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PLANNING AND ENVIRONMENTAL DESIGN

Lower Barwon and Lower Moorabool Flood Investigation

Greater Geelong Planning Scheme Amendment C??

Planning Scheme Report

December 2018

Version	Author	Date	Reviewed by	Date
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1 Introduction

The floodplains of the Barwon and Moorabool Rivers have faced significant riverine floods in 1852, 1880, 1909, 1951, 1978, 1995, 2001 and 2011. Fortunately, given the long and frequent history of flooding along the Barwon and Moorabool Rivers, much of the residential development through Geelong and the wider catchment is located outside of the areas known to be subject to flooding. Consequently, much of the floodplain is now occupied for recreational uses with some land still occupied by commercial and industrial businesses.

Completion of the Lower Barwon and Lower Moorabool Rivers Flood Risk Management Study (the study) project increases community resilience and provides the mechanism to manage and reduce future flood damages through the development of a full suite of fit-for-purpose floodplain mapping products to guide land use and development planning, flood response planning and determination of appropriate flood warning arrangements.

Corangamite CMA in partnership with the Greater Geelong City Council and Golden Plains Shire Council engaged Water Technology to undertake the study. The overall objective of this project was to review and revise existing flooding information and produce detailed flood mapping for a range of flood scenarios within the study area. The project has involved a definitive flood investigation for the floodplain reaches within the study area, including collation of available relevant data, a comprehensive hydrological assessment, and determination of robust flood levels, velocities, depths and extents for a range of design floods. The project developed an improved understanding of flood behaviour to enable improved land use planning and emergency response.

The Lower Barwon and Lower Moorabool Rivers Flood Risk Management Study (Water Technology, 2018) makes the following recommendations: -

- Corangamite CMA and the Greater Geelong City Council adopt the determined design flood levels for future planning purposes.
- In conjunction with VICSES, the Greater Geelong City Council and Corangamite CMA continue to engage the community in the treatment of flood risks through regular flood awareness programs such as the VICSES FloodSafe program, starting with the development of a local flood guide.
- In consultation with VICSES, the Greater Geelong City Council and Corangamite CMA explore further the recommendations for enhanced flood response through co-operation with VICSES and Victoria Police, utilising the flood inundation maps and flood intelligence findings detailed in this report.
- The Greater Geelong City Council and Corangamite CMA further consider the findings regarding flood warning and responses outlined in the flood warning report.

This report provides additional specific recommendations regarding planning scheme controls for inclusion in the Greater Geelong Planning Scheme.

2 Study Background

The study area is defined by the lower reaches of the Moorabool River and the Barwon River, through to the mouth of the Barwon River. The study area also includes Waurn Ponds Creek and a number of small tributaries. The study area extends upstream to the Batesford streamflow gauge on the Moorabool River and the Pollocksford streamflow gauge on the Barwon River.

The study area and significant watercourses are shown below in Figure 1.

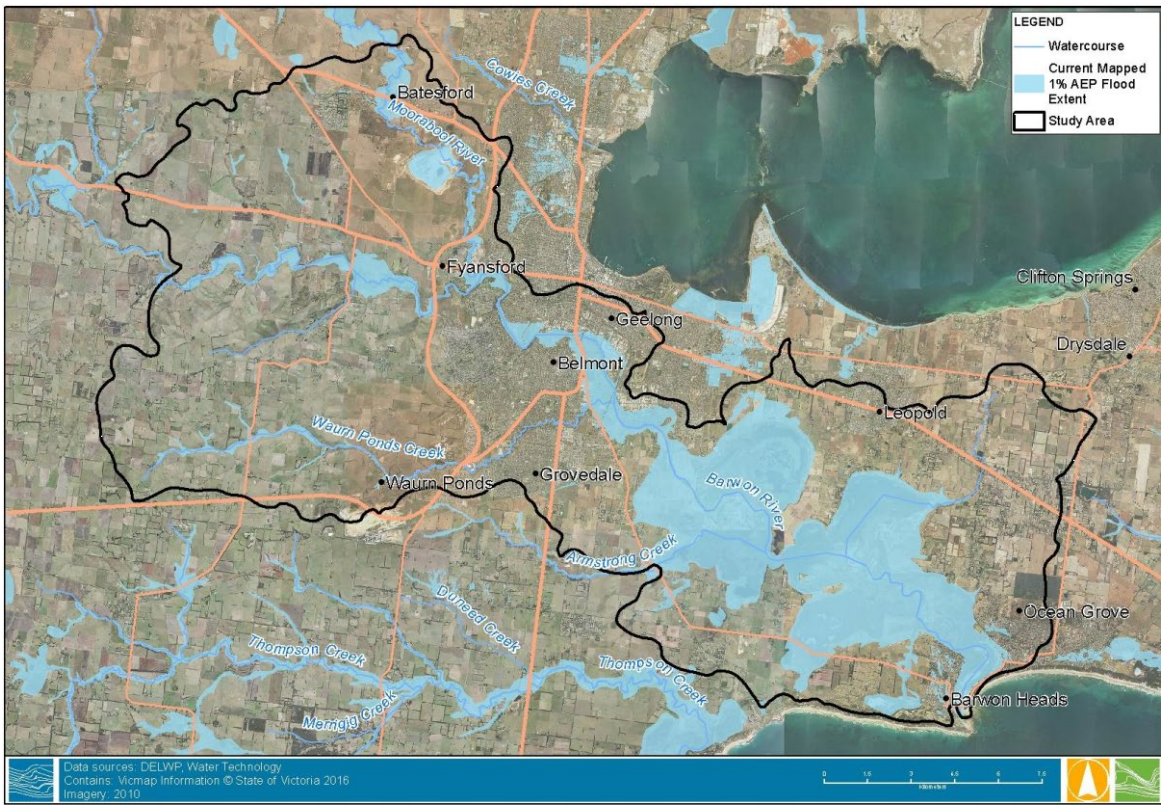

Figure 1: Study area and major waterways

3 Defining the Extent of Flood Controls for the Greater Geelong Planning Scheme

The study provides hydrological analysis for Design Events including the 50%, 20%,10%, 5%, 2%, 1%, 0.5%, 0.2% Annual Exceedance Probability (AEP) flood events, probable Maximum flood (PMF) and climate change scenarios. The key study output relevant to planning considerations is the delineation of the 1% AEP extent, as it is the 1% AEP which is adopted as the design flood

event, as identified by Planning Practice Note 12 Applying the Flood Provisions in Planning Schemes[1].

The 1% AEP flood event is considered to be the likelihood of occurrence of a flood of a given size or larger in any one year; expressed as a percentage. The AEP of a flood event gives no indication of when a flood of that size will occur next.

For the purposes of the Greater Geelong Planning Scheme, the 1% AEP is delineated into areas of high and low risk.

In general terms, the Floodway Overlay (FO) is applied to the high-risk areas of the floodplain, and accordingly, development is more tightly controlled by the planning scheme. These areas include waterways, main flood paths, drainage depressions and high hazard areas that carry relatively deep and/or high velocity flows.

Land within the 1% AEP outside of these high risk areas are considered to be flood fringe areas, where risk associated with flood are less. The Land Subject to Inundation Overlay (LSIO) is applied to the low risk area of the floodplain.

4 Stakeholder Engagement

The Corangamite CMA formed a Steering Committee for the project which consisted of key stakeholders from Corangamite CMA, Department of Environment Land Water and Planning (DELWP), Greater Geelong City Council, Golden Plains Shire Council and VicSES. The steering committee provided governance and management of the Investigation and ensured that issues important to the Greater Geelong community were properly considered. Throughout the study, regular meetings were held with the Steering Committee at which the interim reports and presentations were discussed and issues were resolved.

Further Stakeholder engagement shall occur during the exhibition of Greater Geelong Planning Scheme Amendment **C??.**

5 Lower Barwon River and Lower Moorabool River Flood Risk Management Study Summary

An overview of the hydrological analysis for the study is provided below. For further detail regarding the analysis the hydrology report should be consulted (Water Technology 2018).

[1] PPN12 uses the term "100-year Average Recurrence Interval (100-year ARI)" for the Design Flood Event. The terms 100-year ARI and 1% AEP synonymous. 1% AEP is used in this report to be consistent with the Lower Barwon and Lower Moorabool Rivers Flood Risk Management Study (Water Technology, 2018).

The primary aim of the hydrological analysis undertaken for this project included:

- Determining design event peak flows and hydrographs for input to the hydraulic model at the model boundaries which were located at the Barwon River from Pollocksford, the Moorabool River at Batesford, Waurn Ponds Creek and a number of small local tributaries.
- Identifying Design Events, including the 50%, 20%,10%, 5%, 2%, 1%, 0.5%, 0.2% AEP flood events, probable Maximum flood (PMF) and climate change scenarios.
- Determining historic flows and stream flow data available for calibration of the hydraulic model.

To achieve these aims, the hydrological assessment was separated into three components:

- Flood Frequency Analysis (FFA) – which included analysis of the Barwon River at both the Pollocksford and Geelong gauges and the Moorabool River at Batesford.
- Waurn Ponds Creek hydrological (RORB) model.
- Rain-on-grid modelling of the small local tributaries.

The rainfall on grid modelling of the local tributaries has provided mapping of the smaller tributaries right to the top of each catchment.

The hydrologic analysis provided flood inflow hydrographs for the hydraulic model. These inflow hydrographs were routed through the calibrated hydraulic model. This enabled the modelling of flood depths, extents and velocities over a range of design flood magnitudes. It also provided a tool to assist the understanding flood behaviour across the study area.

The modelling process involved the following stages:

- Model development and calibration for the historical events of November 1995, January 2011, April 2001 and September 2016 were used for calibration and validation process;
- A review of the current rating curve at Geelong, including comparison to historic and hydraulic model rating curves, which has concluded that the current rating curve is appropriate and suitable for continued adoption across the range of flow rates up to the 1% AEP.
- Sensitivity tests; and
- Design flood simulations for the 50%, 20%, 10%, 5%, 2%, 1%, 0.5%, 0.2% AEPs, and PMF

The calibration, validation and sensitivity assessments were completed during an iterative investigative process and all outcomes from these stages informed the final design flood simulations.

Results from the modelled data, including grids and extents, were produced in specified Victoria Flood Database (VFD2) format for each flood event. The following result components were generated:

- Flood level, flood depth, flood velocity and flood hazard grids
- Flood elevation contours
- Flood extent data
- Hydrographs at key locations
- Long-section of river water levels

Hazard maps were developed as a significant output of the study. Analysis of flood hazard is used to determine if it is safe for people and vehicles leaving a property during a flood event. Flood hazard was derived for the study area based on hazard guidelines provided by the Corangamite CMA. The flood hazard extents are based on the following criteria, derived from Australian Rainfall and Runoff: A Guide to Flood Estimation, 2019.: -

High Hazard

- depths greater than or equal to 0.3 metres; or
- velocity greater than or equal to 3.0 m/s; or
- the product of depth multiplied by velocity greater than or equal to 0.3 m^2/s.

Low Hazard

- depths less than 0.3 metres; ***and***
- velocity less than 3.0 m/s; ***and***
- the product of depth multiplied by velocity less than 0.3 m^2/s.

A range of other mapping products are also contained within the study. This flood mapping provides significantly more detail than any previous mapping of the study area. These outputs can be used to better manage development within the study area, and also predict and manage flood conditions during times of emergency.

6 Non-Structural Management Options

Non-structural measures are floodplain management activities aimed at reducing future flood damages. Non-structural measures aim to reduce existing flood risk by lowering flood damages (consequences) at a given location (as opposed to structural measures which tend to reduce frequency or likelihood of flooding). Non-structural measures include: -

- Catchment management
- Flood awareness, preparedness, warning and response
- Land use planning

Catchment management activities in the upstream catchment can influence the existing catchment runoff characteristics (flood peaks and volumes). Flood volumes and peaks are a function of the vegetation cover and land use within a catchment (in addition to topography). Much of the upper catchments of the study area are cleared for agricultural purposes however the lower catchments are developed with significant pressure for further development. As a result, future catchment management opportunities to reduce flood risk through changes to land use are somewhat limited.

Flood awareness, preparedness, warning and response aims to reduce the growth in future flood damages by improving community awareness of flooding and emergency services response. Flood awareness within a community reflects the frequency of significant flooding i.e. infrequent insignificant flooding leads to lower community flood awareness. Given there have been only relatively minor flood events within the study area in recent years the community awareness of flooding around the study area is expected to be low. Added to that, there has been no detailed flood mapping available for this area prior to this study. The level of community awareness has been demonstrated to diminish over time if community flood awareness programs are not ongoing.

Land use planning aims to reduce flood damages by providing appropriate guidelines/controls for land use and development. The Victorian Planning Provisions (VPPs) allow for zoning of land and the application of controls on the type of land use and permitted activities in areas prone to flooding. Only the LSIO and FO overlays were considered relevant to the present study.

7 Land Subject to Inundation Overlay (LSIO)

The LSIO identifies land affected by the 1% AEP flood or any other area identified by the floodplain management authority.

The permit requirements of LSIO are intended to:

- Ensure that development maintains the free passage and temporary storage of floodwaters.
- Minimise flood damage.
- Be compatible with the flood hazard and local drainage conditions.
- Not cause any significant rise in flood level or flow velocity.
- Protect water quality in accordance with relevant State Environment Protection Policies (SEPPs).

The decision guidelines of the LSIO include consideration of the potential risk to life, health and safety associated with the development if the site or its accessway are flooded.

The strategies of Clause 13.03-1S (Floodplain Management) include locating emergency and community facilities (including hospitals, ambulance stations, police stations, fire stations, residential aged care facilities, communication facilities, transport facilities, community shelters and schools) outside the 1% AEP floodplain and, where possible, at levels above the height of the probable maximum flood.

Similarly, developments or land uses which involve the storage or disposal of environmentally hazardous chemicals or wastes, and other dangerous goods should be discouraged within the LSIO.

8 Floodway Overlay (FO)

The FO identifies land that has the greatest risk and frequency of being affected by flooding. In general, only development that is designed, constructed and used in a manner that is commensurate with a high-risk flood environment is permissible in the Floodway Overlay.

9 Flood Related Planning Controls and Overlay Delineation

As detailed in the study, the Corangamite CMA has adopted the following definitions for floodways and the flood fringe area which have then been used to delineate the FO and LSIO overlays in this study.

9.1 Floodway Overlay (FO)

FO has been based generally on the definition of floodway by Edwards (Edwards (1998) Advisory Notes for Delineating Floodways) with some modifications: -

- Generally the high hazard portion of the floodplain.
- Water is likely to be deep and fast moving in these areas during large floods.
- Generally areas where major discharge or storage of water occurs during large floods.
- Often aligned with naturally defined channels and include areas which, if filled or even partially blocked, would cause a significant redistribution of flood flow, or significant increase in flood levels.

- Extent within the 1% AEP area defined by the following parameters, in accordance with the Australian Rainfall and Runoff Project 10 guidelines for vehicle safety: -
    - 1% AEP depths ≥0.3m, or
    - 1% AEP velocity ≥ 3.0 m/s, or
    - 1% AEP depth velocity product >=0.3m^2/s

9.2 Land Subject to Inundation Overlay (LSIO)

The following definition was adopted for the flood fringe for LSIO: -

- Any area within the 1% AEP flood extent that does not meet the above high hazard criteria, and
- Any area expected to be surrounded, and therefore isolated, by high hazard (Floodway) floodwaters

The inclusion in the LSIO of areas expected to be isolated by high hazard floodwaters ensures due consideration is given to the potential risk to life, health and safety associated with a development due to flooding on the accessway through the planning process. Areas surrounded by low hazard floodwaters but not expected to be inundated are not included in either overlay.

9.3 Planning Map Development Principals

The following principals were used to create the draft flood related planning maps: -

- The Floodway and Land Subject to Inundation boundaries were defined using the criteria discussed previously.
- The raw flood boundaries were smoothed to create a visually enhanced representation of the floodway and flood fringe boundaries (smoothing from a grid outline to a more continuous “smoothed” boundary).
- “Floodway islands”, i.e. areas completely surrounded by floodway, are automatically delineated as within the LSIO at the request of the Corangamite Catchment Management Authority.
- Small holes of less than 100m^2 were removed from both overlays.
- Areas of lower flood hazard located within a waterway area, for example Lake Connewarre or Hospital Swamp, were designated Floodway Overlay for simplicity in the Scheme.

The flood related planning maps were developed in consultation with the Greater Geelong City Council and Corangamite CMA. Through this consultation, due consideration was given to local social, economic and environmental issues.

Figure 2, below, shows the draft Floodway Overlay and Land Subject to Inundation planning layers developed as an output of this study.

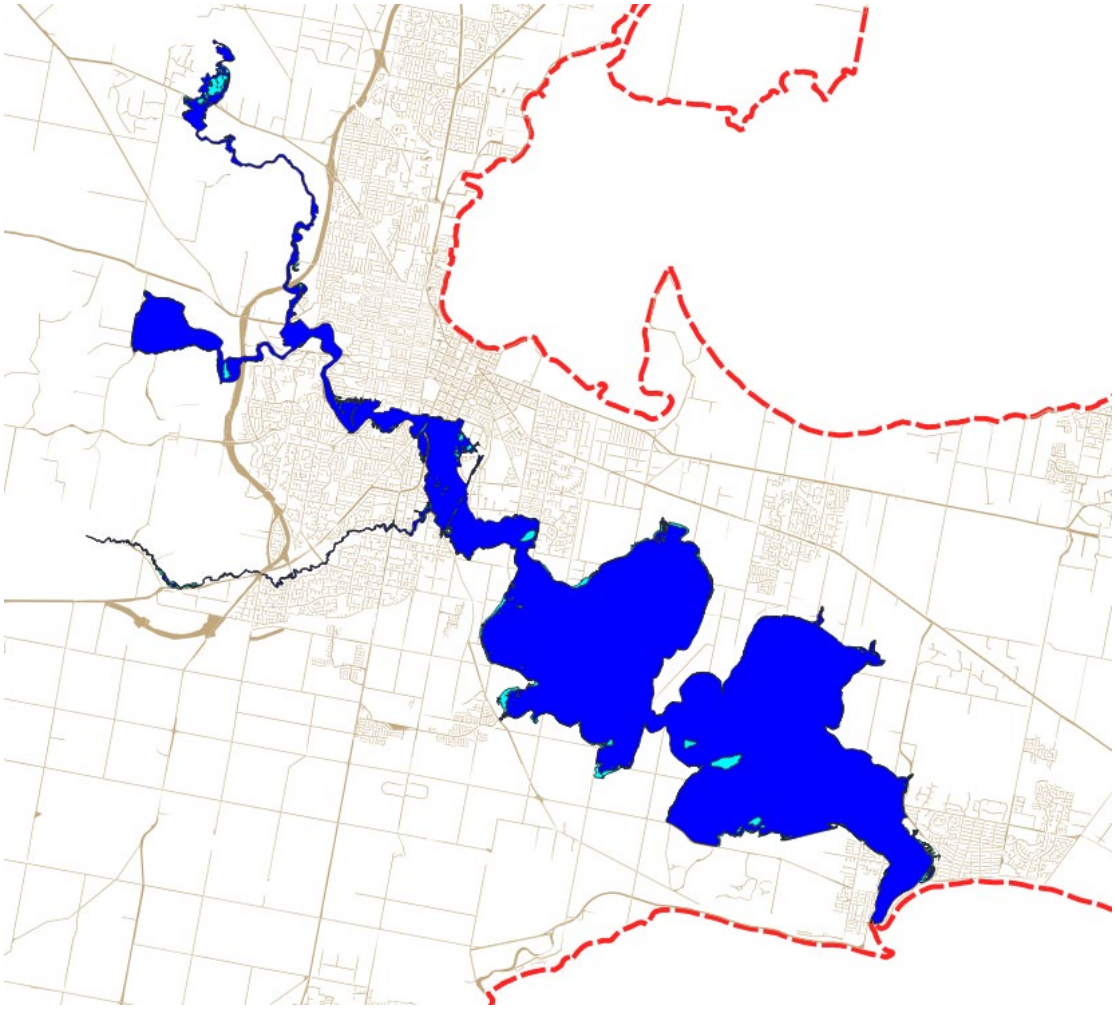

Figure 2: Recommended Floodway Overlay and Land Subject to Inundation Overlay planning scheme layers for Greater Geelong Planning Scheme (LSIO light blue, FO dark blue).

9.4 Planning Scheme Controls

In addition to the LSIO and FO Planning Scheme maps, the Greater Geelong Planning Scheme also contains a number of Clauses that provide direction for the use and development of land that is affected by flooding.

Some of these controls are considered to be operating effectively an require no amendment, whilst others may be improved by updating the content in line with recent changes made to the Victorian Planning Provisions by Planning Scheme Amendment VC148.

Given that new Planning Scheme maps have been produced from the study for inclusion in the Greater Geelong Planning Scheme, a Planning Scheme

amendment is recommended. This amendment should also include changes to Planning Scheme ordinance, as discussed below.

9.4a State Planning Policy Framework

The Greater Geelong Planning Scheme also contains Clause 13.03 Floodplains in the State Planning Policy Framework section. This clause provides direction for floodplain management.

As this is a State wide planning control that is included in every Planning Scheme in Victoria, no changes to its content can be made by an amendment to the Greater Geelong Planning Scheme.

While acknowledging the above, the CCMA would like to draw attention to the Clause 62.02-1 exemption for buildings and works associated with a minor utility installation, and the associated potential floodplain impacts. The definition of “minor utility installation” in Clause 73.03 includes buildings and works which, if placed in a floodplain, can be incommensurate with best practice floodplain management.

Specifically, the placement of drains and retarding basins in a floodplain can impact flood storage and flows if ground levels are raised, i.e. perched channels or raised basin walls. The headers of the UFZ, FO, LSIO and SBO all include the following purpose:

- *To ensure that development maintains the free passage and temporary storage of floodwaters*

Additionally sewerage treatment plants, pumping stations and electrical substations are susceptible to damage during a flood and are likely to require prioritisation in protection efforts during a flood event, potentially drawing response resources away from other needs.

The environmental and public health impacts of a flooded sewerage treatment plant or pump station also require consideration. This is reflected by the specific inclusion in Clause 13.03-1 of sewage treatment plants as a development that involves the storage and disposal of dangerous goods.

The exemption in this case restricts the ability of the Floodplain Management Authority to properly manage the floodplain and is contradictory to the Objectives and Strategies of Clause 13.03-1. The exemptions apply to all flood related Overlays and the Urban Floodway Zone.

A potential solution would be to move the exemption for a minor utility installation from Clause 62.02-1 to Clause 62.02-2 and alter the header of Clauses 44.03 (FO), 44.04 (LSIO), 44.05 (SBO) and 37.03 (UFZ) to include “minor utility installation” as a permit requirement unless specified in a schedule. This would allow municipalities and floodplain management authorities to exempt all minor utility installations, some specific types of minor

utility installation, or require permits for all minor utility installations as appropriate for local conditions and requirements.

Should this be adopted, the CCMA's preferred approach would be to exempt only those types of minor utility installation with no potential to impact, or be impacted by, the floodplain. Underground works which do not permanently alter the surface level would be exempt from the requirement for a permit, for example.

9.4b Municipal Strategic Statement

The Greater Geelong Planning Scheme already contains clause 21.05-7 Flooding in the Municipal Strategic Statement (MSS) that provides policy direction with respect to managing the environmental risks emanating from floodwaters. This clause includes the following objectives and strategies: -

Objectives

To protect floodplains.

To minimise the potential for damage and risks to public safety and property from flooding.

Strategies

Ensure that land use and development is compatible with flood prone land.

Discourage land use and development in floodplains where flood function may be impaired.

Recognise flood hazards associated with waterways and ensure the free passage of water whilst protecting development from flooding impacts.

Consultation with the Greater Geelong Council has indicated that due to imminent changes to the structure of the State Planning Policy Framework and the Local Planning Policy Framework, no changes should be made to the Municipal Strategic Statement at this time.

9.4c Overlays

The Planning Scheme also contains clause 44.03 Floodway Overlay and schedule, and clause 44.04 Land Subject to Inundation Overlay and schedule. Consultation undertaken with the Greater Geelong City Council during preparation of the study identified the opportunity to improve the performance of the LSIO and FO schedules, in line with recent changes made to the Victorian Planning Provisions.

The changes to the schedules include identifying a number of types of development that do not require a Planning Permit assessment for

development in the floodplain. This is generally referred to as “scheduling out” those developments that can occur in the floodplain, so that unnecessary permit triggers are removed from the Geelong Planning Scheme.

Developments not listed in the either the LSIO or FO schedules still require a Planning Permit assessment.

As the current schedules relate to a now concluded project, they can be replaced with the new schedules. It is the intention that the new schedules will apply to all land currently designated as LSIO or FO as they represent a decrease in the planning burden applied to the land.

This can be achieved by identifying the LSIO and FO maps and schedules as being LSIO1 and FO1 on the maps and in the title block of the relevant overlay schedule.

This in turn necessitates an amendment to other Planning Scheme maps to identify those areas as being LSIO1 and FO1.

10 Recommendations

A number of changes to the Greater Geelong Planning Scheme are recommended to assist in implementing the findings of the Lower Barwon and Lower Moorabool Flood Investigation.

It is recommended that the Greater Geelong Planning Scheme be amended to: -

- Introduce Planning Scheme Maps ?LSIO2/FO2;
- Amend Planning Scheme Maps ?LSIO/FO to read as Maps ?LSIO1/FO1.
- Introduce the Floodway Overlay Schedule 1, and the Land Subject to Inundation Overlay Schedule 1.
- Amend the existing LSIO schedule and FO schedule to read as Land Subject to Inundation Overlay Schedule 1 and Floodway Overlay Schedule 1.