

**LOCAL FLOODPLAIN DEVELOPMENT PLAN
PRECINCT OF GOULBURN RIVER, October 2017**

1.0 APPLICATION

This local floodplain development plan (LFDP) applies to the Goulburn River floodplains and which is within either the Urban Floodway Zone, Floodway Overlay or Land Subject to Inundation Overlay of the Strathbogie, Mitchell and Murrindindi Planning Schemes (or any other area known to be subject to inundation by flooding).

This LFDP has been prepared to provide a performance-based approach for decision making that reflects local issues and best practice, including flood risk assessment, in floodplain management for two types of applications, namely:

Section 2.0 – General Floodplain Development; and

Section 3.0 – Extractive Industry.

2.0 GENERAL FLOODPLAIN DEVELOPMENT APPLICATION

This section of the LFDP applies to commonplace applications to construct a building, construct or carry out work or subdivide land other than those associated with extractive industry, which is considered in **Section 3.0**.

2.1 Flood History

The Goulburn River has a long history of flooding, with major floods recorded in 1870, 1916, 1917, 1934, 1974, and 1993. The 1916 flood is considered to be the largest flood experienced in the 20th century in the township of Seymour, with floods of this magnitude or greater exceeded on average every 100 years. Floods exceeding the magnitude of the 1974 flood will occur every 30 years or so. The 1993 flood in Seymour caused localised flooding of low-lying areas.

2.2 Flood Information

The extent of flooding has been determined from flood mapping completed in 2000 by the Department of Natural Resources and Environment. The project made use of historic flood levels documented in past floods, aerial flood photography, and surface level information. FO, LSIO and UFZ areas are based on the relative flood risk assessed for different parts of the floodplain, considering factors such as flood depth, velocity, natural storage, flood frequency and flood duration.

Major flooding along the Goulburn River within the Mitchell Shire area is deep and wide with relatively well defined river terraces. Flooding in the Shire may occur from the Goulburn River or from a number of other sub-catchments such as the Sunday, Dry, Sugarloaf and Whiteheads Creek catchments, or a combination of all.

The duration of flooding varies considerably with each flood. How fast floodwaters rise and fall depends on a number of factors, including the shape of the floodplain, and the magnitude and duration of the flood. Estimates of flood duration are limited to several days.

Substantial improvements to the flood warning arrangements for Seymour were carried out during 1999 to 2001 as part of the Eildon to Seymour Flood Warning Project. However, the catchment response to storm runoff of some 12 hours imposes a limitation on the flood warning time that can be made available.

2.3 Impacts

Flood impacts in the area are significant, resulting in road closures, loss of access for residents, disruption to schools, property isolation, risk to emergency personnel during sand bagging and evacuation operations and damage to buildings constructed below flood level. During major floods, there are also likely to be substantial rural and infrastructure flood damages. Flood impacts for FO areas are greater than LSIO areas, as the velocities, depths and frequency of flooding are generally greater.

Seymour is the major town along this reach of the Goulburn River and is highly flood prone, especially in areas adjacent to High Street and Emily Street. Seymour township is located at the confluence of the Goulburn River, Whiteheads and Sunday Creeks, with the town experiencing flooding primarily as a result of Goulburn River, Whiteheads and Sunday Creeks. Generally, flooding from the Goulburn River is of longer duration and larger magnitude. Flooding from the Sunday Creek mostly coincides with high flow in the Goulburn River, whereas flooding from Whiteheads Creek generally tends to be shorter in duration and primarily affects the eastern portion of the town.

During the 1974 flood, approximately 200 buildings suffered direct flood damage and today there is an estimated 400 buildings susceptible to flood damage in a 100-year ARI type flood.

2.4 Development Requirements

An application to construct a building, construct or carry out works or subdivide land, must be accompanied by four sets of plans and supporting documents that demonstrate the following relevant development requirements have been met.

Where relevant, the supporting documents and plans (drawn to scale) must show the following:

- The boundaries and dimensions of the property.
- A regional locality plan showing the property whereabouts within the region, including roads, streams and other prominent land marks.
- The layout plan of the existing and proposed building, works or subdivision boundaries.
- Floor level of any existing and proposed buildings to Australian Height Datum.
- Natural ground levels of the proposed dwelling site to Australian Height Datum, taken by a licensed surveyor.
- Natural ground levels along access routes to flood free land (as indicated by the planning scheme flood overlays and zone) to Australian Height Datum, taken by a licensed surveyor. The access route includes access along any relevant government road to the property and then to the proposed dwelling location.

2.5 Development Requirements for the UFZ

Buildings

- Where no more than 50% of the existing building has been damaged or destroyed, the construction of the replacement ground floor area must not be more than 20 m² greater than the destroyed ground floor area of the pre-existing dwelling on 26th March 1999 and must be set at least 300 mm above the 100-year ARI flood level or a higher level set by the responsible authority;
- the construction of the floor area of any building extension (single or multiple) must not be more than 20 m² greater than the ground floor area of the pre-existing building on 26th March 1999; and

- New buildings must not obstruct natural flow paths or drainage lines on land located within the zone.

Works

- New earthworks must not obstruct the natural flow paths or drainage lines.

2.5.1 Development Requirements for FO or LSIO

Buildings

- new buildings must not obstruct natural flow paths or drainage lines;
- the construction of a dwelling, including a replacement dwelling, must not be located closer than 50 metres to an existing river levee, unless the purpose of the levee is to protect a dwelling, or the levee is less than 1 metre in height;
- the construction of a dwelling must be sited on land where the 100-year ARI flood depth is less than 0.5 metres above the natural surface level, and is less than 0.8 metres above the natural surface level along the defined access route to the dwelling site for rural areas, or 0.5 metres above the natural surface level for urban areas, unless a lot is greater than 80 hectares or is an infill site in an urban area surrounded by existing buildings (dwelling, industry, commercial) within 50 metres on at least 3 sides;
- the construction of any new dwelling, including a replacement dwelling, must be sited on the highest available ground unless the applicant can demonstrate to the satisfaction of the responsible authority and floodplain management authority that an alternative site is more suitable;
- the floor level of any dwelling, is set at least 300 mm above the 100-year ARI flood level or a higher level set by the responsible authority;
- any non habitable buildings must be aligned so that their longitudinal axis is parallel to the predicted direction of flood flow.

Dwelling Extensions

- where a dwelling extension (or multiple extensions) is greater than 20 m² and below the nominal flood protection level the owner must:
 - use water resistant materials up to the nominal flood protection level.
 - within the **FO** areas obtain approval from the responsible authority and the floodplain management authority.
- the construction of the ground floor area of any dwelling extension (single or multiple), which is more than 300 millimetres below the 100-year ARI flood level and greater than 20 m² to the existing dwelling at 26th March 1999, must be set at least to the nominal flood protection level as determined by the floodplain management authority or a higher level as determined by the responsible authority.
- the construction of the ground floor area of any dwelling extension (single or multiple) between the 100-year ARI flood level and 300 millimetres below the 100-year ARI flood level, must not be more than 40 m² greater than the existing dwelling at 26th March 1999. Where a dwelling extension (or multiple extensions) is greater than 20 m² and below the nominal flood protection level the owner must:
 - enter into an agreement with Council under Section 173 of the *Planning and Environment Act 1987*, stating that combined ground floor area of the constructed extension together with any future extensions, must not be lower than the highest existing ground floor level, and must not exceed 40 m². Extensions beyond 40 m² must be set at least to the nominal flood protection level.

- the construction of the ground floor area of any dwelling extension (single or multiple) between the 100-year ARI flood level and the nominal flood protection level, must not be more than 80 m² to the existing dwelling at 29th March 1999. Where a dwelling extension (or multiple extensions) is greater than 20 m² and below the nominal flood protection level the owner must:
 - enter into an agreement with Council under Section 173 of the *Planning and Environment Act 1987*, stating that combined ground floor area of the constructed extension together with any future extensions, must not be lower than the highest existing ground floor level, and must not exceed 80 m². Extensions beyond 80 m² must be set at least to the nominal flood protection level.

Works

- any earthworks do not obstruct natural flow paths or drainage lines on land located within the overlay;
- any earthen land fill at the site of a new building or a building extension should be no more than 2 metres from the building footprint;
- any works that are designed to protect the immediate surrounds of existing habitable dwellings, where the floor level is below the 100-year ARI flood level, and do not enclose an area of more than 1,000 m² including the footprint area of works.

Subdivision

- any subdivision does not increase the number of lots, except for the purposes of a lot excision agreed to by the responsible authority and the floodplain management authority, or any subdivision located partly within FO or LSIO is structured so that:
 - new lot boundaries (other than existing and/or realignment of lot boundaries) are sited on land where the 100-year ARI flood depths are less than 0.5 metres; and
 - each lot is accessible via a defined access route where the 100-year ARI flood depths are less than 0.8 metres for rural areas, or 0.5 metres for urban areas.

2.6 Development Requirements for ~~LSIO in~~ Residential, Industrial and Business Zones the Precinct of the Goulburn River.

Buildings

- the floor level of a new industrial, retail or office building (including a replacement building), must be set at least 300 mm above the 100-year ARI flood level (nominal flood protection level) unless the applicant can demonstrate to the responsible authority and the floodplain management authority that this requirement can not be practically achieved. A written design response statement must accompany the application to justify a proposed floor level below the nominal flood protection level. Where relevant, the design response statement must include:
 - Relationship of the proposed building floor level to the floor levels of adjoining buildings, access-ways (vehicle and pedestrian) and street footpaths levels, which demonstrate transport and pedestrian access into the proposed building as impractical. Submitted survey levels must be to Australian Height Datum, by a licensed surveyor.
 - Plans and elevation drawings of the building and surrounding areas showing maximum allowable ramping grades to meet relevant Australian Standards and Building Regulation and Codes, which achieve the highest possible floor level.

- Plans showing and specifying flood proofing arrangements up to the nominal flood protection level for retail or office buildings.
- Plans showing and specifying electrical fitting located at least to the nominal flood protection level.
- Plans showing adequate storage areas and shelving above the nominal flood protection level for the storage of valuable goods and hazardous materials.
- Plans showing placement of flood markers inside and outside of the building showing the 100-year ARI flood and other historical flood levels.
- A flood response action plan which sets out procedures and actions to minimise flood damage, risk to occupants, and demands on emergency services.

Subdivision

- land is subdivided to realign the boundaries of existing lots except if the site is in either an infill site (i.e. surrounded by existing buildings (dwelling, industrial or commercial) within 50 metres on at least three sides) or land where the 100-year ARI flood depth is less than 0.5 metres.

3.0 EXTRACTIVE INDUSTRY

This section of the LFDP applies to an application to develop a new extractive industry or construct or carry out works associated with an existing extractive industry within the land described in clause 1.0 of this schedule.

Consideration must be given to balancing the economic benefits of the extraction of sand and gravel resources with the potential impacts on the cultural, economic, environmental and social values of the Goulburn River and its floodplain.

This section applies a performance-based approach to decision making, to reduce to an acceptable level, the potential risks to public safety, physical environment and infrastructure assets within the floodplain.

3.1 Impacts

The Goulburn Valley is a complex and sensitive environment and development of extractive industry within the floodplain increases the landscape's vulnerability to change during floods by altering the natural patterns of water flow and sediment transport. Major impacts associated with extractive industry can occur if, during flooding, the stream leaves its channel and creates a new channel (process of avulsion) into or through the extraction pit. This is known as pit capture which can result in channel bed degradation and aggradation, bank erosion and channel widening.

The impacts of pit capture can extend for a number of kilometres upstream and downstream of the pit and as a result have significant consequences for public safety, property, community infrastructure and the environment (Jacobs and Moroka 2014). Further impacts are described in clause 3.2 of this schedule.

3.2 Development requirement overview

Reviewing the sustainability of sand and gravel extraction on the mid-Goulburn River, Erskine et al. (1993, 1996) investigated the nature and frequency of bed material mobility and sediment transport rates and yields. They found extremely low sediment yields and a replenishment rate that is too low to allow commercial extraction (in-stream channel). Important influences were the limited sediment input from the upper Goulburn River, with Eildon Dam trapping 99% of the sediment load. Whilst the work of Erskine et al. (1993, 1996) was focused on the sustainability of the in-channel extraction that was occurring at the time, due to the tendency for floodplain pits to be captured, they should

be considered as potentially instream on a timescale of decades (Kondolf 1994). Further, the geomorphic impacts of floodplain extraction are generally more dramatic than the impacts of instream extraction (Mossa & Marks 2011).

Jacobs and Moroka (2015) identified three main mechanisms that have the potential to result in pit capture include:

- 1) **Lateral migration of the river channel into the pit** – pit capture occurs when the strip of land separating the pit from the channel is breached by lateral channel erosion and migration of the channel into the pit.
- 2) **Geotechnical failure of pit walls** – this risk increases during high flow conditions where there are high water levels in the river or an adjacent depression which leads to seepage of groundwater from pit walls. This can weaken the substrate resulting in erosion and failure of material.
- 3) **Flow of floodwater into and through the pit and subsequent erosion of the buffer strip between the channel and the excavated pit** – Once floodwaters have access to the pit areas the hydraulic conditions of the river changes which often results in acceleration of flow toward the pit and subsequent erosion.

Positioning pits at a distance away from waterways can assist in lowering the risk of pit capture by lateral migration of the river channel into the pit and by geotechnical failure of pit walls. It is preferable to site extractive industry on terraces and higher floodplain areas outside of the 100-year ARI floodplain of the Goulburn River. However, an appropriate setback from the waterway to mitigate against these two risks can be determined with reference to data on channel migration rates, geotechnical assessment and the riparian zone required for the health and stability of the Goulburn River.

Avulsions are a natural process along the Goulburn River. This process is commonly initiated by floodwaters spilling into natural floodplain depressions. Sand and gravel extraction in the Goulburn Valley creates floodplain depressions, but they are substantially deeper and wider than natural depressions and represent a threat to the stability of the river, surrounding environs and infrastructure. It is the depth of existing pits relative to the Goulburn River and their size that are a particular concern.

The literature documents that the risks of pit capture arising as a result of flow of floodwater into and through the pit and subsequent erosion of the buffer strip between the channel and the excavated pit are high where the pit depth extends to or below the depth of the surrounding waterways.

In addition to setting a limit on the depth of the pit, to protect the stability of the floodplain there is also a need to limit the pit surface area and achieve an appropriate spacing between pits. The literature identifies that shallow pits can still cause rivers to change course where, along with the other depressions and watercourses on the floodplain, the hydraulic conveyance of a section of floodplain is high. Hence, minimum setbacks and a limit on the surface area of pits serves to prevent an area of the floodplain capturing a large portion of the flood flow, potentially destabilising the floodplain and triggering pit capture through a pit or series of pits.

Pits should be stable without the use of levees and grade control structures so as to remove issues associated with their integrity and performance, future ownership, maintenance and management of the infrastructure and their potential impact on flood behaviour. Stockpiles should be managed to minimise their potential to impact on flood behaviour. Stockpiles should be setback from waterways, aligned with the direction of flow and restricted in their dimensions and spacing to minimise their impact on flood behaviour.

Where possible an extractive industry should be sited on higher floodplain surfaces above the 100-year ARI floodplain of the Goulburn River, outside the Urban Flood Zone,

Flooding Overlay or the Land Subject to Inundation Overlay. Applications for building and works associated with extractive industry within the Urban Flood Zone, Floodway Overlay or the Land Subject to Inundation Overlay shall demonstrate that the development objectives and development requirements have been met as set out in clauses 3.3, 3.4 and 3.5 of this schedule as applicable.

3.3 Development objectives

A permit application for development associated with extractive industry must meet the following general objectives:

- risks posed to public safety, property, community infrastructure and the environment must be avoided, eliminated or minimised to an acceptable level;
- protection of the nature conservation, recreation, scenic and cultural heritage attributes of the Goulburn River and its floodplain;
- planning should adopt a best practice environmental management and risk management approach which aims to avoid or minimise environmental degradation and hazards;
- a proposal must not increase the risk of serious or irreversible environmental damage;
- protection of water quality and waterways as natural resources;
- ensuring that mineral and stone resources are developed with appropriate management measures to protect the long term stability of the Goulburn River and its floodplain;
- maintaining the natural flood carrying capacity and storage function of the Goulburn River and its floodplain;
- maintaining or improving river and wetland health, waterway protection and floodplain health;
- protection of areas prone to erosion, landslip or other degradation ; and
- ensuring that excavated areas can be appropriately rehabilitated.

3.4 Development requirements

Where an application seeks to vary the development requirements set out in clauses 3.4.1, 3.4.2 and 3.4.3 of this schedule an extractive industry management statement in terms of clause 3.4.4 of this schedule shall be submitted with the application and shall describe how the proposed development meets the relevant development objectives as set out in clause 3.3 of this schedule.

3.4.1 Pit location

Development associated with extractive industry must be sited such that extraction pits are:

- setback a minimum of 1,000 metres from public or private infrastructure including pumping stations, water intakes, bridges, utility crossings (e.g. power, gas, telecommunications) and buildings;
- not in a location that increases the risk of an avulsion; and
- not in areas where the Goulburn River is partly confined and the alluvial valley is narrow, including within the reach from King Parrot Creek to Seymour.

3.4.2 Stockpiles

Development associated with extractive industry must be sited such that stockpiles are:

- setback a minimum of 100 metres from the top of bank of the Goulburn River, anabranches and tributaries of the Goulburn River;
- aligned with the direction of floodplain flow;
- restricted to 30 metres wide (measured perpendicular to floodplain flow and from the toe of the stockpile); and
- multiple stockpiles are separated with 20 metre gaps, measured from the closest point of the toe of each stockpile.

3.4.3 Risk mitigation infrastructure

Development associated with extractive industry must be sited such that risk mitigation infrastructure:

- is not required to mitigate risks to acceptable levels (including the use of levees);
- is commensurate with:
 - the potential long duration of floods on the Goulburn River;
 - the permanence of pits and associated risks; and
 - an acceptable level of risk to the environment, infrastructure and public safety; and
- the ongoing ownership, management and maintenance of risk mitigation infrastructure shall be secured by legal mechanisms to the satisfaction of the responsible authority and the floodplain management authority where that infrastructure is mitigating ongoing risks.

3.4.4 Extractive industry management statement

An extractive industry management statement for the purposes of this schedule is a statement or report that details how the proposed extractive industry development satisfies the objectives set out in clause 3.3 of this schedule to the satisfaction of the responsible authority and the floodplain management authority.

The extractive industry management statement must be prepared by a suitably qualified and experience person with expertise in extractive industry matters and in particular extractive industry matters relevant to the proposed development.

3.5 Specific development requirements

It is mandatory that extractive development meets the requirements set out in clauses 3.5.1 and 3.5.2 of this schedule.

3.5.1 Pit depth

The lowest level for extraction within a pit must be a minimum of one metre above the invert level of the Goulburn River in the vicinity of the pit and any adjacent anabranch and tributary of the Goulburn River. The invert level of the Goulburn River and any adjacent anabranch and tributary for the purpose of this clause must be measured at the point where the 100-year ARI water surface level contour at the upstream end of the proposed pit intersects the Goulburn River, anabranch or tributary as designated in writing by the relevant floodplain management authority.

3.5.2 Pit area and setbacks

The development associated with extractive industry must be designed and sited such that:

- the area of each excavation pit must be less than five hectares;

- multiple excavation pits must be a minimum of 100 metres apart; and
- an excavation pit must be setback a minimum of 100 metres from the top of bank of the Goulburn River and any palaeochannel, anabranch and tributary of the Goulburn River.

3.6 References

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- Mossa, J., & Marks, S. R. (2011). Pit avulsions and planform change on a mined river floodplain: Tangipahoa River, Louisiana. *Physical Geography*, 32(6), 512-532.