372/10,000)x100) (EQ 1.4.4.1.)	
TRIBUTARY AREA (m <sup>2</sup> )	372	(APPENDIX A3) F1 <sub>100</sub>	1.09	PSD <sub>s</sub> (l/sec) 12.46	
EX. IMPERVIOUS AREA (m <sup>2</sup> )	118 <sup>1</sup>	(APPENDIX A4) F2	1.12	(1.09x1.12x4.67x(372/10,000)x100) (EQ 1.4.4.2.)	
DEV. IMPERVIOUS AREA (m <sup>2</sup> )	300	(APPENDIX A5) F3	0.17	PSD <sub>100</sub> (l/sec) 21.21	
1. REFER FIG 1 FOR PROPOSED DEVELOPMENT TRIBUTARY AREA PLAN		(APPENDIX A6) F4	0.44	(0.17x0.44x2.25x12.46/1.12) (EQ 1.4.4.3.)	
				SSR <sub>s</sub> (m <sup>3</sup> ) 1.87	
				(0.17x0.44x2.25x21.21/1.12) (EQ 1.4.4.4.)	
				SSR <sub>100</sub> (m <sup>3</sup> ) 3.19	
				(1.87-0.88)	
NOTE : SSR*REQUIRED IS EQUAL TO SSR FOR PROPOSED DEVELOPMENT LESS SSR FOR EXISTING DEVELOPMENT CALCULATED IN FIG 2.				SSR* <sub>s</sub> (m <sup>3</sup> ) 0.99	
				(3.19-1.55)	
				SSR* <sub>100</sub> (m <sup>3</sup> ) 1.67	

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EXAMPLE 4 - 17 LOT GREENFIELD SUBDIVISION (STAGE 3)  
(TRIBUTARY AREA BEYOND SITE)

(APPENDIX A2)  
RAINFALL  $I_{50yr}^{7hr} = 100 \text{ mm/hr}$

PLAN DATA	
SITE AREA ( $\text{m}^2$ )	13,290
TRIBUTARY AREA ( $\text{m}^2$ )	19,967
EX. IMPERVIOUS AREA ( $\text{m}^2$ )	0
DEV. IMPERVIOUS ROADS AREA ( $\text{m}^2$ ) (2621@ 95%)	2,490
DEV. IMPERVIOUS LOTS AREA ( $\text{m}^2$ ) (10,669@60%)	6,402
DEV. TOTAL IMPERVIOUS AREA ( $\text{m}^2$ )	8,892

GRAPHS	
(APPENDIX A3) $F1_s$	1.00
(APPENDIX A3) $F1_{100}$	1.00
(APPENDIX A4) $F2$	0.95
(APPENDIX A5) $F3$	0.12
(APPENDIX A6) $F4$	1.19

OSD REQD	
$(1 \times 0.95 \times 2.67 \times (19,967 / 10,000) \times 100)$	(EQ 1.4.4.1.)
$PSD_s (\text{l/sec})$	506
$(1 \times 0.95 \times 4.67 \times (19,967 / 10,000) \times 100)$	(EQ 1.4.4.2.)
$PSD_{100} (\text{l/sec})$	886
$(0.12 \times 1.19 \times 2.25 \times 506 / 0.95)$	(EQ 1.4.4.3.)
$SSR_s (\text{m}^3)$	171
$(0.12 \times 1.19 \times 2.25 \times 886 / 0.95)$	(EQ 1.4.4.4.)
$SSR_{100} (\text{m}^3)$	300

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## 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

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

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ITEM	DESIGNER		COUNCIL REVIEW	
	YES	NO	YES	NO
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				



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Name of Designers Organisation .....

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

Signature of Reviewing Officer ..... /...../.....

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## 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

(e.g. 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 (egg. 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 5). 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.

**MAXI-MESH  
RH3030**



**Figure 5: Maximesh Screen**

*(Source: UPRCT OSD Design Handbook)*

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## SAMPLE MAINTENANCE SCHEDULE

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

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Inspect overflow weir & remove any blockage	Six monthly	Maintenance Contractor	Remove grate and open cover to ventilate underground storage if present. Ensure weir clear of blockages.
Empty basket at overflow weir (if present)	Six monthly	Maintenance Contractor	Remove grate and ventilate underground storage chamber if present. Empty basket, check fixings secure and not corroded.
Inspect pit walls (internal and external, if appropriate) for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls. Repair as required. Clear vegetation from external walls if necessary and repair as required.
Inspect outlet pipe & remove any blockage	Six monthly	Maintenance Contractor	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).
Check step irons for corrosion	Annually	Maintenance Contractor	Remove grate. Examine step irons and repair any corrosion or damage.
Check fixing of step irons is secure	Six monthly	Maintenance Contractor	Remove grate and ensure fixings secure prior to placing weight on step iron.
Inspect internal walls of return pit (and external, if appropriate) for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls. Repair as required. Clear vegetation from external walls if necessary and repair as required.
Compare storage volume to volume approved. (Rectify if loss > 5%)	Annually	Maintenance Contractor	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.
Inspect storages for subsidence near pits	Annually	Maintenance Contractor	Check along drainage lines and at pits for subsidence likely to indicate leakages.

## **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:** \_\_\_\_\_



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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:**

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---

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**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)

Part E – General Controls – Environmental Controls  
Chapter E14: Stormwater Management

**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.

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Signature: \_\_\_\_\_ Date: \_\_\_\_\_

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## 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 10 of this DCP.

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)

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Form: 13RPA  
Licence: 98M111  
Edition: 9906

**RESTRICTION ON THE  
USE OF LAND BY A  
PRESCRIBED AUTHORITY**  
New South Wales  
Section 88E(3) Conveyancing Act 1919

Land Titles Office use only  
Do not affix additional pages  
here: use the left-hand corner

(A) <b>TORRENS TITLE</b>			
(B) <b>LODGED BY</b>	LTO Box	Name, Address or DX and Telephone  Reference (optional):	CODE  <b>R</b>
(C) <b>REGISTERED PROPRIETOR</b>	Of the above land		
(D) <b>LESSEE MORTGAGEE or CHARGE</b>	Of the above land agreeing to be bound by this restriction on land		
	Nature of Interest	Number of Instrument	Name
(E) <b>APPLICANT</b>	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  
(F) 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  
(G) 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:  
Address of witness:

(H) I, 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:  
Address of witness:

All handwriting must be in block capitals.  
A set of notes on this form (13RPA-2)  
is available from the Land Titles Office.

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Checked by (LTO use):



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13RPA-2 (9909)

**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 CHARGE**

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 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 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.*

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Form: 13PC  
Licence: 98M111  
Edition: 9909

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

Land Titles Office use only  
Do not affix additional pages  
here: use the left-hand corner

(A) <b>TORRENS TITLE</b>			
(B) <b>LODGED BY</b>	LTO Box	Name, Address or DX and Telephone  Reference (optional):	CODE  <b>PC</b>
(C) <b>REGISTERED PROPRIETOR</b>	Of the above land		
(D) <b>LESSEE MORTGAGEE or CHARGE</b>	Of the above land agreeing to be bound by this positive covenant		
	Nature of Interest	Number of Instrument	Name
(E) <b>APPLICANT</b>	A prescribed authority		

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

Signed in my presence by the **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:

Address of witness:

(H) I, the **lessee/mortgagee/chargee** under lease/mortgage/charge No. , agree to be bound by this positive covenant.

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:

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.

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Checked by (LTO use):

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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 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 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 CHARGE**  
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 88E(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 of 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



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### *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.

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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.

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**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.**

(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  
 referred to in above-mentioned plan

Positive Covenant under  
 Section 88E of the  
 Conveyancing Act 1919



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**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*).

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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'
- **Information Bulletin No. 56** - 'Property Legislation (Easements) Amendment Act 1995.'

#### **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**

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**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

**4. Creating Profits à Prendre, Restrictions on Use of Land.**

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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

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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**

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<p>PLAN FORM 2 (APPROVED FORM 3)</p> <p><b>SIGNATURES, AND SEALS ONLY</b></p>	<p>Plan Drawing only to appear in this space</p>		<p><b>D.P.</b></p> <p>Registered: *</p> <p>C. A. :</p> <p>Title System:</p> <p>Purpose:</p> <p>Ref. Map:</p> <p>Last Plan:</p> <p>PLAN OF SUBDIVISION OF LOT 8 IN DP29743</p> <p>Lengths are in metres. Reduction Ratio 1:300</p> <p>L. G. A. : GOODAREA</p> <p>Locality: FINE</p> <p>Parish: GOOD</p> <p>County: PLEASANT</p> <p>This is sheet 1 of my plan in sheets. (Delete if inapplicable) Surveyors Certificate</p> <p>Plans used in preparation of Survey/Compilation</p> <p>PANEL FOR USE ONLY for statements of intention to dedicate public roads, to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants</p> <p>PURSUANT TO SEC. 888 OF THE CONVEYANCING ACT 1919, IT IS INTENDED TO CREATE:-</p> <p>1. RIGHT OF CARRIAGEWAY AND EASEMENT FOR SERVICES 2.7 WIDE</p> <p>2. RIGHT OF WAY 1.05 WIDE AND VARIABLE WIDTH</p> <p>3. POSITIVE COVENANT</p> <p>4. RESTRICTION ON THE USE OF LAND</p> <p>RELEASE:-</p> <p>1. EASEMENT TO DRAIN WATER 2 WIDE (DP 840601)</p>
	<p>DP 30479</p> <p>DP 29743</p> <p>DP 372237</p> <p>CRANE AVENUE</p> <p>(A) RIGHT OF CARRIAGEWAY AND EASEMENT FOR SER</p> <p>(B) RIGHT OF WAY 2.1 WIDE AND VARIABLE WIDTH</p> <p>(C) STORMWATER RETENTION BASIN</p> <p>NOTE</p> <p>THIS PLAN HAS BEEN PREPARED FOR SAMPLE PURPOSES ONLY BEARINGS AND OTHER SURVEY INFORMATION HAVE BEEN OMITTED</p> <p>Table of mm</p> <p>WARNING CREASING OR FOLDING WILL LEAD TO REJECTION</p>		
<p>Subdivision Certificate</p>		<p>SURVEYOR'S REFERENCE :</p>	

ANNEXURE 1

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**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.**

**Plan:** Subdivision of Lot 8 D.P.29743 covered  
by Subdivision Certificate No. 98/200 of  
9/7/1998

**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, restriction or positive covenant to be created and firstly referred to in the plan** Right of Carriage Way and  
Easement for Services 2.7 wide

**Schedule of Lots etc. Affected**

<b>Lots Burdened</b>	<b>Lots Benefited</b>
82	81

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

**Schedule of Lots etc. Affected**

<b>Lots Burdened</b>	<b>Lots Benefited</b>
81	82

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

**Schedule of Lots etc. Affected**

<b>Lots Burdened</b>	<b>Lots Benefited</b>
81	Goodarea Council

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

**Schedule of Lots etc. Affected**

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**Lots Burdened**

81

82

**Lots Benefited**

Goodarea Council

Goodarea Council

DRAFT

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**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.**

**Plan:** Subdivision of Lot 8 D.P.29743 covered  
by Subdivision Certificate No. 98/200 of  
9/7/1998

**Part 1A**

**1. Identity of easement to be released and** Easement to Drain Water 2 wide  
**firstly referred to in the plan** (DP 840601)

**Schedule of Lots etc. Affected**

**Lots Burdened**

8/29743

**Lots Benefited**

9/29743

**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.

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**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.**

**Plan:** Subdivision of Lot 8 D.P.29743 covered  
by Subdivision Certificate No. 98/200 of  
9/7/1998

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 proprietor 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



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**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**

*(Brief description in same terms as*

**prendre, restriction or positive covenant to be created and firstly**

*used in relevant statement in the plan).*

**referred to in the plan.**

**Schedule of Lots etc. affected**

**Lots burdened**

**Lots, relevant roads, bodies or**

**prescribed authorities benefited.**

*(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**

*(Brief description in same terms as used*

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**prendre, restriction or positive** *in relevant statement in the plan).*

**covenant to be created and firstly**

**referred to in the plan.**

**Lots burdened by existing  
prescribed easement, , profit à prendre**

**Lots, relevant roads, bodies or  
authorities benefited by existing  
easement.**

*(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).*

**Annexure 3**

**Part 2**

Terms of easement, profit à prendre, restrictions or positive covenant("firstly", or as the  
case may be) referred to in the plan.

*(Continue the 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)*

Name of person empowered to release, vary or modify restriction or positive covenant  
("firstly", or as the case may be) referred to in the plan:

*(Not required where it is intended that the restriction may only be released, varied or modified by the owners  
for the time being of all lots benefited, or by order of the Supreme Court)*

**Annexure 4**

**Examples of the Schedule of Lots Burdened and 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.

**Lots burdened**

1

**Lots benefited**

2, 3 & 4

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2	3 & 4
3	4
or	or
Each lot except lot 6 ( <b>see note</b> )	Every other lot except lot 6 ( <b>see note</b> )
or	or
Each of the lots 1 to 4 inclusive	Every other lot and the
the part of lot 5 designated (A) in	Council of .....
the plan and lot 6	
or	or
Each lot	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.

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*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.**

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**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

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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)



Part E – General Controls – Environmental Controls  
Chapter E14: Stormwater Management

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.

Section	Change	Comment
1. Introduction	Added chapter of the DCP should be read in conjunction with: a) Wollongong Local Environmental Plan; b) Wollongong City Council DCP Chapter E13: Floodplain Management; c) Wollongong City DCP Chapter E15: Water Sensitive Urban Design; d) Australian Rainfall and Runoff (1987 and 2019 versions); e) Sydney Water Guidelines for Building over or Adjacent to Stormwater Assets; f) Austroads; and g) Other relevant local and state guidance.	2009 Chapter only referred to floodplain and WSUD DCP Chapters only
2 Definitions / Technical Terms	<b>AEP</b> The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. Example, if a peak flood discharge of 500 m <sup>3</sup> /s has an AEP of 1%, it means that there is a 1% chance (that is one-in-100 chance) of a 500 m <sup>3</sup> /s or larger event occurring in any one year. Annual Exceedance Probability: The probability of a rainfall or flood event of given magnitude being equalled or exceeded in any one year.	Consistent with FDM (2005)
2 Definitions / Technical Terms	<b>ARR2019</b> Australian Rainfall and Runoff 2019, published by the Commonwealth of Australia (Geoscience Australia).	Definitions and DCP chapter refer to both ARR1987 and ARR2019
2 Definitions / Technical Terms	<b>DPIE</b> Department of Planning Infrastructure and Environment	State Government departmental name change
2 Definitions / Technical Terms	<b>Suitably Qualified Civil Engineer</b> A civil engineer who is included in the National Professional Engineers Register, Australia administered by the Institution of Engineers Australia or is eligible for membership of Engineers Australia.	Council engages consultants who are not on the NER for flood studies and stormwater designs
2 Definitions / Technical Terms	<b>Trunk Drainage</b> High capacity channels or networks which carry runoff from local street drainage systems to receiving waters and forms part of the major system as defined in ARR2019 Book 9.	Suggest removing 15ha definition. This definition is not in ARR1987. ARR2019 says trunk drainage is part of the Major System
2 Definitions / Technical Terms	<b>Zone of Influence (ZOI)</b> The area around an asset (both at ground level and below the ground) that may impact on a asset	Provides clearer guidance for the protection of Council and private stormwater assets
3.3 Trunk Drainage	1. Trunk drainage networks must be designed to the 100 year ARI event. High consequence trunk drains and networks (e.g. detention basins, high consequence culverts) must be designed to accommodate larger flood events up to the PMF. Further information on trunk drainage is provided in Section 5.8.	Unclear what "cater to the PMF" means for all trunk drainage elements. Suggest only high consequence trunk drainage

		structures been designed or checked against PMF
5.1.1 Design Rainfall Intensities	a) All parameters used in hydrologic models must be selected in accordance with those values adopted as part of Council's catchment wide flood studies or FRMS. b) For unstudied catchments, ARR1987 IFDs and hydrologic procedures will be used until Council has investigated the implications of ARR2019 for the Wollongong LGA through catchment wide FRMS.	The hydrologic techniques used in adopted Council Flood Studies and Floodplain Risk Management Studies will be used to estimate minor and major system flows in the study area
5.1.2 Estimating Flows	Figure 1 indicates the likely range of effectiveness for different hydrologic models against flood magnitude and model scale. The applicant must justify the appropriateness of any selected hydrologic model selected for the estimation of minor and major system flows	Allows developers to select an appropriate hydrologic model for their development
5.2.2 - Inlets and their Capacities	b) The blockage factors to be used in the analysis of pits are: • Sag pits – 50% • On grade pits – 20%	Clarify confusing requirement from 2009 version
5.3 Hydraulic Design - Minor System	1. The hydraulic design of the minor system must be carried out using the hydraulic grade analysis in accordance with Chapter 5 of Book 9 ARR2019. Suitable computer software (e.g. Drains, 12D) should be used. For simple systems, (e.g. less than 10 pits) manual or spreadsheet calculations are accepted.	Prefer computer modelling rather than hand calcs/spreadsheet calcs
5.3 Hydraulic Design - Minor System	Table 4 Minimum cover	Adopted from QUDM
5.9 Safety in Design	Section added	
6.2 Other Stormwater Designs	Added: 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.	
6.3.9 (11.3.9) Discharge of Stormwater through Public Reserves	a) 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, an easement issued by Council must be applied for under section 46 (1) of the Local Government Act.	Installation of infrastructure for drainage of private land though council-owned community land policy revoked in 2017
6.3.12 (11.3.12) Absorption and Transportation Disposal Systems	Added: g) Offsets around new buildings may be reduced if the footings are designed commensurate to the groundwater and geotechnical stability of the absorption trench.	

	A suitably qualified structural or geotechnical engineer will complete the footing designs.	
6.3.12 (11.3.12) Absorption and transpiration Disposal Systems	Added: j) Granny flats and detached garages may drain to an absorption trench subject to the set backs listed in 6.3.12.f)	
7.1.2 (12.1.2) Developments to Which OSD Does Not Apply	Added: viii) Buildings in rural/non urban areas including RU1, RU2 RU3 RU4, RU6 E2, E3 and E4.	
9 (14)APPLICATION OF THIS CHAPTER	Recommend we remove or modify - does not seem relevant	
APPENDIX -A1	Water Courses to be removed from figure	
APPENDIX - Drawings	Removed Roadway Capacity Determination Details and Explanation Figure and Tables 7.1 and 7.2	Not referred to in document. Unclear why they are in DCP.
Standard Sumps and inlets	Updated	