City of Stonnington

Stonnington Special Building Overlay Review 2017

Final Report

January 2018

Glossary of terms and abbreviations

Term	Definition
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood discharge of 70 m^3/s has an AEP of 5%, it means that there is a 5% chance (i.e. a one-in-20 chance) of a 70 m^3/s or larger event occurring in any one year.
Australian Height Datum (AHD)	A datum for the recording of elevations. Zero metres AHD approximates mean sea level along the coast.
Australian Rainfall and Runoff (ARR)	Australian Rainfall & Runoff, A Guide to Flood Estimation, is a design guide for hydrological and hydraulic analyses. Different versions have been released over time, the main ones commonly referred to as ARR1987 and ARR2016, which were released in 1987 and 2016 respectively.
Average Recurrence Interval (ARI)	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. This terminology although widely used by specialists is often misinterpreted by the public and is subsequently being replaced with AEP terminology.
Catchment	An area of land draining to a specific location.
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s).
Flood	A relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences (excluding tsunami).
Floodplain	The area of land that is subject to inundation by floods up to and including the Probable Maximum Flood event (i.e. flood prone land).
Floodway	Floodways are typically designated as being an area where the velocity x depth product exceeds unity and the flow velocity exceeds 0.25 m/s.
Flood Hazard	The potential for damage to a property or risk to a person(s) during a flood. Flood hazard is calculated as the product of the flow depth and the flow velocity. Flood hazard is a tool used to determine flood severity.
Flood Level	The height of the flood described either as a depth of water above a particular location (e.g. 1 m above a floor, yard or road) or as a depth of water related to a standard level such as Australian Height Datum (e.g. the flood level was 7.8 m AHD).
Flood Prone Land	Land susceptible to flooding from events up to the Probable Maximum Flood (PMF).
Flow	Refer to discharge.

Term	Definition
Freeboard	A factor of safety expressed as a 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.
Hydrograph	A time series of flows or flood levels.
Hydrological	Pertaining to the rainfall and runoff process; in particular, the estimation of peak discharges, flow volumes and the derivation of hydrographs (graphs that show how the discharge or stage/flood level at any particular location varies with time during a flood).
Hydraulic	Term given to the study of water flow in waterways; in particular, the estimation of flow parameters such as water level and velocity.
LiDAR	A remote sensing method of obtaining a feature survey of a large area by using **Li**ght **D**etection **a**nd **R**anging typically from a plane in conjunction with ground control spot heights.
Overland flow path	The path that floodwaters can follow if they leave the confines of the main flow channel. Overland flow paths can occur through private property or along roads. Floodwaters travelling along overland flow paths, often referred to as 'overland flows', may or may not re-enter the main channel from which they left — they may be diverted to another watercourse.
Peak discharge	The maximum flow or discharge during a flood.
Photogrammetry	A remote sensing method of obtaining a feature survey of a large area by using low level aerial photography (with overlapping stereo pairs to enable depth perception) in combination with ground control spot heights.
Planning controls	Requirements to control and guide appropriate development outcomes.
Probable Maximum Flood (PMF)	The largest flood that could conceivably occur at a particular location, usually determined from the Probable Maximum Precipitation (PMP). Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land (i.e. the floodplain). The extent, nature and potential consequences of flooding associated with the PMF event should be addressed in a floodplain risk management study.
Probable Maximum Precipitation (PMP)	The theoretical 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 us the primary input to the estimate of the Probable Maximum Flood.
RORB	A software program used to analyse the hydrology (rainfall–runoff processes) of the catchment and calculates hydrographs and peak discharges.
Runoff	The amount of rainfall that ends up as flow in a stream, also known as rainfall excess.
Special Building Overlay (SBO)	An area defined by the extent of overland flooding in the 100 year ARI flood, within which particular planning controls apply. For the City of Stonnington, the proposed SBO defines the known areas of inundation for the City of Stonnington drains and the Melbourne Water drains.

Term	Definition
TUFLOW	A software program used to assess the flow depths, velocities and levels over the land surface and through the drainage system.
Velocity	Term used to describe the speed and direction of floodwaters, usually in m/s (metres per second). For reference, 10 km/h is approximately 2.8 m/s.

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

Stonnington City Council is in the process of revising some of the Stonnington Special Building Overlay (SBO). This revision will cover flood mapping changes that have occurred since the GHD Stonnington Flood Plain Mapping Revision (June, 2003).

In October 2001 GHD provided a report 'Review of Technical Derivation' that provided support for Council officers when queries were raised by residents and when attending the panel hearing for the existing SBO, which came into operation in May 2005. This new document provides a high level summary of a number of changes, which have occurred both locally and within the industry, It is appropriate that revisions and changes are made to flooding overlays from time to time to reflect changed physical conditions as well as improvements in knowledge and understanding of the expected flood risk or vulnerability to flooding.

1.2 Purpose of this report

This report provides information to explain:

- Why much of the original mapping is being retained
- The general suitability of the modelling methods applied for the revised mapping

The proposed amendments have been derived from a number of more recent studies including:

- Stonnington Flood Mapping Revisions (GHD - 2008)
- Darling Road Catchment Report (GHD - July 2005)
- Melbourne Metro Rail Project (flood extent in Chapel Street – 2016)
- Melbourne Water Main Drain Flood Mapping Revisions

The City of Stonnington have produced a plan overview of the proposed amendments, which has been included in Appendix A as a reference.

1.3 Scope and limitations

This report has been prepared by GHD for the City of Stonnington and may only be used and relied on by the City of Stonnington for the purpose agreed between GHD and the City of Stonnington as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than the City of Stonnington arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

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1.4 Assumptions

GHD has not reviewed modelling undertaken by other consultants or provided comment on the suitability of the reported methodology, nor on its specific application in this instance.

The proposed amendments to the SBO are expected to improve the reliability of the overlay in its primary use as a referral layer. The Stonnington SBO has been developed using a mixture of experience, judgement and modelling to cover most areas within the municipality that are prone to flooding. Flooding can affect areas beyond the extents shown for a range of reasons, including but not limited to:

- Not all areas have been investigated
- Floods larger than the design flood on which the SBO is based can occur
- Blockages and changes to catchments and flow paths can alter flooding characteristics

As a result of the above it is considered that the proposed SBO is generally suitable as a reference layer, which is considered as part of a more detailed investigation by a suitably experienced drainage engineer, to establish site specific development requirements. Additional information which may be required to undertake a site specific investigation or assessment may include:

- Additional survey
- A review of changes to the catchment and drainage system
- A more detailed hydraulic analysis
- A detailed understanding of the development proposal
- Broader flood plain management considerations

2. Background

2.1 Purpose of the SBO

The SBO is one of several flooding overlays and zones commonly used in the Victorian Planning Provisions to help control development so that new developments are relatively well protected from flooding and do not increase flooding problems of existing properties. Overlays and their associated schedules provide additional requirements and guidance to the provisions of the underlying zone. The flood related overlays and zone are summarised in Table 2-1.

Table 2-1 Overlays

Overlay Type	Abbreviation	Relevant Clause	Application / Description
Special Building Overlay	SBO	44.05	Land subject to overland flow in urban areas.
Land Subject to Inundation Overlay	LSIO	44.04	Associated with riverine systems, open waterway and open drains
Floodway Overlay and Rural Floodway Overlay	FO RFO	44.03	Typically deep and or fast flowing areas subject to the greatest risk and frequency of flooding
Urban Floodway Zone	UFZ	37.03	Similar to the floodway overlays providing a stronger control of land use.

Clause 44.05 of the Victorian Planning Provisions states the purpose of the SBO as:

To implement the State Planning Policy Framework and the Local Planning Policy Framework, including the Municipal Strategic Statement and local planning policies.

To identify land in urban areas liable to inundation by overland flows from the urban drainage system as determined by, or in consultation with, the floodplain management authority.

To ensure that development maintains the free passage and temporary storage of floodwaters, minimises flood damage, is compatible with the flood hazard and local drainage conditions and will not cause any significant rise in flood level or flow velocity.

To protect water quality in accordance with the provisions of relevant State Environment Protection Policies, particularly in accordance with Clauses 33 and 35 of the State Environment Protection Policy (Waters of Victoria).

The first paragraph includes references and requirements of other related documents such as the Municipal Strategic Statement and any local planning policies.

The second paragraph identifies that this overlay identifies urban areas liable to flooding from surcharging of urban drainage systems.

The third paragraph requires that new developments and their occupants are relatively well protected from flooding and do not increase flooding problems on existing properties.

The last paragraph relates to sewerage planning and management requirements to minimise the potential for interchange between stormwater and wastewater systems.

The proposed amendment to the SBO also segregates the SBO into SBO1 and SBO2, to differentiate Melbourne Water and City of Stonnington flood extents respectively. The purpose of this separation is to clarify jurisdictions (i.e. which approval authority needs to be consulted).

2.2 Continual change

The SBO is based on the estimated flood extent from a 1% AEP design storm (i.e. a storm with a 1% chance of being exceeded in any given year). Stonnington City Council was one of the first councils to undertake flood mapping covering much of its municipality and to include this information in its planning scheme. The cost and time frame for the original project was minimised by applying local knowledge of the municipality to identify which regions were prone to flooding and required mapping. Selectively identifying the areas to be mapped allowed the majority of the municipality's flood prone regions to be thoroughly investigated and mapped, thus substantially improving future planning outcomes for the municipality.

There has subsequently been numerous revisions to the underlying flood mapping for a number of reasons including:

1. Flood mitigation works by Melbourne Water and or Council
2. Major infrastructure works such as Melbourne Metro and Level Crossing Removal
3. New survey data
4. Approved modifications to the overland flow paths, developments, roadworks
5. Assessments of changes in land use and development
6. More detailed localised flood models using newer techniques
7. Identification of additional areas which are prone to flooding
8. Assessment of the impact of maintenance and or upgrade works

Updating and or amending the flood related planning scheme overlays is an involved process which is not undertaken lightly. It is generally not practical to update the planning scheme for each individual revision of the underlying flood mapping. Rather, what tends to happen is that the revisions are collated and put together as a package for a planning scheme amendment.

It is likely that there will continue to be some ongoing refinement and extension of the SBO in the future with additional mitigation works and refined modelling. In general however, the expected changes are likely to be refinements and may in themselves not warrant an update of the SBO.

2.3 Changes in urban flood plain management

The following sections provide a brief overview of the changes that have occurred and are occurring in urban flood plain management:

2.3.1 Drainage standards, principals and practise

There have been some significant changes in drainage standards and approaches over time. The Stonnington City Council includes a wide range of development densities and ages. Many areas were developed very early on with little consideration of drainage requirements. In contrast, recent developments are typically designed to minimise susceptibility to flooding and any potential impact on surrounding properties. Legacy constraints often limit the potential to provide contemporary drainage standards and strategies, which include a convenience (minor) drainage system and a designed overland flow path for more major storm events.

2.3.2 Development densities and planning changes

Current areas of high density development have little potential for becoming denser and producing more runoff during a particular storm event. In contrast, current lower density areas have more potential to develop into denser areas with less pervious area. Development in the lower density areas has the potential to increase impervious area resulting in increased runoff volumes and flooding unless mitigated by stormwater recycling/storage and/or improvement in the capacity of the drainage system.

2.3.3 Revision of ARR 1987 to 2016

With an additional 30 years of observations and refined analysis techniques, the new version of Australian Rainfall and Runoff (ARR2016) has the potential to enable some further refinement of the flooding extents in the City of Stonnington. The impact of the revised methodologies and data provided by ARR2016 is still being evaluated and will require further testing before a firm opinion can be made. It is likely that flooding in some areas will be slightly worse and that flooding in other areas will be slightly less than currently estimated. It is expected that the general extents of flood prone land will not change significantly as a result of adopting ARR2016, although this is yet to be proven.

2.3.4 Climate change

It is now widely accepted that climate change is occurring and is influenced by human activities. There remains however significant uncertainty and variability in the currently available analysis. Consequently, it is likely that there will be significant future changes in climate change predictions.

It is generally considered good practise to consider the robustness and adaptability of drainage systems and development to cope with potential increases in the frequency of more intense rainfall and higher sea levels.

Book 1 Chapter 6 of ARR 2016 recognises that current climate models are better at predicting temperature change than change in storm events, and subsequently recommends that Climate Change predictions be made using projected temperature increases from the climate futures web tool developed by the CSIRO.

This tool provides a number of scenarios considered with varying Representative Concentration Pathways (RCPs) which were used to drive a number of Global Climate Models (GCMs). The City of Stonnington (and most of Melbourne) is located within the “Southern Slopes Mainland” region, which has predicted temperature increases as shown in the copy of Table 1.6.7 below (from Book 1 Chapter 6 of ARR 2016).

Table 1.6.7. Southern Slopes Cluster

	Temperature Class Interval (°C)			
	Slightly warmer	Warmer	Hotter	Much hotter
Year	< 0.5	0.5 to 1.5	1.5 to 3.0	> 3.0, (median)
RCP4.5 and 40 GCMs				
2040	1	39		
2050		37	3	
2060		31	9	
2070		28	12	
2080		20	20	
2090		20	20	
RCP8.5 and 42 GCMs				
2040	1	38	3	
2050		24	18	
2060		9	33	
2070			39	3 (3.0)
2080			26	16 (3.3)
2090			18	24 (3.6)

Noting an expected increase in heavy rainfalls of between 1% and 15% for each degree of local warming, ARR recommends an interim value of 5% increase in rainfall for each degree of local warming.

Current Melbourne Water advice is to access the impact of climate change by adopting the Representative Concentration Pathways (RCP) 8.5 values for 2090 from the ARR data hub (http://data.arr-software.org/), which means an expected increase in temperature of 3.21^{O} C and a consequent 16.1% increase in rainfall intensities. Any increase in rainfall intensities could potentially affect all areas of the municipality although flood prone areas will in general be more significantly affected.

In general, Stonnington is sufficiently elevated that sea level rise is not likely to become a significant concern. If water levels in Port Phillip Bay were to increase significantly there are a number of low lying areas indicated using (http://coastalrisk.com.au/viewer) where drainage issues might be exacerbated such as River Street, Yarra Street, Claremont Street, and parts of the Gardiners Creek Floodplain.

It is usual for the climate change assessments to be undertaken as a sensitivity assessment to better understand potential future scenarios, while current conditions are actually used to create planning overlays. It is expected that the current SBO extents are and will remain a good indicator of flood prone land. The potential effects of climate change may be to increase the frequency, severity and extent of flooding. On this basis over time, additional areas may be included in the SBO. Based on currently available information it is unlikely that areas currently identified by flooding overlays will be removed as a result of climate change considerations.

2.4 Changes in assessment methods

2.4.1 Early mapping

Early flood mapping was undertaken using fully routed RORB modelling to estimate design flows and 1D hydraulic modelling (XP-EXTRAN) with constant flow rates. This was standard practise at the time and was the only practical method given the computing capacity of the time. Analysis using this approach is very dependent on the skills and understanding of the modeller in representing the fundamental catchment mechanisms, in particular the routing and storages within the hydrologic RORB model and the flow paths and relative roughnesses of various one dimensional flow paths in the hydraulic model.

2.4.2 Recent mapping

The methodology adopted in recent mapping investigations is still dependant on careful modelling however, by utilising a more detailed representation of the processes, it is easier to get a good result. Design storms are still modelled using a hydrologic model (RORB) although, within the bounds of the hydraulic model, much of the routing and attenuation is now undertaken using the more detailed representation in the hydraulic model. To enable this approach the hydrologic model is now used to generate time varying flows (hydrographs) for input into the hydraulic model. Previously all the routing was undertaken within the hydrologic model and only peak design flows were produced and transferred to the hydraulic model.

The hydraulic modelling undertaken in recent work utilises a two dimensional hydraulic model (TUFLOW), which enables flows to propagate in multiple directions throughout a fine resolution grid. In TUFLOW, the flow paths based primarily on the direction and speed of flow, and the roughness and topography represented in the model. Previously with the one dimensional hydraulic model, the primary flow directions had to be estimated prior to running the model and refined as necessary.

The two dimensional results also provide a better and more representative data set for mapping purposes, making the mapping process easier and less reliant on appropriate interpretation of the hydraulic results.

2.4.3 Future mapping

It is expected that analysis techniques will continue to change as computing power increases. The following are some currently evident trends that are expected to continue to develop and progressively become practical for the derivation of flooding overlays:

1. Current 2D modelling using TUFLOW in urban areas is largely undertaken using an efficient algorithm optimised to run on a single fast Central Processing Unit (CPU, the main processor in a computer). A new highly parallelised version of the software, designed to run on high end graphics cards, is about to be released, which will significantly cut down on simulation time by running multiple threads of the same simulation in parallel across a large number of processors. This will facilitate more detailed assessment both in terms of resolution and the number of scenarios considered.
2. Hydrology may move toward a rain on grid approach within the hydraulic model. This, and a number of related variations, are currently available and widely used, although there are still some issues to resolve before it becomes a mainstream approach.
3. Faster computers, larger storage and improved data transfer mechanisms will continue to change what is practical and affordable.
4. With the release of ARR2016 the assessment of design storms has moved from discrete storms to ensemble patterns and Monte Carlo simulations, which are becoming more practical as computing power increases.

2.5 Effect of changes to methodology and survey

It is not economically viable or necessary to regularly remap areas that have been previously mapped, unless changes to infrastructure, terrain, survey and or methodology are likely to make a significant difference to the flood extent. The following is an example where remapping has been undertaken because it was considered that the potential for change made it worthwhile.

The Darling Road Catchment was originally mapped in 1998/99 by Egis consulting using the methodologies briefly described in Section 2.4.1 above and using aerial photogrammetry purpose flown on the 25 October 1998. The original 100 year ARI flood extent is shown in the left of Figure 2-1.

This catchment was remapped in 2015 using new LiDAR survey, a revised RORB hydrologic model and a TUFLOW unsteady flow hydraulic model, in general accordance with the description of recent mapping above refer Section 2.4.2. The revised 100 year ARI flood extent is shown in the right of Figure 2-1. Notable differences in the modelling approach are most evident at the upstream end (south of Waverley Road). In the original modelling, the effects of that storage were represented in RORB, while in the recent modelling a more detailed representation of the drainage system in a two dimensional hydraulic model results in a better representation of the storage effects.

1998 Mapping 2015 Mapping

Figure 2-1 Comparison of early and recent mapping - Darling Road Catchment

2.6 Key mapping milestones

The chronological summary of key mapping milestones/projects is presented in Table 2-2. This summary indicates how the modelling process has changed over time.

Table 2-2 Flood Mapping Chronology

Year		Brief Description
1998	AAM	Photogrammetric aerial survey
1999	Egis	The original flood mapping packages in which Council optimised coverage of the entire municipality by carefully selecting areas to be investigated
2001	Egis	This revision/extension of the previous work filled in some gaps identified in the original flood mapping packages.
2001	GHD	Proposed Special Building Overlay – Review of Technical Derivation, October 2001 GHD undertook an independent audit of various aspects of the technical derivation of the draft SBO extents prepared by Egis and proposed for inclusion in the Stonnington Planning Scheme (Amendment C18).
2002		GHD acquires Egis Consulting
2003	GHD	Floodplain mapping revisions undertaken by GHD in 2003
2004		Stonnington Planning Scheme Amendment C18 – Panel Hearing – Support Information, September 2004 Response to various address specific questions/issues
2003 /04	GHD	Yarra Street Catchment, GHD 2004 Council accepted custodianship of the Yarra Street Main Drain (Drain No. 4801) from Melbourne Water and wished to remap this drain to: • Bring it up to the same standard as other flood mapping undertaken by GHD for Council • Produce a continuous extent with existing Council mapping integrating modelling and extents where appropriate such as along Station, Yarra and Claremont Streets and the railway line north of Toorak Road The remapping of the Yarra Street Main Drain assisted in Council's assessment of recent Planning Applications in Yarra Street. Old photogrammetry and some new data – last UDD model MW handed over drain to Council in 2003 Property data base and report not updated
12 May 2005		Amendment C18 Introduces the Special Building Overlay and accompanying maps and makes consequential changes to Clauses 21.02 and 21.04 in the Municipal Strategic Statement.
2007		LiDAR survey obtained

Year		Brief Description
2008 /09	GHD	Stonnington Flood Mapping Revisions 2008, October 2009 Unsteady state TUFLOW Package 1 (Yarra Street) Package 2 (Wrights Terrace) Package 3 (East Street and High Street) Package 4 (Rotherwood Drive and Peverill Street) Scotchmans Ck Package 5 (Argyll Street) Holmesglen
2014 /16	GHD	Darling Road Catchment Report (GHD - July 2015) Two phases Waverley Road Updated to broader remap and referred to as Darling Road
2016		Melbourne Metro Rail Project Flood Mapping (Chapel Street)
2017		Tooronga Road and Creswick Street MD Mitigation Flood Mapping
2017		Commercial Road Catchment

3. Industry norm and best practise

3.1 Other Councils

The City of Stonnington was one of the earlier Councils to undertake wide spread flood mapping. Many other Councils have subsequently developed flooding overlays to improve and control development outcomes.

Stonnington is one of 27 organisations to have endorsed the Flood Management Strategy – Port Phillip and Westernport (Melbourne Water 2015). The first objective of this widely accepted document is to *make the right information available at the right time to the people that need it*. Updating and improving the coverage, reliability and availability of flood mapping was identified as a major part of achieving this objective. This update of the SBO will contribute towards this target and objective.

3.2 Melbourne Water

Melbourne Water is working closely with a range of Councils to undertake combined flood investigations as required by their Flood Management Strategy (Melbourne Water 2015).

3.3 Interstate

Planning controls and the structure of management agencies varies from State to State. In general most States adopt planning controls with overlays based on flood mapping. In some jurisdictions it is common practise to include freeboard in planning overlays beyond the calculated flood extents or to include risk based layers which reflect the depth and velocity of flows. In Victoria, this additional information is typically considered by the flood plain manager, however a relatively simple flood extent such as the LSIO or SBO is used as the basis for triggering the initial referral.

In NSW, the Floodplain Development Manual (NSW Office of Environment and Heritage, April 2005) defines a Flood Planning Level (FPL), which for standard residential development defines the minimum flood level and is typically the 1% AEP flood event plus a freeboard (typically 0.5 m). In accordance with the Flood Plain Development Manual (2005) and the Guideline on development controls on low flood risk areas – Floodplain development manual, local Councils in NSW typically declare flood prone land in accordance with the flood planning level (FPL) (i.e. including a freeboard). Queensland generally also takes a similar approach, although freeboards are often less (for instance, Cairns typically adopts a freeboard of 300 mm for residential and 150 mm for commercial and industrial areas).

4. Conclusion

4.1 Basis for going forward

Flooding overlays are typically based on the best available information at the time they are created or amended. Over time, changes may occur for a range of reasons including:

1. Changing catchments.
   i) Development and redevelopment
   ii) Large scale infrastructure projects
2. Changes in drain capacity
   i) Maintenance, relining, replacements
   ii) Upgrades and mitigation
3. Changes in modelling approaches
   i) Initial extents were produced with one-dimensional steady-state hydraulic models
   ii) More recent flood extents have typically used two-dimensional unsteady-state models
   iii) Future models are likely to have finer resolutions as computing power increases and more detailed models become more practical
   iv) ARR 1987 hydrology to ARR 2016 with design storms extracted from an additional 30 years of rainfall records
4. Survey information is updated over time to include changes in terrain and technology
   i) Terrain changes may arise for many reasons including road works, changes to level crossings, fill platforms for development, wetlands
   ii) Early mapping was undertaken using photogrammetry
   iii) Subsequent mapping has been undertaken using LiDAR information and some field survey
   iv) The state government is capturing new LiDAR for most of Melbourne soon and is expected to be available for some areas in early to mid 2018

The common theme is that further changes are likely for a large number of reasons. In general, significant changes are unlikely, in the sense that low lying areas are likely to remain flood prone, however, extents may increase (for instance, as a result of climate change) or reduce (for instance, as a result of mitigation works). It is typical that these types of changes will trigger future amendments to the flooding overlays.

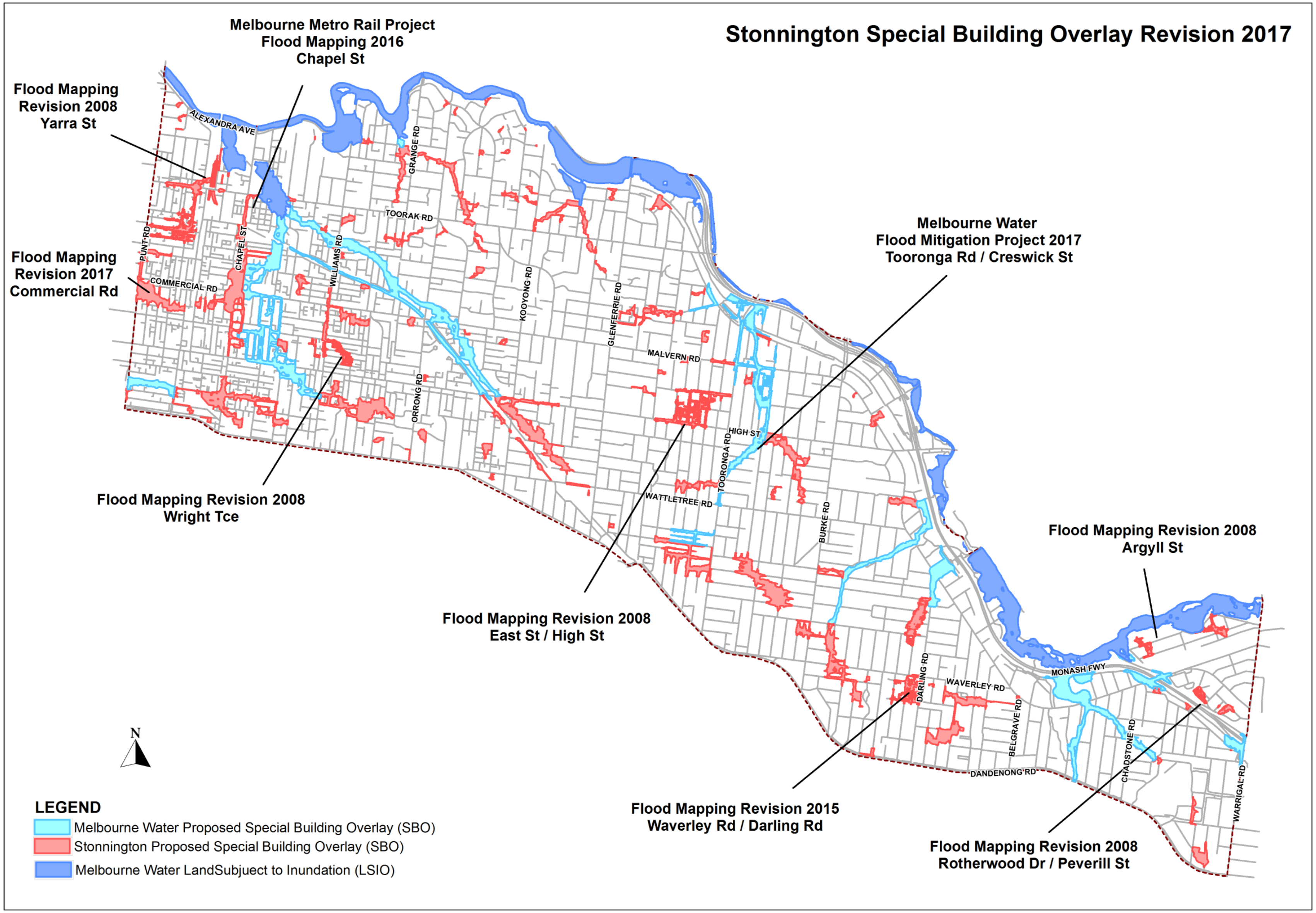
4.2 Recommendations

The currently proposed SBO amendments include a number of refinements and benefit from some more recent investigations and a more coordinated approach between Melbourne Water and Stonnington City Council.

Although they are generally based on the best available information it is likely that there will continue to be amendments and revisions to these overlays into the future.

Appendices

Appendix A – Stonnington Special Building Overlay Revisions 2017 (reproduced with permission from the City of Stonnington)



Stonnington Special Building Overlay Revision 2017
Melbourne Metro Rail Project
Flood Mapping 2016
Chapel St
Flood Mapping
Revision 2008
Yarra St
Flood Mapping
Revision 2017
Commercial Rd
Melbourne Water
Flood Mitigation Project 2017
Tooronga Rd / Creswick St
Flood Mapping Revision 2008
Wright Tce
Flood Mapping Revision 2008
East St / High St
Flood Mapping Revision 2008
Argyll St
Flood Mapping Revision 2015
Waverley Rd / Darling Rd
Flood Mapping Revision 2008
Rotherwood Dr / Peverill St
ALEXANDRA AVE
PUNT RD
CHAPEL ST
COMMERCIAL RD
WILLIAMS RD
GRANGE RD
TOORAK RD
KOOYONG RD
ORRONG RD
GLENFERRIE RD
MALVERN RD
HIGH ST
TOORONGA RD
WATTLETREE RD
BURKE RD
DARLING RD
WAVERLEY RD
BELGRAVE RD
MONASH FWY
CHADSTONE RD
DANDENONG RD
WARRIGAL RD
N
LEGEND
Melbourne Water Proposed Special Building Overlay (SBO)
Stonnington Proposed Special Building Overlay (SBO)
Melbourne Water LandSubjuect to Inundation (LSIO)

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3135294-53683/https://projects.ghd.com/oc/Victoria/stonningtonccspecial/Delivery/Documents/3135294-Rev 1-City of Stonnington.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	Gavin Hay	Greg Eaton		Gavin Hay		4/12/2017
1	Gavin Hay	Greg Eaton	Greg Eaton	Gavin Hay	Gavin Hay	12/01/2018

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