# Stormwater System Management Plan

**November 2019**

City of LAUNCESTON

# About This Document

The purpose of this document is to outline the plan for management of the stormwater system within the urban areas of the City of Launceston, as required under the *Urban Drainage Act 2013*. The report was prepared by the City of Launceston and is based on City of Launceston operational procedures as well detailed flood modelling that was completed by Cardno from 2016 - 2018 and water quality and aquatic ecology data that has been collected or collated by the City of Launceston across the urban stormwater network. This information has been combined with best practice guidelines to identify a range of actions and projects for implementation to better improve stormwater system management across the City of Launceston urban areas.

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# Executive Summary

Tasmanian councils are required to develop a Stormwater System Management Plan (SSMP) under the *Urban Drainage Act 2013*. This SSMP has been developed for the urban areas of the City of Launceston, notably suburban Launceston as well as the township of Lilydale. The SSMP forms a four-year action plan and is to be reviewed on a four-yearly basis.

The City of Launceston has an extensive urban stormwater system, including 440 km of stormwater pipe and approximately 16,000 stormwater nodes (manholes, gully pits and side entry pits). Approximately thirty-seven kilometres of natural waterways form an integral part of the stormwater network. In the central parts of Launceston there is a combined stormwater and sewage drainage system, which adds significant complexity to the system. TasWater manage the operation of the combined system on behalf of the City of Launceston.

The City of Launceston has well established plans for management of drainage assets. These incorporate operational maintenance, capital renewals and upgrades, as well as reactive responses to customer enquiries or unforeseen issues.

Detailed technical analysis has been undertaken within the urban area to consider risks associated with stormwater flooding and water quality. Flood studies were completed for each of the urban catchments (excluding Lilydale). To relate outputs from the flood modelling to the likely impact on people, vehicles and buildings, flood hazard categorisation is completed to establish how hazardous (i.e. dangerous) the modelled floodwaters are (Figure 4). Hazard based stormwater risk studies were completed to consider the risks associated with stormwater flooding in the urban area. The majority of modelled flooding within the urban area is the lowest hazard category H1 (68%), meaning flooding is generally safe for people, vehicles and buildings. However, there are locations which exhibit higher hazard categories, and the modelling identifies flooding of private properties and roadways. The urban (stormwater) flood mapping for the 1% AEP stormwater flood event can be accessed on the City of Launceston's online mapping portal; http://launceston.maps.arcgis.com/home/index.html.

Assessment of the Lilydale urban area was completed using an evidence based approach, considering flood related customer complaints and a review of associated projects. Historically, flooding of Lilydale has been as a result of inundation from the local creeks (riverine flooding), rather than related to the stormwater system. The review process has confirmed there are no major stormwater flooding issues outstanding within the Lilydale urban area.

In addition to the flood risk assessments, water quality risks have also been considered. Water quality and aquatic habitat health in Launceston's urban waterways is generally poor, with high pollutant loads and low ecological health scores at all sites monitored. Many urban waterways have born significant degradation as a result of being incorporated into the stormwater network. Monitoring shows elevated concentrations of Enterococci, sediments, nutrients and metals in the days after rainfall, and foam is frequently observed in open waterways. Despite their degraded state, urban waterways can still have substantial conservation value and retain important functions by providing habitat, connectivity between isolated habitats, and acting as natural retention features for sediment and water flow.

Plans for the management of stormwater risks and issues are documented, and separated into a range of categories, including:

- Development controls - Development controls are an effective and economical means to manage flooding and minimise impacts of development on water quality on a large scale. Current development controls as applicable for stormwater management are; limitations on the discharge of stormwater for new subdivisions, controls to reduce impacts on water quality and other aspects that can be applied through permit conditions, such as requirement to comply with the Tasmanian Subdivision Guidelines to ensure overland flow paths are not compromised. The overlay associated with the flood prone areas code (E5.0) in the *Launceston Interim Planning Scheme 2015* does not include the mapped overland flow paths and flooding of urban waterways. It is necessary to introduce the urban flood mapping to the relevant planning scheme to ensure informed decision making in the future. This will minimise the introduction of additional risk to the community. Issues also currently exist around the application of the Biodiversity (E8.0) and Water Quality (E9.0) codes, and compliance with permit conditions requiring soil and water management. Clarification of internal processes and more robust assessment, mitigation actions and compliance enforcement has the potential to substantially improve water quality and environmental outcomes in the urban area.
- Community resilience - The catchment response for the urban area is generally very quick, with urban stormwater flooding appearing and then retreating quickly. Due to the flashy nature of urban flooding, the best way to expand community resilience is to improve flood awareness for people residing in flood prone areas. Urban (stormwater) flooding was a key topic of discussion during the resilient city theme as part of the City of Launceston's Tomorrow Together community consultation program in winter 2019. Actions proposed to continue to build the community's awareness of urban flooding include; development of an online portal, an update to the land information (337) certificate process to incorporate urban flooding and implementation of additional flood warning signage in known problem locations.
- Structural interventions - Structural interventions are measures to modify the behaviour of flood water with the aim of reducing both the flood damage cost to the community and the risk to life. Structural interventions may range from small upgrades to large scale, multimillion dollar projects. The stormwater risk studies outline locations where there is the potential for significant flood damage to the community as well as possible risk to life. These areas are documented within each of the risk study documents, with the top priorities across the urban area detailed within the SSMP. Structural intervention projects will be scoped and delivered based on available funding and other associated constraints. Throughout the project scoping and investigations stage the priority for the individual projects may change. Priority projects / investigations are proposed for a range of sites, including parts of Prospect, Kings Meadows and Trevallyn. Areas within the CBD also rank highly as part of the prioritisation process, with works impacting on these areas currently being finalised by TasWater as part of the kanamaluka/Tamar Estuary River Health Action Plan.
- Water Quality and Aquatic Habitat Specific Mitigation Measures - Measures specifically to address water quality and aquatic habitat health are often complementary to the structural interventions to

mitigate flood risk. The water quality risk study identified a number of policy and procedural, capital and operational projects aimed at improving environmental health. High priority projects include reviewing the Urban Open Drain Procedure, intensifying reinstatement of riparian vegetation and protection of important local wetlands, quantifying water quality discharge limits for new developments, implementing a monitoring program to assess long-term waterway health trends, investigating options to improve water quality in Heritage Forest perimeter drain and implementing water sensitive urban design principles within Newnham Reserve.

Implementation of capital projects within the stormwater space need to be carefully considered due to the long term financial implication associated with capital expenditure, as well as the risk of inaction and the considerations associated with increasing levels of service. Budget is not currently confirmed for stormwater system capital upgrades or new assets and funding opportunities will need to be explored. City of Launceston historically has had some success with obtaining joint project funding for stormwater related projects, and will continue to investigate future options to supplement stormwater project funding.

A range of individual projects and actions are outlined throughout the Stormwater System Management Plan, as summarised in Table 9. These actions are necessary to build a more resilient community and to reduce risk to the community for stormwater flooding. The responsibility for implementation of these actions is distributed across the City of Launceston networks, and the projects have a range of different priorities for delivery over the four-year time period.

# 1. Introduction

A stormwater system is an essential service provided by councils to the community for the primary focus of managing stormwater within the urban area. This Stormwater System Management Plan (SSMP) is a requirement under the *Urban Drainage Act 2013*. The *Urban Drainage Act 2013* states that a SSMP must specify:

> *(a) plans for the management of any assets used for the delivery of a stormwater service; and*
>
> *(b) the level of risk from flooding for each urban stormwater catchment in the public stormwater system; and*
>
> *(c) any other matters prescribed in the regulations or that the council considers appropriate.*

Beyond the draining of stormwater from urban areas, the City of Launceston also recognises the role it has in managing water quality. Runoff from urban areas can introduce pollutants to receiving waters resulting in the degradation of the natural environment. Understanding both the economic and environmental risks associated with delivering a stormwater service provides a base for the appropriate and effective management of a stormwater system in the short, medium and long term.

This SSMP fulfils the requirements of the *Urban Drainage Act 2013* providing an overview of the management plans for stormwater assets as well as summarising the technical analysis undertaken within the urban area for flood and water quality studies. This then presents a harmonised and holistic approach to the management of stormwater within urban areas. It is important to note that the SSMP applies to urban areas and locally derived rainfall. It should not be confused with flooding impacts from river systems such as the North and South Esk Rivers, Rocky Creek and the St Patricks River. This SSMP provides an overview of issues as documented at the time of writing and requires routine review.

## 1.1 Legislation / Guidance

In Tasmania there are several pieces of legislation, policy and regulations that are relevant to stormwater system management. This SSMP will make reference to these documents as necessary. The legislation, policy and regulations relevant at the time of writing include the:

- *Urban Drainage Act 2013;*
- *Local Government Act 1993;*
- *Land Use Planning and Approvals Act 1993;*
- *Launceston Interim Planning Scheme 2015;*
- *Northern Tasmania Regional Land Use Strategy 2018;*
- *Local Government By-Laws;*
- *Local Government (Building and Miscellaneous Provisions) Act 1993;*
- *Environmental Management & Pollution Control Act 1994;*

- *Weed Management Act 1999;*
- *Threatened Species Protection Act 1995;*
- *Inland Fisheries Act 1995;*
- *Nature Conservation Act 2002;*
- *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
- *Building Act 2016;*
- *Building Regulations 2016; and*
- *State Policy on Water Quality Management 1997*.

In addition to the legislation, policy and regulations, there are other guidance documents that help frame discussions, including:

- City of Launceston Sustainability Strategy (2019);
- Tasmanian Subdivision Guidelines (LGAT, 2013);
- State Stormwater Strategy (DPIPWE, 2010);
- Waterways and Wetlands Works Manual (DPIWE, 2003);
- Australian Disaster Resilience Handbook Collection Handbook 7, Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR, 2017);
- Australian Building Codes Board Standard: Construction of buildings in flood hazard areas (ABCB, 2019);
- Climate Action 21: Tasmania's Climate Change Action Plan 2017 - 2021 (State of Tasmania, 2017);
- Guidelines for Development in Flood Affected Areas February 2019 (Victorian State Government, Department of Environment, Land, Water and Planning 2018); and
- blueprint2013 - Stormwater Management in a Water Sensitive City (Wong et al. 2013).

# 2. Urban Area and Stormwater System

## 2.1 Urban Area

As specified within *The Urban Drainage Act 2013* the SSMP must be developed for the urban areas of the municipality. However, a definition of urban is not included within the Act. As such, the City of Launceston have nominated the urban area as the developed areas of the municipality with particular zoning under the *Launceston Interim Planning Scheme 2015*. This includes areas that are zoned residential (including general, inner and low density residential), urban mixed use, business (including local, general and central business), industrial (including light and general industrial) and commercial. The study includes suburban Launceston as well as the township of Lilydale, as shown in Figure 1. Also shown in Figure 1 are the relevant urban catchment boundaries, overlapping into the rural areas of Launceston, as well as entering other municipalities.

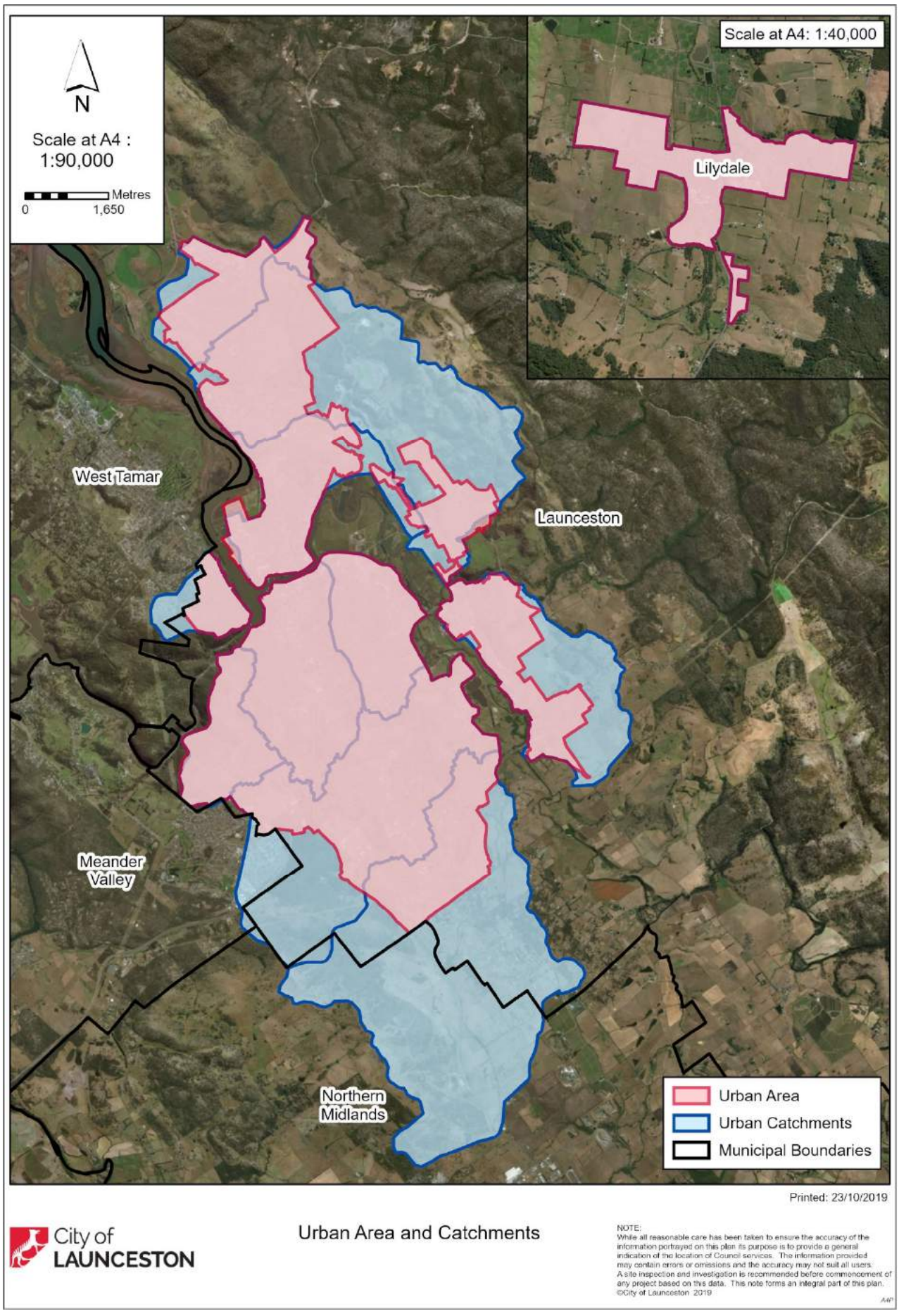



**Figure 1 - Urban Area and Catchments**

## 2.2 Urban Stormwater System

The City of Launceston has an extensive urban stormwater system, as summarised in Table 1.

**Table 1 - City of Launceston Stormwater System**

| Asset Category | Dimension |
|---|---|
| Stormwater Pipe | 440 km |
| Stormwater Nodes;<br>Manholes, Gully Pits & Side Entry Pits | 16,198 structures<br>$41,258,756 current replacement cost |
| Stormwater Detention Basins | 10 |
| Maintained Drains and Urban Waterways* | 16 km |
| Gross Pollutant Traps | 6 |
| Stormwater Pump Stations | 1 (Racecourse Cres) |

*16 km of open drains and waterways are currently included in the City of Launceston's asset register and maintained under the Open Drains Procedure (Section 3.1). Mapping as required under Section 12 of the Urban Drainage Act 2013 has confirmed the waterway component of the urban drainage network is approximately 37 km.

In addition to the assets listed within Table 1, the central parts of Launceston contain a combined stormwater and sewage drainage system. The management of the combined drainage system is complex and discussed further in Section 2.2.1.

### 2.2.1 Combined Stormwater and Sewage Drainage System

Historical development of Launceston involved the construction of a combined stormwater and sewage drainage system, by which stormwater and sewage are conveyed using the same infrastructure within the older portions of Launceston. Launceston's combined system is the last combined drainage system of any significant size still operating within Australia, however they are common in older cities internationally. The combined drainage area, shown in Figure 2, incorporates approximately one third of Launceston's urban catchment area.

Management of the drainage network within this area is complex as the drainage assets are owned and operated by TasWater, however the City of Launceston has legal responsibly for the stormwater service within this area. The City of Launceston currently pays an arbitrated annual fee to TasWater for operating the 'stormwater system' but the fee does not include provision for renewal or upgrade of the infrastructure. As such, City of Launceston is required to pay an additional sum for the stormwater component of capital renewals and upgrades completed within the combined sewer and stormwater system. Details of the arrangement are documented within the *Launceston Combined Drainage System Service Agreement* (City of Launceston & TasWater, 2016). Significant changes are planned for the combined area as part of the state and federally supported kanamaluka/Tamar Estuary River Health Action Plan (TEMT, 2017), discussed in Section 5.4.1. City of Launceston work closely with TasWater regarding the management of the combined system.

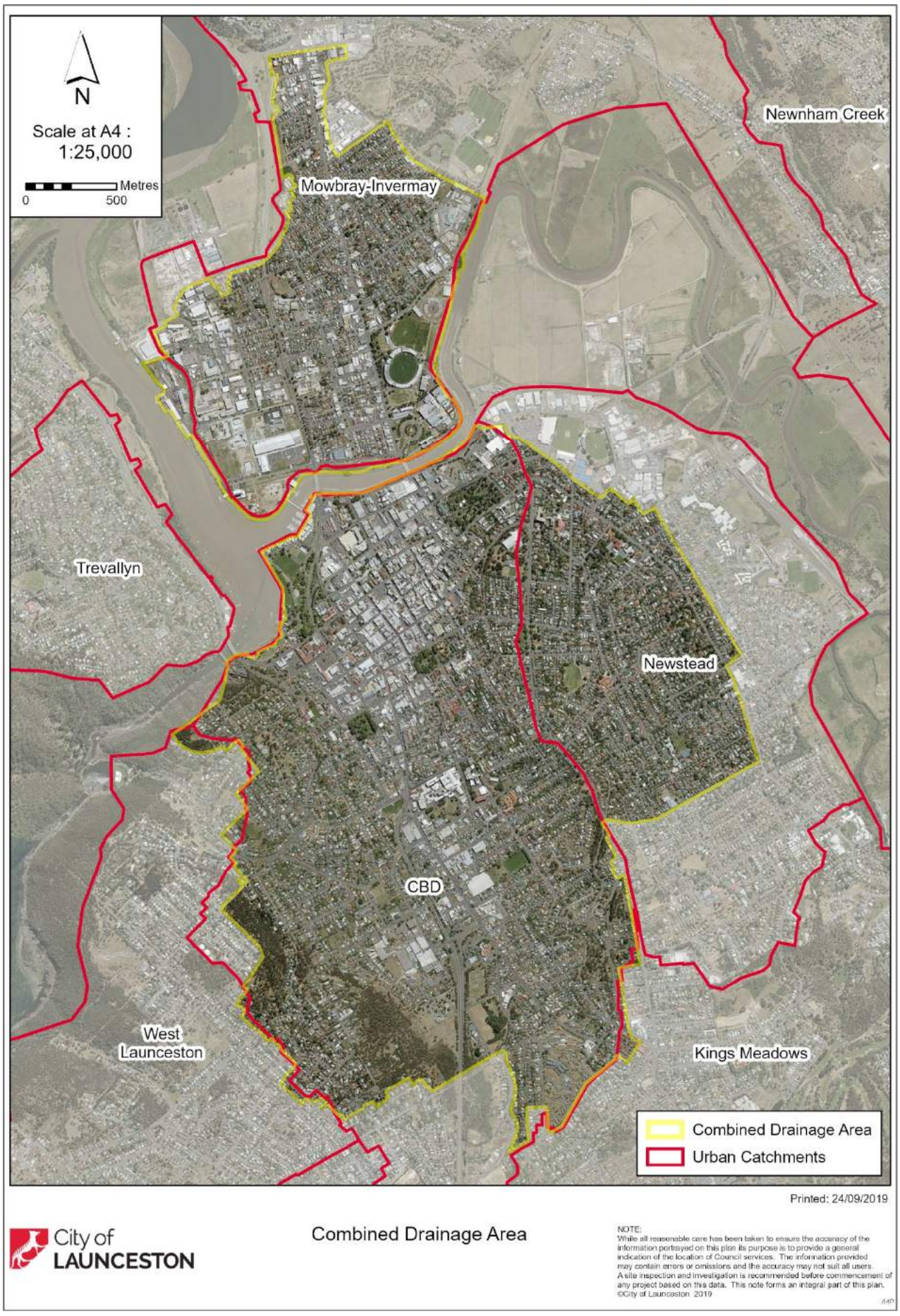



**Figure 2 - Combined Drainage Area**

# 3. Management of Stormwater Service Delivery Assets

The City of Launceston have extensive and well established plans for management of drainage assets. These incorporate operational maintenance, renewals and capital upgrades, as well as reactive responses to customer enquiries or unforeseen issues. Existing processes are outlined in the following sections and detailed in the Drainage Asset Management Plan (City of Launceston, 2015) and other associated documentation.

## 3.1 Operational

The City of Launceston stormwater assets operational program comprises multiple components. These include;

- Pipe Inspection program - The stormwater system is inspected using the City of Launceston CCTV camera on a rotating monthly schedule, based on geographical location, time since last inspection and previously recorded pipe condition. Around 700 stormwater pipe assets are inspected each year through this program, equating to approximately 5% of the network. The inspection reviews pipe condition and any other abnormalities, such as root intrusions. Pipeline cleaning is considered at this stage if necessary. Pipeline condition is noted as per the guidelines (IPWEA, 2015) with this information updated in the asset register. Pipelines in poor or very poor condition (conditions 4 or 5) are considered for asset renewal as necessary.
- Stormwater Pit Inspection and Cleaning - City of Launceston routinely inspects, and if necessary, cleans the stormwater pits. Pits in problem areas are considered on a three monthly basis, with the balance of pits assessed twelve or twenty four monthly as necessary.
- Gross Pollutant Trap Maintenance - City of Launceston currently operates six gross pollutant traps across the urban area. These are emptied and maintained on a six or twelve monthly basis as required.
- Scheduled Root Cutting - Pipelines that regularly require root cutting are included on the root cutting schedule, with roots cut six monthly, to ensure pipe hydraulics are not compromised.
- Stormwater Detention Basins - operational requirements for the stormwater detention basins depend on the classification of the dam.
    - Operational checks are completed on a monthly / three monthly basis for the dams classified High-C; Mt Pleasant Dam and Kings Meadows High School Detention Basin.
    - Additional dam safety inspections at lower category dams / detention basins are currently undertaken informally, at approximately three monthly intervals. These safety inspections will be formalised and tasked via the Dam Compliance Engineer.
    - Vegetation management of the stormwater detention basins / dams is scheduled at routine intervals, with responsibility split between external contractors and the City of Launceston operational staff.
    - Compliance reporting for Dams Category Significant and above is completed five yearly.
    - TasWater have responsibility for the public stormwater detention basins located within the combined drainage system.

- Stormwater pump station - Racecourse SWPS
    - Scheduled debris clearing for the screen and wet well is undertaken on a six monthly basis.
    - TasWater complete tasks regarding the mechanical and electrical operations, included SCADA monitoring as required.
- Waterways - as noted in Section 2.2, approximately 37 km of waterway can be considered part of the urban network. Responsibilities for the waterways depend on the location of the waterway, and whether the predominant use of the waterway is to accommodate concentrated stormwater runoff from outside the property. The responsibilities and maintenance levels for the waterways are outlined in City of Launceston's Urban Open Drain Procedure. The level of service applied to a particular drain / waterway is dependent on the effect of the failure and associated risk, as documented in Table 2. Urban open drains categories, associated levels of service and maintenance methods will be reviewed (refer also to Section 5.4).

**Table 2 - Urban Open Drains Procedure; Level of Service**

| Category | Failure | Minimum Level of Service |
|---|---|---|
| 1 | Would pose a risk to the public, cause flooding of property or create major inconvenience. | Vegetation management undertaken within channel twice per year, remove rubbish and repair damage as required. Pre and post event inspection of inlets to ensure conveyance capacity is maintained. |
| 2 | Would cause minor flooding of property or minor inconvenience. | Vegetation management undertaken within channel once per year, remove rubbish and repair damage as required. Pre and post event inspection of inlets to ensure conveyance capacity is maintained. |
| 3 | Those drains that have alternative flow paths such that flooding would largely go unnoticed. | Slash vegetation, remove rubbish and repair damage as required to maintain hydraulic requirements and profile. |
| 4 | Scouring of natural watercourses creating a nuisance or potential for erosion. | Maintenance to be restricted to the immediate vicinity of concentrated discharges from the Council system where localised scouring is likely to occur. Also removal of rubbish, obstructions, localised repairs as required. |

- Silt Cleaning and Outfalls - 53 segments of stormwater pipe prone to siltation are inspected and cleared (if necessary) on a 12 monthly basis. Outfalls of these pipes are also inspected at this time.
- Reactive investigations / maintenance - reactive investigations and maintenance of issues reported by members of the public are actioned under timelines related to the City of Launceston customer service charter. Responses to drainage and stormwater flooding concerns for the urban area are prioritised as per Table 3. Drainage related complaints are reviewed, with capacity related flooding issues documented and compiled on an as needs basis.

**Table 3 - Drainage Related Customer Issues and Response Times**

| Issue Classification | Priority & Response Times |
|---|---|
| RPD - Stormwater / Drainage Maintenance | Medium - Action by 10 working days |
| RPD - Stormwater Lid / Grate Missing | Urgent - Action same day |
| RPD - Water Run Off | Urgent - Action same day |
| RFR - Water Over Road | Urgent - Action same day |
| RFR - Flooded Home / Business | Urgent - Action same day |

## 3.2 Capital

Capital works within the stormwater space at City of Launceston can be classified as one of two types; asset renewals / replacements or upgrades / new projects. Asset renewals / replacements are major works that do not increase the asset's design capacity, but restore, rehabilitate, replace or renew an existing asset to its original or lesser required service potential. Work over and above restoring an asset to original service potential is an upgrade / expansion, or new works expenditure. These works will then have implications for ongoing operational and future renewal costs.

City of Launceston plans renewal and replacement projects to meet level of service objectives and minimise infrastructure service risks. Renewal projects vary from significant maintenance, e.g. pipe relining, to full asset replacement. As documented within City of Launceston's asset management plans, stormwater renewal rates are currently appropriate (City of Launceston, 2015; City of Launceston 2019). However, beyond the 20-year horizon predictions suggest renewals will be significantly under-funded at current rates. Renewal costs are expected to rise due to the approaching first round of pipe renewals following the post WWII suburban expansion.

New works are those that create a new asset that did not previously exist, or work which upgrades or improves an existing asset beyond its existing capacity. These projects may result from growth, social or environmental needs. Assets may also be built by others and contributed free of cost to the City of Launceston. Capital upgrade and new projects are planned and prioritised by the City of Launceston to reduce flood risk and achieve water quality objectives as outlined through the risk identification process. Any upgrade or construction of new assets needs to be carefully considered due to the long term financial implication associated with this capital expenditure. Resourcing considerations are discussed further in Section 6.

Asset renewals and capital upgrades within the combined drainage system (Section 2.2.1) are the joint responsibility of the City of Launceston and TasWater, as discussed in the Service Agreement (2016). Under the current Service Agreement capital upgrade projects are identified, with the City of Launceston contributing a nominated percentage. Complexities associated with resourcing in the combined drainage system are further documented in Section 6.2.

# 4. Identification of Stormwater Risks and Issues

For the purposes of detailed investigation and documentation, Launceston's urban area has been separated into stormwater catchments and these catchments then combined to create five study areas (Figure 3). For each of the study areas a detailed report has been developed to consider risks and issues relating to the catchments in question. A sixth report considers issues and risks associated with water quality within the urban catchments. The reports are as follows;

- Launceston Central Risk Study Area - CBD, Newstead, Invermay and Mowbray Catchments;
- Launceston North & East Risk Study Area - Alanvale, Newnham Creek and St Leonards Catchments;
- Launceston West Risk Study Area - Trevallyn and West Launceston Catchments;
- Launceston South Risk Study Area - Kings Meadows and Youngtown Catchments;
- Lilydale Stormwater Study Area - Lilydale Urban Area; and
- Launceston Stormwater Risk Study: Water Quality & Aquatic Ecology

The following sections provide an overview of the process that has been followed in the stormwater studies to identify risks and issues.

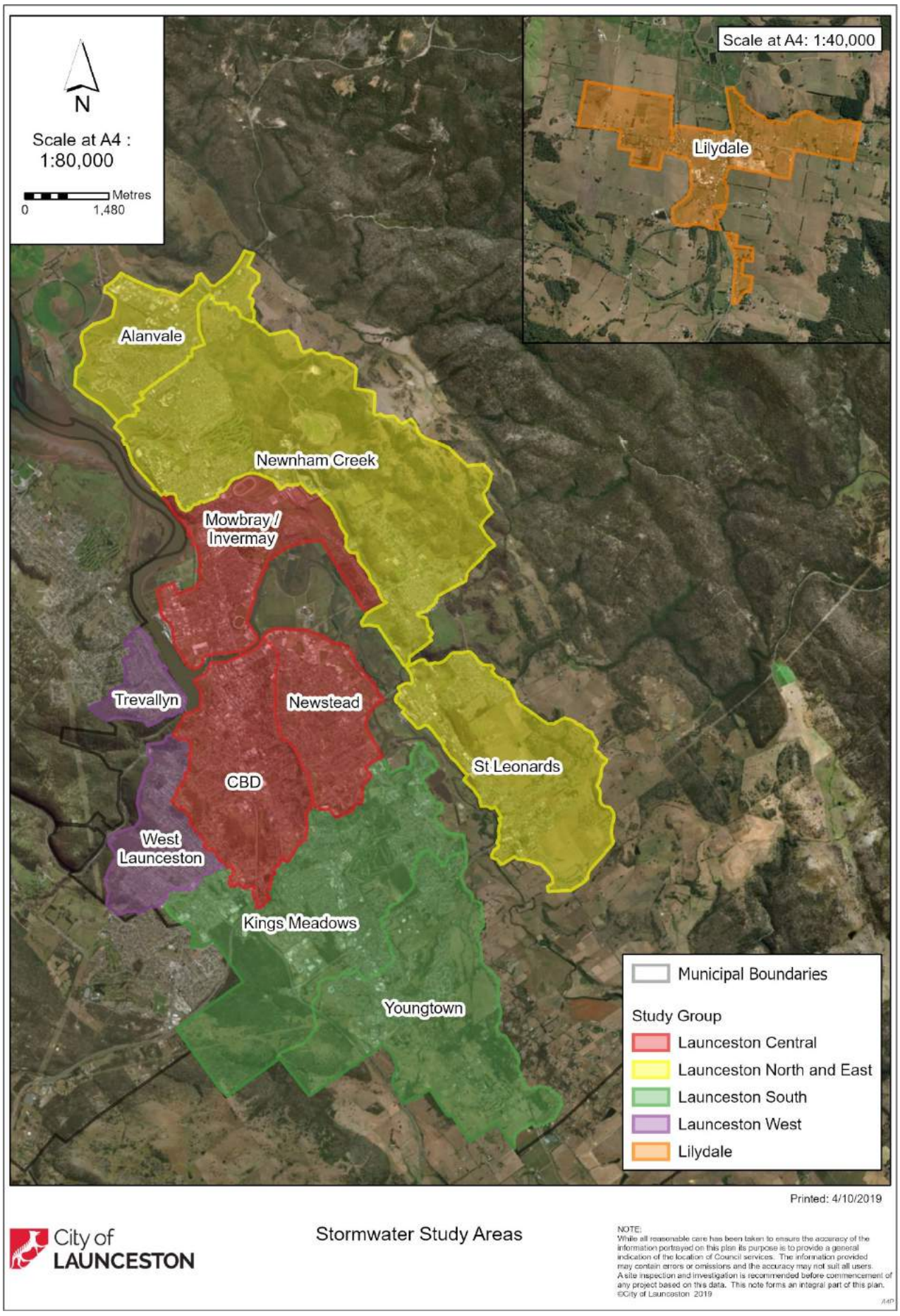



**Figure 3 - Stormwater Study Areas**

## 4.1 Stormwater Risk Study Process

The detailed stormwater risk studies completed for the main urban catchments follow the same process, allowing for comparison across the catchments. Initially, flood studies were completed for each catchment (Figure 1). In some cases, upper catchments within the rural areas of the municipality have been included to ensure whole of catchment management approaches. Where catchments cross municipal boundaries these areas were also included in the flood studies to ensure accurate representation of the downstream environment. The results of the flood studies are included for the 1% AEP stormwater flood event on the City of Launceston's online mapping portal; http://launceston.maps.arcgis.com/home/index.html.

Flood behaviour is assessed within the stormwater risk studies to gain an understanding of the existing and possible risk factors and how these impact the community. Two key indicators, flood hazard and flood damages, are used in the stormwater risk reports to quantify flood risk. These are discussed in greater detail in the following sections. Both flood hazard and flood damages provide a baseline to measure and justify improvement projects within the public stormwater system.

The stormwater risk studies also consider the relationship between stormwater flooding and critical services and vulnerable developments as the impact of flooding has the potential to be higher for these. Vulnerable developments and critical infrastructure are locations within the community where either vulnerable members of the community will be located, or locations that provide critical services to the community. These include but are not limited to; schools, child care facilities, aged care facilities, retirement villages, utilities, police and fire stations and hospitals, medical centres and ambulance facilities.

### 4.1.1 Flood Hazard

To relate outputs from flood modelling to the likely impact on people, vehicles and buildings, flood hazard categorisation is completed to establish how hazardous (i.e. dangerous) various parts of the catchment are. Primarily the hazard is a function of the depth and velocity of floodwater, however, the hazard categorisation considers a wider range of flood risks, particularly those relating to personal safety. Figure 4 demonstrates how flood hazard can be used to consider impacts on the community. The majority of flooding within the urban area is hazard category H1 (68%), meaning flooding is generally safe for people, vehicles and buildings. There are some locations within the urban area which exhibit higher hazard categories, these are detailed further in the following sections, with some examples provided in Table 4. Also included within Table 4 is an overview of the extent of each hazard category within the urban area.

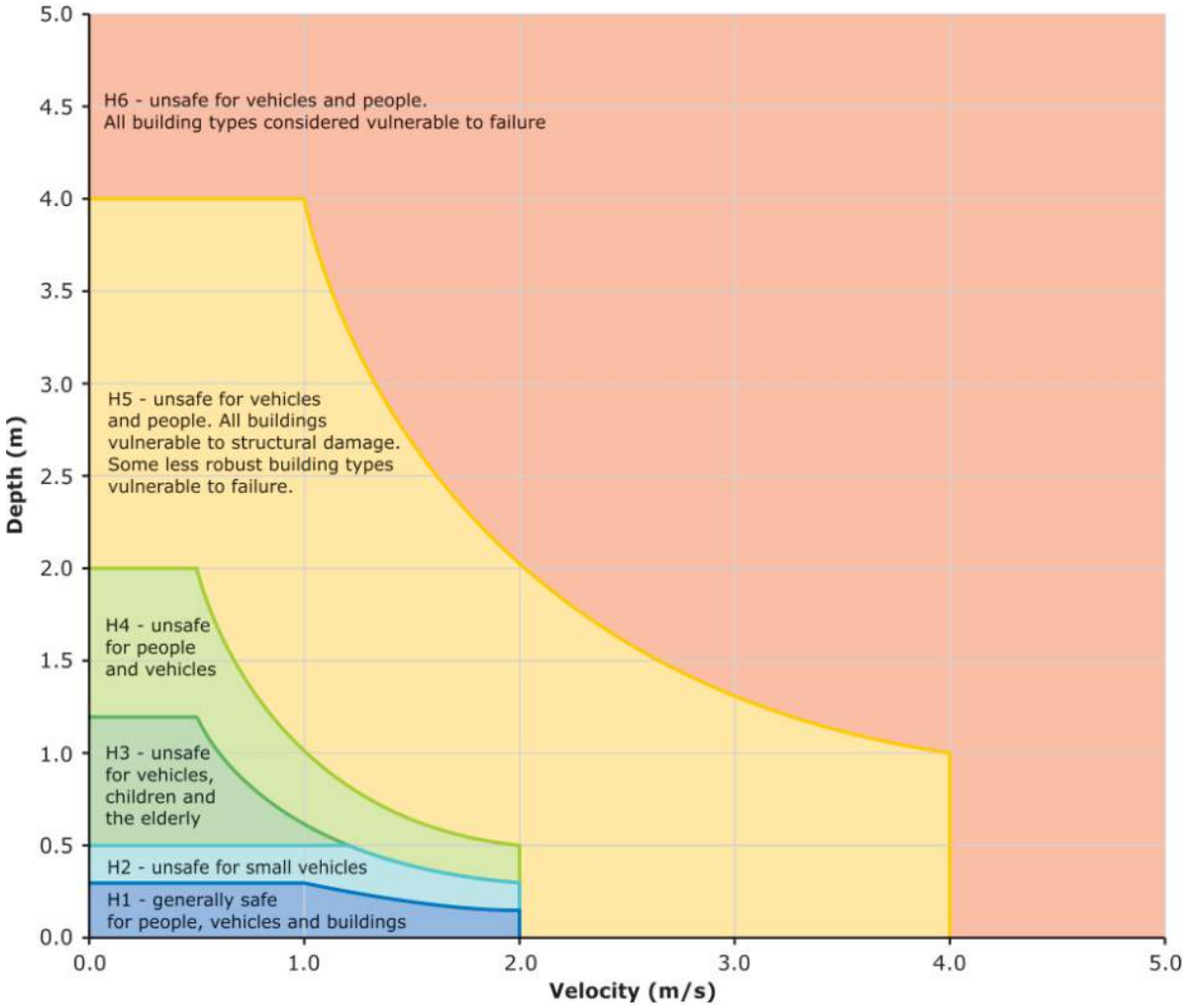
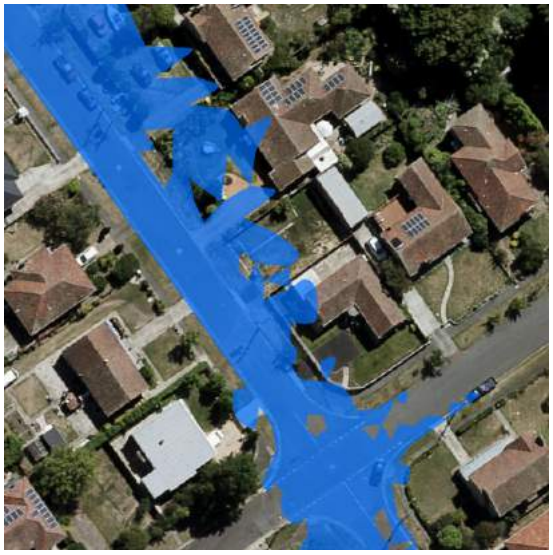
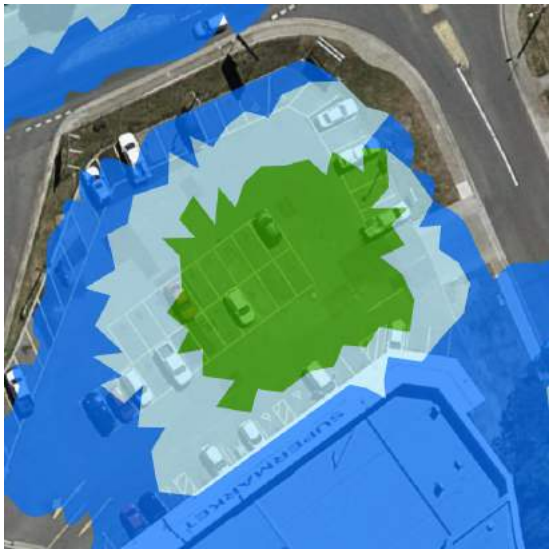
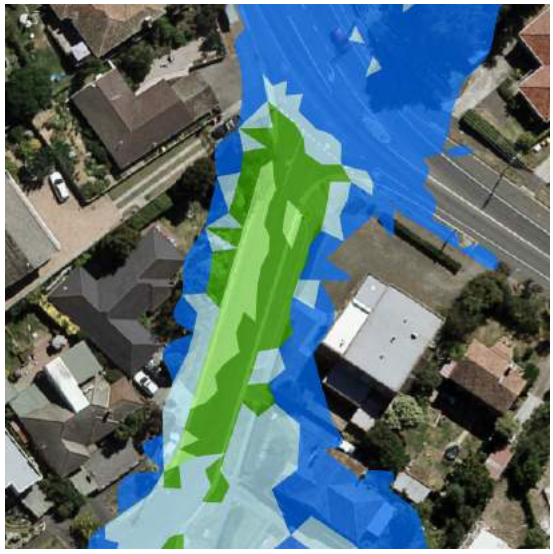
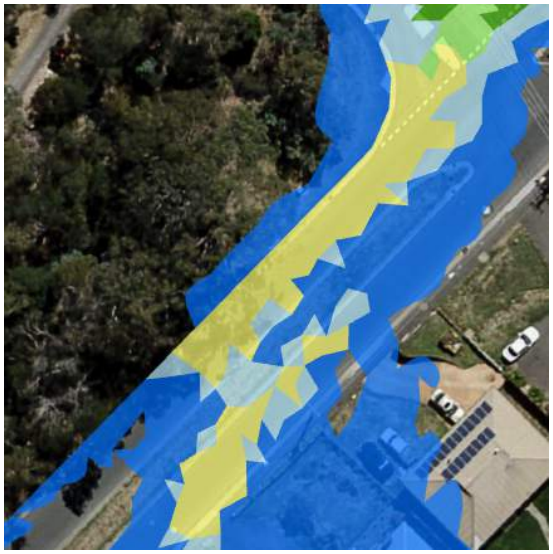
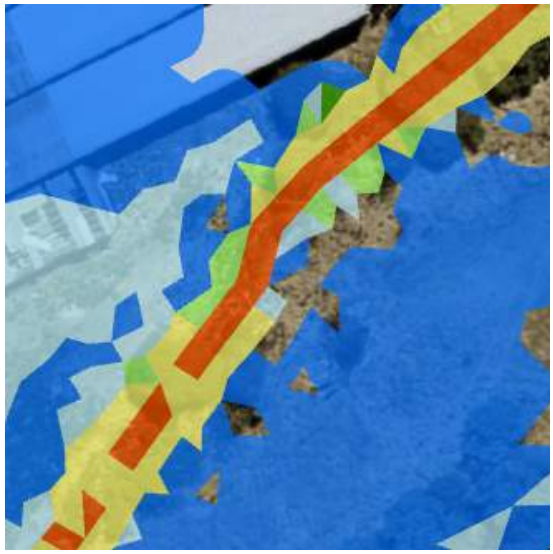



**Figure 4 - Combined Flood Hazard Curves (Smith *et al.*, 2014)**

**Table 4 - Examples of Flood Hazard in the Urban Area**

| | |
|---|---|
|  |  |
| H1 - Shallow, slow moving floodwaters, 68% | H2 - Floodwaters deeper, slow moving, 13% |
|  |  |
| H3 - Floodwaters deeper again, slow moving, 11% | H4 - Floodwaters deeper again, slow moving, 4% |
|  |  |
| H5 - Fast flowing but shallow floodwaters (above) or deeper floodwaters (right), 3% | H6 - Very fast flowing and / or very deep floodwaters, generally centre of channel, 0.2% |

### *Vehicle Instability*

One of the highest represented causes for injuries and deaths as a result of flooding is people crossing flooded roads. For a vehicle or person to become overwhelmed by flood water does not necessarily require deep flood water. Locations in the roadway where the depth velocity product is greater than 0.3, or still water depth is greater than 0.3 m (H2 hazard floodwaters as presented in Figure 4) pose a potential risk to vehicle stability. These locations are documented within each of the risk study reports.

Most road inundation within the urban area presents flood behaviour below the threshold for vehicle stability, however in some locations floodwaters pose a risk to vehicle stability. These locations have been considered alongside a range of factors, including the hazard rating of the floodwaters and associated risk to life, the frequency of inundation, the area directly impacted and the order or hierarchy of the road impacted. These factors were combined to enable prioritisation of works, as tabulated in Section 5.3.

### *Other Hazardous Locations*

Floods create hazardous conditions to which humans are particularly vulnerable. If flood prone areas were unoccupied and unused, flooding would not create a risk to the community. It is the human interaction with the floodplain, and the associated exposure to flood hazard that creates the flood risk. As such, it is advised that risk from hazardous floodwaters be minimised by not entering floodwaters.

As discussed in Section 4.1.1 the hazard rating across the study area has been determined and mapped, with the majority of floodwaters determined to be H1; generally safe for people, vehicles and buildings. However, several locations exist within the study area that pose a potential risk to life if floodwaters were entered. Generally these areas are waterways, undeveloped floodplains, stormwater detention basins, drainage reserves or other open space such as sports fields. Individual locations have been documented within the stormwater risk studies for the relevant areas.

## 4.1.2 Flood Impacted Properties

The economic impact of flooding can be defined by what is commonly referred to as 'flood damages'. Flood damages are discussed in greater detail in the Stormwater Modelling Technical Report (City of Launceston, 2017) and comprise tangible and intangible damages. Tangible damages for flooded residential, commercial and industrial properties have been calculated using methods outlined in the technical report as part of the flood studies to determine an expected annual damage (EAD) for properties. The EAD provides a representation of annualised likely damage expected and can be summed for impacted areas, sub-catchments and study areas to quantify the impacts of property flooding. EAD can be used for both prioritisation and to assess the effectiveness of mitigation works.

It should be noted that EAD calculations are based on three main factors: damage curves, modelled flood levels and exceedance probability of a range of storm events. Each of these three factors are influenced by many uncertainties, including:

- Assumptions made in hydrological modelling and hydraulic modelling;
- Assumed floor levels where no survey is available;
- Relationship between damage and flood depth; and
- Probability of storm events.

As such, the EAD results provide a good average estimate of flood damage for comparison purposes, but are considered indicative only. Table 5 presents a summary of the estimated flood damages for each urban catchment.

**Table 5 - Estimated Flood Damages, per Catchment**

| Catchment | Expected Annual Damage ($) | Expected Annual Damage (% of total) |
|---|---|---|
| Alanvale | $190,904 | 4% |
| Newnham Creek | $307,444 | 7% |
| St Leonards | $62,176 | 1% |
| Mowbray - Invermay | $484,726 | 11% |
| CBD - Newstead | $1,252,027 | 29% |
| Trevallyn | $316,497 | 7% |
| West Launceston | $193,676 | 4% |
| Kings Meadows | $1,296,556 | 30% |
| Youngtown | $283,477 | 6% |

The EAD results shown in Table 5 align well with Council's knowledge of flooding complaints and observations. Historically, the most significant stormwater flooding within urban Launceston has been in the CBD and the Kings Meadows catchments, including Prospect. Significant infrastructure upgrades have been undertaken to reduce flooding in these areas, including upgrades of the Kings Meadows High School detention basin (2015), and Mt Pleasant Dam (2012), construction of the Margaret St detention basin (2004), pipe and pit upgrades throughout Kings Meadows and the CBD, and pump capacity increases within some of the CBD pump stations. The Glen Dhu pipeline diversion (completed November 2019) is not included within the modelling. This project increases capacity on the western side of the Southern Outlet, with associated reductions in localised flooding.

Despite the significant investment on the aforementioned projects, these locations continue to feature as areas for improvement due to the piping of significant waterways. Notably Kings Meadows Rivulet under the Kings Meadows shopping precinct, and Fishermans Creek, the original waterway in the Margaret St area, as well as smaller creeks in the CBD area.

## 4.2 Lilydale Stormwater Study

The Lilydale urban area, at 128 ha, makes up 2.5 % of the overall urban area of Launceston. The stormwater system comprises several small pipe networks and associated kerb and channel, and pits, draining into waterways running through the urban area. Some of the roads in the urban area have roadside table drains rather than kerb and channel. The 3.2 km of stormwater pipeline within the Lilydale urban area amounts to 0.7 % of Launceston's urban stormwater network.

As such, an evidence based approach has been undertaken for the Lilydale Stormwater Study, considering flood related customer complaints and a review of associated projects. Historically, flooding complaints within Lilydale are attributed to riverine flooding of Rocky Creek and McGowans Creek rather than related to the stormwater system. Risks associated with fluvial flooding of the creek systems are a separate issue and excluded from the stormwater studies.

The review process has confirmed there are no major stormwater flooding issues outstanding within the Lilydale urban area. Existing processes for stormwater management within Lilydale will continue. Concerns will be considered as they are raised and prioritised alongside works identified within the stormwater system management plan and the asset management plan.

## 4.3 Water Quality and Aquatic Habitat Study

Many urban waterways have born significant degradation as a result of being incorporated into the stormwater network. This has led to reductions in biodiversity and quality, and has compromised their ability to deliver ecosystem services. Attitudes towards urban waterways have begun to change as part of wider reformation in the way in which the environment is viewed; they are no longer simply viewed as degraded systems of little value other than for the conveyance of stormwater, but as ecosystems with an intrinsic value in their own right. Urban waterways make significant contributions to local biodiversity and can have substantial conservation value. Despite being often degraded systems, urban waterways retain important functions, by providing connectivity between isolated habitats and populations and acting as natural retention features for sediment and water flow.

Urban waterways contribute to a range of ecosystem services, such as reducing the impact of the urban heat island effect, reducing peaks in stormwater runoff, absorbing air pollution, and providing habitats for biodiversity, including threatened species. They also deliver a range of benefits to human health and wellbeing: people are more likely to live longer (Donovan et al. 2013), and have better general health and wellbeing (Dallimer et al. 2012) in a city with more trees. Urban green spaces, such as urban waterways, promote physical exercise, reduce stress (via psychological restoration), strengthen attachment to place, lower crime rates (Dallimer et al. 2012) and increase social interaction (Southon et al 2018). Furthermore, they have the potential to connect urban residents with Indigenous history and culture. Indigenous Australians have strong connections and obligations to biodiversity arising from spiritual beliefs, and urban green zones create an avenue for preserving traditional knowledge and engaging urban Indigenous people in city planning processes (Cresswell & Murphy 2017). Consequently, there has been increased interest in managing impacts and restoring urban waterways.

In separated stormwater networks, all the pollutants (e.g. sediment, oil and other hydrocarbons contaminants, litter, leaves, nutrients, metals and animal droppings) are delivered to the waterways without treatment. As such, urban waterways are often highly polluted with sometimes severely impacted aquatic habitat. These pollutants and organisms also pose a risk to human health if the water is used for recreational purposes (swimming, kayaking etc.) due to the risk of inhaling or swallowing the water (DoH 2018).

Water quality and aquatic habitat health in Launceston's urban waterways is generally poor, with high pollutant loads at all sites monitored. Aquatic habitat health assessments undertaken in representative waterways such as Kings Meadows Rivulet return a very low score, indicating that the ecosystems are severely degraded. Some or all of the natural waterways in most of the stormwater catchments (all but the CBD and Alanvale catchments) are identified as being of very high conservation management in the DPIPWE Conservation of Freshwater Ecosystem Values (CFEV) database (DPIW 2005). The North Esk River floodplain, while not included in the stormwater catchments, is impacted by the stormwater discharges. The drainage lines, wetlands and waterbodies are identified as being of very high conservation management in the CFEV database.

The underlying soil types in an area of development or infrastructure installation/renewal are important considerations during the planning phase in order to limit environmental harm and to protect infrastructure assets. For example dispersive soils can result in tunnel erosion around a stormwater pipe and discharge large quantities of sediment to waterways; high salt concentrations or exposure of potential acid sulfate soils can reduce the life of the asset and discharge toxicants. Launceston has known areas of dispersive, slaking, saline and potential acid sulfate soils which need to be managed in order to mitigate environmental and infrastructure impacts.

Weeds and pests also present a risk to the water quality and aquatic ecology of the local waterways. Canadian pondweed is a declared weed in Tasmania under the *Tasmanian Weed Management Act 1999*, and is known to occur in parts of the Launceston drainage network. The pest fish, *Gambusia holbrooki*, has been recently identified in Queechy Lake and the North Esk River, and presents a serious and credible threat to the local ecosystems.

Aquatic values within the Launceston stormwater network include:

- platypus, native fish, frog and macroinvertebrate populations, particularly in the larger named waterways (Kings Meadows Rivulet, Newnham Creek, Distillery Creek and Jinglers Creek);
- burrowing crayfish in tea tree swamp forests, particularly at the West Tamar Walking Trail and the Kings Meadows Rivulet tributary downstream from Mt Pleasant dam;
- listed threatened flora and fauna that are aquatic and/or water-dependent species; and
- water quality for stream health.

# 5. Managing Stormwater Risks and Issues

Risks and issues associated with each situation will be unique; each with its own set of constraints and opportunities. All factors need to be considered in determining the most appropriate response for the situation. Risk management measures are presented in one of the following two categories:

- **Catchment / LGA based measures** - These are measures that are not specific to any one location but rather can be applied through administrative channels to achieve a reduction in risk. An example of this could be an education program for targeted communities or the implementation of development controls. These are generally policy based measures.
- **Site specific management measures** - These measures respond to a specific issue that either results in an economic loss to the community or poses risk to life or the environment. The recommended measures are usually infrastructure related modification measures like piped system capacity increases, channel improvement, levees or detention basins, however they can also include projects to improve water quality and aquatic ecosystem health. This can also include a site-specific planning control, installation of flood warning signs or a property modification measure. Property modification measures are focused on preventing / avoiding and reducing consequences of flood risks.

Many of Launceston's stormwater flood related issues in the urban area are the result of a lack of flood intelligence to inform historical land use planning decisions. The cost to the community attributed to non-compatible development in a flood prone location is substantial. As such, a significant component of the stormwater system management plan is focusing on future planning to ensure these lessons are learned and not repeated. However, that does not resolve the issues currently existing within our community.

As discussed in Section 7.2 of *Managing the Floodplain: A guide to Best Practice in Flood Risk Management in Australia:*

*"The need to treat risk will depend upon whether the current level of residual risk is acceptable to the community. What level of risk is acceptable will depend upon who is asked, what their experience of floods has been and when they are asked." (AIDR, 2017).*

Council are unable to satisfy the needs and requirements of every person on an individual basis. The responsibility falls to Council to make an informed decision about prioritisation of projects, whether they be capital upgrades, planning strategies or anything in-between. Project prioritisation requires consideration of a number of factors, with a focus on minimising both risk to life and property damage, as well as significant disruption of commercial activity due to localised flooding and potential environmental impact. Managed and intended flooding of open spaces, including parklands, is considered acceptable.

Stormwater monitoring shows elevated concentrations of Enterococci, sediments, nutrients and metals in the days after rainfall. Foam is frequently observed in the open waterways that form part of the stormwater network. These data and observations indicate that the kanamaluka/Tamar River estuary receives inputs of faecal contamination and pollutants from the urban stormwater network, presenting a risk to environmental and human health.

To consider flooding and water quality issues in isolation has the potential to impede the management of either flood or water quality risk. For example, the installation of a detention basin without consideration of water

quality could result in a missed opportunity to improve water quality. A combined use bio-retention basin / stormwater detention basin could have been considered instead. Conversely, if a natural water course is rehabilitated only to improve its resistance to erosion, but flow conveyance is not considered, an opportunity may be missed where flood mitigation could have been improved.

The following sections outline a range of options for managing stormwater risks and provide specific actions as part of this iteration of Council's SSMP.

## 5.1 Development Controls

The primary purpose of development controls is to ensure that future development is compatible with identified risks, in both greenfield and brownfield development sites. Development controls are an effective and economical means to manage flooding and minimise impacts of development on water quality on a large scale. Development controls can relate to controls required under either the relevant planning or building legislation, including through the use of permit conditions. Development controls are primarily applied at the LGA scale or wider, and are generally not catchment specific.

Table 6 identifies development controls to reduce flooding and water quality impacts, current at the time of writing, and provides comments and associated actions for inclusion within the Action Plan (Table 9). It is noted that the Tasmanian Planning Scheme is currently in the approval process and likely to be adopted during 2020. As such there will be changes to the codes noted in Table 6.

The Northern Tasmanian Regional Land Use Strategy outlines the strategy and policy basis for facilitating development across Northern Tasmania, and any future proposed amendments must be consistent with the strategy. Specific policies and actions within the Regional Environment Policy relevant to the Stormwater System Management plan include:

- NH-P02 - Future land use and development is to minimise risk to people and property resulting from flooding;
- NH-P04 - Where avoidance of hazards is not possible or the level of risk is deemed acceptable, best practice construction and design techniques and management practices are to be implemented;
- CW-P05 - Protect and manage the ecological health and environmental values of surface and groundwater;
- CW-P06 - Where appropriate, development in new or redevelopment areas is to adopt best practice Water Sensitive Urban Design (WSUD) principles; and
- CW-P07 - Protect the water quality of the region’s waterways and wetlands, including key water supply catchments.

**Table 6 - Development Control Mechanisms - Existing Status and Comments**

| Development Control Mechanism | Existing Status and Comments |
|---|---|
| Launceston Interim Planning Scheme 2015; Zone Provisions, Development Standards Section; Discharge of Stormwater | • The *Launceston Interim Planning Scheme 2015*, within the development standards for zones within the urban area (Part D), outlines requirements for 'discharge of stormwater', to ensure that subdivision layout, including roads, are satisfactorily drained and discharged. To achieve this goal there are two components;<br>  • Each lot must be capable of connecting to the public stormwater system.<br>  • Council's General Manager has provided written advice that the public stormwater system has the capacity to accommodate the stormwater discharge from the subdivision. Council currently considers these requests on an as needs basis, applying permit conditions requiring stormwater detention if necessary.<br>*It has been identified that a more consistent approach to consideration of this matter, and the associated permit conditions is required. However, application of stormwater detention conditions as a blanket approach is neither practical nor appropriate from a technical perspective.*<br>*In addition to this, there is an increasing trend towards development of detention storage features that then become the responsibility of council. The quality of these features varies, and there is the potential for significant ongoing and maintenance costs associated with stormwater detention basins.*<br>*As such, it is necessary to review the "Discharge of Stormwater - Acceptable Solutions" high level procedure to include the results of the stormwater system modelling. It is also necessary to consider the introduction of guidelines around the development of detention storage features to ensure the high quality and functional assets are handed over to the City of Launceston.* |
| Launceston Interim Planning Scheme 2015; E5.0 Flood Prone Areas Code | • The purpose of the flood prone areas code is to ensure that use or development subject to risk from flooding is appropriately located and managed; and to minimise the risk of damage or pollution in the event of a flood.<br>• The code applies to use or development of land as shown as flood risk areas on the planning scheme overlay maps; or identified in a report prepared by a suitably qualified person, that is lodged with an application for permit, or required in response to a request under section 54 of the Act, as actually or potentially subject to a 1% annual exceedance probability flood.<br>• Flooding is defined as a natural phenomenon that occurs when water covers land that is normally dry. It may result from coastal or catchment flooding, or a combination of both. Catchment flooding is defined as flooding due to prolonged or intense rainfall and includes riverine, local overland and groundwater flooding.<br>• The code requires considerations of;<br>  • Risk to sensitive use; to minimise the risk of injury to, or loss of human life or damage to property, in relation to sensitive uses in the event of a flood.<br>  • Development subject to flooding; to minimise the risk of injury to, or loss of human life, or damage to property or the environment, by avoiding areas subject to flooding where practicable, or mitigating the adverse impacts of inundation to an acceptable level.<br>*The urban (stormwater) flood mapping developed as a component of the stormwater system management plan has confirmed a significant portion of Launceston's urban area is subject to stormwater related flooding. These areas are not currently shown as flood risk areas on the planning scheme overlay maps but are being considered as part of development applications currently, using engineering judgment to help mitigate the flood risk associated with proposed development.*<br>*The City of Launceston are currently exploring the mechanisms to ensure appropriate development and relevant controls for lands impacted by urban flooding. This will include updates to the planning scheme as well as the development of guidelines for both developers and the community to better outline the requirements for development within the identified flood risk area.* |

| Development Control Mechanism | Existing Status and Comments |
|---|---|
| Launceston Interim Planning Scheme 2015; E8.0 Biodiversity Code | • The purpose of the biodiversity code is to support the conservation of biodiversity including the extent, condition and connectivity of important habitats and priority vegetation communities, and the number and status of threatened species and consider and manage the impact of use or development on biodiversity through minimisation of vegetation and habitat loss or degradation and appropriate location of development.<br>• The code applies to land shown as priority habitat on the planning scheme overlay maps or land identified in a flora and fauna report which identifies that the removal of native vegetation will have a significant impact on priority vegetation communities.<br>*There is ambiguous wording and a significant exemption in the Biodiversity Code that makes it open to interpretation. It is therefore difficult to apply in a way that addresses the intent of the code. The ability to apply the Biodiversity Code in places of high conservation value, such as Queechy Lake, would have significant environmental benefits. The proposed Statewide Planning Scheme will deal with these ambiguities, however until this scheme is implemented, it is recommended that internal processes around the application of the current Biodiversity Code are formalised.* |
| Launceston Interim Planning Scheme 2015; E9.0 Water Quality Code | • The purpose of the water quality code is to manage adverse impacts on wetlands and watercourses.<br>• The code applies to use or development of land within a wetland or watercourse; or located with 30 m of a wetland or watercourse; or which discharges stormwater or wastewater to land within 30 m of a watercourse or wetland.<br>• The code requires considerations of;<br>  • Development within the vicinity of watercourses or wetlands; to protect watercourses and wetlands from the effects of development and minimise the potential for water quality degradation. No acceptable solutions. Development must not unreasonably impact water quality, having regard to topography, potential for erosion, siltation and sedimentation, risk of flood, impact of the removal of vegetation on hydrology, natural values, the scale of the development and the method of works, measures to mitigate impact and proposed remediation works, soil and water management and requirements detailed in DPIPWE's Wetlands and Waterways Works Manual.<br>  • Development of watercourses and wetlands; to protect watercourses and wetlands from the effects of development and minimise water quality degradation. Acceptable solutions for this include, A1 - A wetland must not be altered, modified, filled, drained, piped or channelled; and A2 - A pipe or culvert crossing of a watercourse for access purposes.<br>  • Discharges to watercourses and wetlands; to manage discharges to watercourses and wetlands so as not unreasonably impact the water quality. Acceptable solutions for this include, A1 - All stormwater discharge must be a) connected to the public stormwater system; or b) diverted to an on-site system that contains stormwater within the site; and A2.1 No new point source pollution discharging directly into a watercourse or wetland. A2.2 for existing point source pollution discharges into a watercourse or wetland, there is no more than a 10% increase in volume or characteristics of the discharge that existed at the effective date.<br>• All variances of the acceptable solutions above require consideration of a range of requirements, to ensure that development must not unreasonably impact the water quality of watercourses or wetlands.<br>*Given the existing degraded state of many urban waterways, demonstrating the potential impact of any one development and then developing reasonable mitigation strategies, is challenging. There is no ongoing monitoring of cumulative impact on representative waterway sites.*<br>*The impact of a development on water quality is often addressed in general terms, often with no pre-development surveys of natural values and little or no monitoring of construction and post-development impact. More robust assessment, mitigation actions and compliance enforcement has the potential to substantially improve water quality in the urban area.* |

| Development Control Mechanism | Existing Status and Comments |
|---|---|
| Planning Permit Conditions - Tasmanian Subdivision Guidelines | • The City of Launceston requires that engineering designs be prepared in accordance with the Tasmanian Subdivision Guidelines (LGAT, 2013) and the LGAT-IPWEA Tasmanian Standard Drawings.<br>• The Tasmanian Subdivision Guidelines have a range of requirements for subdivision design, including;<br>  • Requirements for piped level of service in new subdivisions.<br>  • Requirement for provision of overland flow up to 100-year ARI storm, to flow overland without undue inundation of any properties.<br>  • Requirements for landscape plans for all areas within the subdivision which will become future Council maintained land; public open spaces, reserves and road reservations, including water sensitive urban design features.<br>*The Tasmanian Subdivision Guidelines are currently undergoing a review. City of Launceston are participating in this review, as well as reviewing the City of Launceston Hydraulic Guidelines referenced within the subdivision guidelines as part of this process. Requirements for Water Sensitive Urban Design features, stormwater detention basins and drainage channels must also be considered as a component of the revised hydraulic guidelines.* |
| Planning Permit Conditions - Soil and Water Management Plan | • As a planning permit condition, consideration for soil and water management is necessary. Effective soil and water management helps to reduce the impact of development on Council's assets, including the roads, footpaths and pipe network, as well as the urban waterways.<br>• Where the water quality code applies, or for larger, more complex, developments, the soil and water management control plan must be approved by council prior to commencement of works onsite.<br>*City of Launceston has been working alongside NRM North, the Environment Institute of Australia and New Zealand and Master Builders Tasmania to educate the construction industry and community on the importance of effective soil and water management. Permit conditions need to be enforced to prioritise this issue.* |
| Building Act 2016 & Building Regulations 2016 | • The Building Act 2016 has conditions applicable for construction in hazardous areas, which includes land that is prone to flooding.<br>• The Building Regulations 2016 outline land that has previously been flooded, or land that has been assessed by the council of the relevant municipal area as having a reasonable probability of flooding, is land that is –<br>  (a) subject to riverine inundation; and<br>  (b) a hazardous area for the purposes of the definition of hazardous area in section 4(1) of the Act.<br>• The Building Act requires that a person must not perform work, or intend to perform work, in a hazardous area if the person knows, or reasonably ought to know, that the work will aggravate an attribute, or risk, of the land that resulted in the land being a hazardous area.<br>• The Building Regulations requirements include - A person must not perform building work on a building on land that is subject to riverine inundation unless the floor level of each habitable room of the building being erected, re-erected or added as part of the work, is at least 300 millimetres above the defined flood level for the land.<br>*The Building Act and Building Regulations outline requirements for flooding, specifically riverine flooding. These conditions are applicable to the urban waterways, where riverine flooding is occurring. Riverine flooding is generally accepted as water that is coming out of a waterway as a result of flooding, whereas overland flow is water that is travelling towards a waterway. Consideration should be given as to how the modelling of the urban waterways can be included within the flood prone areas mapping, and consequently apply under the Building Act 2016.* |

| Development Control Mechanism | Existing Status and Comments |
|---|---|
| Australian Building Codes Board (ABCB) Standard - Construction of buildings in flood hazard areas | • Under the Building Act 2016 it is necessary for construction to be completed in accordance with the National Construction Code and any relevant plans or specifications.<br>• The ABCB Standard - Construction of buildings in flood hazard areas - outlines the requirements for construction within a defined flood hazard area.<br>• Defined flood hazard areas are those subject to flooding during the defined flood event as determined by the appropriate authority.<br>*As noted previously, to be considered a flood hazard area it must be included in the relevant mapping. Consideration should be given as to how the modelling of the urban waterways can be included within the flood prone areas mapping, and consequently apply under the Building Act 2016.* |

## 5.2 Community Resilience

The catchment response for the urban area is generally very quick, with urban stormwater flooding appearing and then retreating quickly. Traditional flood related emergency management actions, such as evacuation, require action to take place open the onset of flooding. Due to the flashy nature of urban flooding, these traditional responses are generally not appropriate for urban flooding. It is more important in the urban environment to focus on community preparedness to minimise the risk to life, potential property damage and reduce the flood recovery actions.

Flood awareness is an essential component of flood risk management for people residing in flood prone areas. The affected community must be made aware, and remain aware, of their role in the overall flood management strategy for the area. Within the urban area this can become particularly relevant as overland flow paths develop through residential and commercial development, where the presence of water could be considered unexpected by the residents. The role of education and awareness largely falls within the domain of the State Emergency Services (SES), although councils are able to provide intelligence to assist the SES and undertake our own actions where necessary.

Rapidly rising, high velocity stormwater flows in urban waterways can have substantial erosion potential. Eroded material, including large river cobbles in old alluvial plains such as Newnham Reserve, can reduce water quality, deliver large quantities of sediment downstream, and blind stormwater grates contributing to further urban flooding.

Urban (stormwater) flooding was a key topic of discussion during the resilient city theme as part of the City of Launceston's Tomorrow Together community consultation program during winter 2019. The flood mapping undertaken as part of the flood studies, including the hazard classifications, is publically available in an effort to educate and inform the community of their flood risk.

### 5.2.1 Property Modifications and Flood Proofing

Property modifications and flood proofing can significantly reduce the damage to property associated with flooding. City of Launceston encourages our property owners and residents to understand their flood risk, and where appropriate, take the necessary measures to reduce the impact of flooding.

Flood proofing involves modifying existing structures utilising flood compatible materials or temporary measures. Examples of flood proofing include:

- Modifying a building to include an automatic or manual barrier system with the aim of preventing flood water from entering up to a defined flood event.
- Structural elements at levels up to the defined flood event be protected from flood water and egress of flood water into the structure limited.

In addition to structural flood proofing measures, pre-arranged temporary measures can be used to minimise damage to property and business owners. These include:

- Stack belongings and possessions on shelving above the flood level.
- Relocate critical or dangerous building components out of flood affected areas. This could include power and communication infrastructure, stored chemicals, poisons and waste containers.

### 5.2.2 Projects to Improve Community Resilience

Table 7 documents actions for City of Launceston to undertake within the urban area to improve community preparedness for urban flooding and build community resilience.

**Table 7 - Community Resilience Projects**

| Project | Description |
|---|---|
| Online Portal | The stormwater section of the City of Launceston website was updated in Winter 2019 in line with the Tomorrow Together Resilient City program. Additional changes will be necessary to better align and consider the location of the stormwater information on the website.<br>Action - develop online portal to better educate the public. |
| Land Information Certificate (337 Certificate) Updates | A land information certificate (often called a 337 certificate) for a property is to make prospective owners of a property aware of issues that be out standing on the property. These are issued when a property changes hands. City of Launceston currently use the 337 certificate process to provide additional information to property owners within riverine flood risk areas, such as Invermay. It is proposed the 337 certificate process be expanded to include information about urban flooding for impacted properties.<br>Action - implement notifications through the 337 certificate process. |
| Flood Warning Signage | For locations that are frequently affected by flood water, and flood water poses a risk to either pedestrians or vehicles, flood warning signs will be considered. These locations could include overland flow pathways, detention basins and roadways.<br>Action - review and implement flood warning signage. |

## 5.3 Structural Interventions

Structural interventions are measures that aim to modify the behaviour of flood water with the aim of both reducing the flood damage cost to the community and reducing the risk to life.

Structural interventions can include:

- Upgrade of the existing underground drainage system, stormwater inlets or open channels;
- Construction of stormwater detention basins;
- Construction of levees, berms or bunds to direct overland flow away from property; and
- Modification of ground levels through overland flow paths to manipulate the behaviour and direction of overland flow.

Structural interventions measures may range from small upgrades to large scale, multimillion dollar projects. Although flood modification measures have a primary goal of managing flooding, as previously noted, the impact these options may have on environmental and ecological factors must also be considered.

The stormwater risk studies outline areas where there is the potential for significant flood damage to the community as well as possible risk to life. Key areas are documented within each of the risk study documents, with the top priorities across the urban area detailed in Table 8. Projects will be scoped and delivered based on available funding and other associated constraints. Throughout the project scoping and investigations stage the priority for the individual projects may change.

**Table 8 - Priority Projects / Investigations - Structural Intervention**

| Project Location | Description | Comments |
|---|---|---|
| Prospect | Two overland flow paths from south west of Trevritch Place combine on the southern side of Stanley St, before crossing Ingamells St and travelling to Westbury Rd.<br>Downstream of Westbury Rd significant flooding occurs within the Olde Tudor Shopping area, including properties on Trotters Lane.<br>Several properties, both residential and commercial, are impacted by flooding in all modelled flood events. Flooding within the IGA carpark reaches Hazard Level 3. | A two stage project is required for the Prospect area. Pipe capacity within the commercial area must be increased to build network capacity prior to any changes to the upstream area.<br>City of Launceston is currently working with an external consultant to consider options to reduce flood risk within this area in the most cost effective manner. |
| Guy St North Sub-Catchment, Kings Meadows | Two overland flow paths from the north-west and the south-west combine at a low point in Chifley St before travelling in an easterly direction through the Manor complex. Several properties are impacted by flooding in a variety of modelled flood events.<br>Flooding of Chifley St and roads within the manor complex has the potential to impact vehicle stability. | Projects in this area have been investigated previously (Pitt & Sherry, 2001), with the Kings Meadows Flood Alleviation Plan (2014) outlining a range of possible projects, without consideration for cost benefit.<br>City of Launceston is currently working with an external consultant to consider options to reduce flood risk within this area in the most cost effective manner. |
| Whitford Grove to West Tamar Road, Trevallyn | Residential development constructed over an overland flow path. Pipe system under capacity in multiple locations, including the downstream end. Several residences impacted by flooding in all modelled flood events. | The steep and rocky nature of Trevallyn make capital works in this area complex. Minor footpath and driveway alterations to a property in Osborne Ave in mid-2019 will provide some localised relief from overland flow and nuisance flooding.<br>City of Launceston is currently considering options to reduce flood risk within this area in the most cost effective manner. |
| Broadland Dr, Launceston | Overland flow from Cypress St combines with overland flow from Dowling St at a low point in commercial and industrial development in Broadland Drive, resulting in flooding in all modelled events.<br>Floodwaters pond at a low point on Broadland Dr, impacting vehicle stability from the 5% AEP flood event. | City of Launceston engaged GHD in 2018 to investigate options to reduce flooding in the Broadland Drive area. Options analysis and concept design was completed, identifying multiple options for progression. All works would require reinstatement of the pressure-gravity main through this area, which would provide some reduction in the flooding. Additional works, including installation of a pump station, would be required to reduce the flooding further. |

| Project Location | Description | Comments |
|---|---|---|
| Margaret St / York St, Launceston | Overland flow from the south and the east combines in the Margaret St / York St area, resulting in flooding of commercial and residential property in all modelled events.<br>Significant flooding of several roads. | Flooding in the Margaret St / York St area is within the combined drainage area. Historically there have been significant flooding issues in this area, but the recurrence of these reduced due to upgrades, notably Margaret St detention basin, completed 2004.<br>Projects identified under the Tamar Estuary River Health Action Plan interact with this area, and as such any projects will need to be considered once the TERHAP works are confirmed and delivered. |
| Tamar St, Launceston | Localised flooding of properties in the Tamar St, the Esplanade and Boland St area occurs in all modelled flood events.<br>Some flooding of roadways modelled along the Esplanade, William St, Tamar St and Boland St. | This area is located within the combined drainage area and has historical flooding issues. The recurrence of these reduced due to upgrades of Tamar St Pump Station, completed 2013.<br>Components of the proposed Tamar Estuary River Health Action Plan are upstream of this location, with the potential to influence the flooding in the area. City of Launceston continues to work with TasWater to understand the implications of proposed TERHAP works on flooding in this area. |
| Kings Meadows Business District (Southern) | Overland flow through the Kings Meadows CBD, on the Southern side of the Kings Meadows Rivulet outlet, impacts a significant number of properties in all modelled flood events. One of these properties is residential, with the remainder commercial.<br>Some flooding of roadways occurs in this area, with H3 floodwaters modelled in Guy St. | City of Launceston is completing upgrades to the stormwater pit capacity in Guy St in late 2019. This will reduce localised flooding of the roadway. |
| Kings Meadows Business District (Northern) | Overland flow through the Kings Meadows CBD, on the Northern side of the Kings Meadows Rivulet outlet, impacts a significant number of commercial properties in all modelled flood events.<br>Some flooding of roadways in the area, notably Riseley St and Hobart Rd. | During the development of the Kings Meadows Flood Alleviation Plan (Launceston City Council, 2014), JMG (2014) completed a modelling investigation into some identified options. One of the suggestions was the diversion of overland flow from the northern sub-catchments prior to travelling downstream into the main business district. This was not progressed further at the time. Any changes proposed to the Guy St North catchment will influence the flood behaviour in this area. |

## 5.4 Water Quality and Aquatic Habitat Specific Mitigation Measures

Several on-ground projects aimed at improving water quality and aquatic habitat are recently completed or currently underway in Launceston's urban waterways, such as the Kings Meadows Rivulet erosion works at Punchbowl Reserve (completed 2018), installation of a stormwater raingarden at the Lawrence Vale Road Bike Centre (completed 2019) and the installation of Water Sensitive Urban Design elements at Newnham Reserve to improve amenity and water quality, and reduce erosion (current 2019-20 capital project).

The Heritage Forest perimeter drain has been identified as a site with substantially impacted water quality, particularly nutrients (ammonia). Capital works to mitigate these impacts are likely to be complex and resource intensive. Future work to identify the source of contaminants, coupled with some local community engagement, may be a feasible first step towards improving water quality outcomes that is less resource intensive.

Identified priority projects include a combination of on-ground works, monitoring and policy and strategic work:

- continue to implement Water Sensitive Urban Design at Newnham Reserve;
- review Urban Open Drain Procedure, including current herbicide spray program and an assessment of alternative measures to balance hydrologic needs and amenity with water quality and aquatic habitat requirements;
- identify strategic locations for GPTs;
- intensify reinstatement of riparian vegetation along urban waterways and protect locally important wetlands (West Tamar Walking Trail, Hoblers Bridge Reserve/North Esk Trail), working with local land managers and natural resource management groups (Tamar NRM, Conservation Volunteers Australia and NRM North);
- improve water quality in Heritage Forest perimeter drain;
- quantify water quality discharge limits for new developments;
- continue involvement in RHAP and NRM North's TEER Program; and
- implement a monitoring program to assess long-term waterway health and water quality impacts/improvements (e.g. AusRivAS methodology) as discussed in Table 6.

### 5.4.1 Tamar Estuary River Health Action Plan

The Tamar Estuary Management Taskforce (TEMT) was established under the Launceston City Deal with an aim of identifying investments to improve the health of the kanamaluka/Tamar Estuary. As part of this work, TEMT was charged with delivering a River Health Action Plan (RHAP, TEMT, 2017). The focus of the RHAP is to improve water quality through the reduction of pathogens in the upper estuary (between Launceston to Legana) as the initial priority. There are two key components of this work, both of which City of Launceston has involvement in both initial project scoping and project delivery; the catchment action working group and the combined system overflow working group.

#### *Catchment Action Working Group*

The catchment action component of the RHAP is being delivered by NRM North. City of Launceston is working with NRM North to undertake a small component of these works, the Launceston sewage / stormwater intrusion project. The Launceston sewage / stormwater intrusion project involves investigation of sewage intrusions into the stormwater network within priority catchments in Launceston. Investigations are being completed in both the City of Launceston and West Tamar Council areas. The project commenced in July 2019 in Riverside and has identified one sewage intrusion to date. The project is approximately 10% complete, and will continue until the funding is exhausted. Sewage intrusions identified through the project are then followed up and rectified under the guidance of the relevant council.

#### *Combined System Overflow Working Group*

The Combined System Overflow Working Group leveraged off work already commenced by City of Launceston to build a detailed hydraulic model of the combined system. The model allowed a better understanding of how the combined network functions in various levels of rainfall event and through this greater detail became known about where the majority of overflows from the system occur.

A multi-criteria analysis and preliminary examination of possible treatments to reduce overflows led to a shortlisting of six infrastructure projects. These being the most feasible in terms of their practical delivery and expected return on investment as measured by reduction of sewage loading to the Estuary. TEMT continues to work with TasWater to progress these projects further. City of Launceston continues to provide support to TasWater to progress these works. Funding of projects within the combined system is discussed in Section 6.2.

## 5.5 Climate Change

Climate change poses a significant concern on a global scale. The Strategic Asset Management Plan (City of Launceston, 2019b) identifies climate change as a strategic challenge; a critical issue that impedes an organisation from achieving its mission. Identified issues within the Strategic Asset Management Plan include:

- Tamar Estuary and Esk rivers water levels; effect on Henry Street and West Tamar Road, the flood levees and water table in Inveresk-Invermay;
- Increased intensity of storms and effect on local flooding; more combined system overflows;
- More frequent severe weather events; and
- Development over overland flow paths and continuing to build on them.

Tasmania can expect an increase in intensity of rainfall events due to climate change combined with longer times in drought. Increased rainfall intensity on very dry soils will likely lead to an increase in runoff, increased erosion potential and an increased risk of mobilising slaking soils. Building resilience to the impacts of climate change by securing water supplies, safe conveyance of flood waters and ecological protection of waterways and wetlands is an emerging challenge as urban communities seek to minimise impact on already stressed water resources (Wong et al. 2013). *Climate Action 21: Tasmania's Climate Change Action Plan 2017–2021* (State of Tasmania, 2017) outlines actions being progressed by the State Government. Of particular relevance are actions building climate resilience; build community resilience to floods (Action 5.1) and help communities understand their exposure to natural hazards (Action 5.2).

The hydraulic modelling undertaken for the stormwater system management plans was completed using the national standard at the time of project commencement. In the time since the project commenced the updated Australian Rainfall and Runoff (AR&R) 2016 and 2019 were released. The updates to AR&R provide guidance for the incorporation of climate change within hydraulic modelling, as well as revised rainfall patterns and providing additional direction for modelling within urban areas.

A full revision of hydraulic modelling is a significant process, but any future model re-runs should incorporate the current hydraulic modelling guidelines, including provision for climate change considerations. In the short term, internal investigations will be undertaken to address incorporation of the AR&R 2019 rainfall data into the existing models and modelled outputs.

## 5.6 Stormwater Network Changes

Development and stormwater capital projects happening around Launceston result in changes to the stormwater network. These changes have the potential to alter stormwater flood behaviour, both reductions and increases in overland flow and stormwater flooding. Significant capital projects, such as the Glen Dhu

pipeline have been designed and modelled to reduce flooding, however the modelling has not been updated to reflect these changes. Subdivisions and development that has been completed since the modelling was commenced, are currently under construction, or will be built in the near future, also change flow characteristics within the catchment due to the presence of new stormwater networks, new structures, shaping of land and increased impervious areas. It is not appropriate to accommodate every change in updated models due to the significant workload associated with model updates, re-runs and mapping. This being considered, a procedure needs to be developed to enable accommodation of major system changes to ensure appropriate consideration is given to both land-use planning and development of structural interventions.

# 6. Resourcing Considerations

Financial support for stormwater projects is currently sourced from the council budget, with operational and capital components. The Long Term Financial Plan (City of Launceston, 2019a) outlines current and future funding considerations, with the Strategic Asset Management Plan (City of Launceston, 2019b) setting out the proposed 10 year capital works program, adopted as a principle input to the Long Term Financial Plan, noting that individual capital projects continue to be assessed for approval annually during Council's capital budgeting process.

Within the SAMP, allocations included for budget considerations are split into three components;

- Asset renewals; stormwater main renewal, pump station renewal, hydraulic modelling and renewal components of upgrade projects,
- Asset upgrades; Prospect flooding minimisation project, and
- New assets; pump stations and other projects and initiatives.

Any upgrade or construction of new assets needs to be carefully considered due to the long term financial implication associated with this capital expenditure. Council must ensure we are acting in a sustainable manner for future generations. We have undertaken the risk studies to better inform future development so that mistakes of the past are not repeated and that if expenditure does occur, it is undertaken in a strategic / prioritised manner. Budget is not currently identified for stormwater system upgrades or new assets, funding opportunities will need to be explored.

City of Launceston historically has had some success with obtaining joint project funding for stormwater related projects. Some examples of this include the implementation of projects associated with the Kings Meadows flood alleviation plan, partially funded by a Tasmanian Government grant, as well as the works being undertaken as part of the Tamar Estuary River Health Action Plan, a local, state and federally funded project. The City of Launceston will continue to investigate future options to supplement stormwater project funding.

## 6.1 Levels of Service

As detailed in the long term financial plan and the strategic and drainage asset management plans (City of Launceston, 2019a, 2019b, 2015), a significant component of asset management, and council business as a whole is the provision of services. As such, it is necessary to consider levels of service. Levels of service are usually defined in two terms;

- Community levels of service - these measure how the community receives the service and whether the organisation is providing community value. Community levels of service can be considered subjective.
- Technical levels of service - these are related to constraints such as standards, regulations and guidelines, and are linked to annual budgets covering operations, maintenance, renewal and upgrades.

Councils face community expectations to maintain and increase existing service levels, while keeping rate rises to a minimum. In addition to this, challenges associated with climate change, including increasing rainfall intensity and sea level rise, as well as incremental development within the urban area pose a range of challenges associated with pipe capacity. The current levels of service are documented within the drainage asset management plan and associated documents, however as outlined in the strategic asset management plan, and the long-term financial plan, City of Launceston is commencing an ongoing review into service levels. This will require ongoing analysis and modelling to support community engagement and decision making processes with regard to any proposed change in service levels.

## 6.2 Combined Stormwater and Sewage Drainage System

Of significant concern, as mentioned in previous sections, is the ongoing responsibility for the stormwater service and the combined stormwater and sewage drainage area of Launceston. City of Launceston has legal responsibility for the stormwater service in the combined stormwater and sewage drainage area of Launceston, however TasWater owns and operates the assets. City of Launceston pays an arbitrated annual fee to TasWater for operating the 'stormwater system' but the fee does not include provision for renewal or extension of the infrastructure (City of Launceston & TasWater, 2016). City of Launceston also, as part of the arbitration, must pay its share of the stormwater component of capital renewals in the combined sewer and stormwater system. The existing service agreement between City of Launceston and TasWater is due to expire in 2020, and arrangements for a new service agreement need to be confirmed.

Some of the proposed projects under the Tamar Estuary River Health Action Plan while greatly improving river water quality and health, will significantly add to the Combined Drainage System's asset base, hence future depreciation, operation and renewal costs. Any additional capital costs to the City of Launceston as a result of the Tamar Estuary River Health Action Plan projects have not been finalised. Initial discussions suggest a significant financial contribution will be requested from the City of Launceston to enable project delivery.

More work by both the City of Launceston and TasWater is needed to better understand future capital renewal programs and commitments for their respective strategic asset management plans and long term financial plans. Assumptions have been made within the current long-term financial plan as to the combined system contribution, with a significant increase in capital contribution expected.

# 7. Strategy for Implementation and Action Plan

A range of individual projects and actions have been outlined throughout the Stormwater System Management Plan. The responsibility for implementation of these actions will be distributed across various City of Launceston networks, and have a range of different priorities. Table 9 summarises the actions, and notes the overall area responsible for implementation and assigns priorities to each component. Implementation of these actions must take into consideration funding availability, practicality and changing community issues.

**Table 9 - Action Plan**

| Action | Document Reference | Responsibility | Priority<br>High - within one year<br>Medium - one to four years<br>Low - four years plus | Resourcing Considerations |
|---|---|---|---|---|
| Formalise dam safety inspection for stormwater detention basins. | Section 3.1 - Operational | City of Launceston - Infrastructure and Asset Network | High | Officer Time |
| Review urban open drain procedure, including categories, associated levels of service and to balance competing requirements. | Section 3.1 - Operational | City of Launceston - Infrastructure and Asset Network | High | Officer Time |
| Review *"Discharge of Stormwater - Acceptable Solutions" high level procedure* for assessing capacity of the stormwater system to accommodate increased discharge from proposed subdivisions. | Section 5.1 - Development Controls | City of Launceston - Infrastructure and Asset Network | Medium | Officer Time |
| Participate in the review of the Tasmanian Subdivision Guidelines. | Section 5.1 - Development Controls | City of Launceston - Infrastructure and Asset Network, other Councils, LGAT and IPWEA | Medium | Officer Time |
| Develop City of Launceston hydraulic guidelines. | Section 5.1 - Development Controls | City of Launceston - Infrastructure and Asset Network | Medium | Officer Time |
| Incorporate stormwater flood overlays within the planning scheme and develop Council policy to guide development. | Section 5.1 - Development Controls | City of Launceston - Community and Place Network | Medium | Officer Time |
| Quantify water quality discharge limits for new developments. | Section 5.1 - Development Controls | City of Launceston - Infrastructure and Asset Network | High | Officer Time |
| Consider resourcing to enable enforcement of permit conditions for soil and water management. | Section 5.1 - Development Controls | City of Launceston - Community and Place Network | Ongoing | Officer Time |
| Formalise internal processes around application of the E8 Biodiversity code. | Section 5.1 - Development Controls | City of Launceston - Infrastructure and Asset Network/Community and Place Network | High | Officer time |

| Action | Document Reference | Responsibility | Priority<br>High - within one year<br>Medium - one to four years<br>Low - four years plus | Resourcing Considerations |
|---|---|---|---|---|
| Review and Update Flood Warning Signage. | Section 5.2 - Community Resilience | City of Launceston - Infrastructure and Asset Network | High | Officer Time, Operational Funds |
| Development of Online Portal. | Section 5.2 - Community Resilience | City of Launceston - Community and Place Network | High | Officer Time |
| Update Land Information Certificate (337 Certificate) Process. | Section 5.2 - Community Resilience | City of Launceston - Organisational Services Network | High | Officer Time |
| Structural Project / Investigation 1 - Prospect. | Section 5.3 - Structural Interventions | City of Launceston - Infrastructure and Asset Network | High | 2019/2020 - Committed capital budget for design |
| Structural Project / Investigation 2 - Guy St North Sub-catchment, Kings Meadows. | Section 5.3 - Structural Interventions | City of Launceston - Infrastructure and Asset Network | Medium | 2019/2020 - Operational funds for concept design<br>Future capital bids |
| Structural Project / Investigation 3 - Whitford Grove to West Tamar Rd, Trevallyn. | Section 5.3 - Structural Interventions | City of Launceston - Infrastructure and Asset Network | Low | 2019/2020 - Operational funds for detailed investigation |
| Structural Project / Investigation 4 - Broadland Drive | Section 5.3 - Structural Interventions | City of Launceston - Infrastructure and Asset Network | Low | Concept design complete<br>Future capital bids |
| Continue to implement water sensitive urban design at Newnham Reserve | Section 5.4 - Water Quality and Aquatic Habitat Specific Mitigation Measures | City of Launceston - Infrastructure and Asset Network | Medium | 2019/2020 - Capital and Operational funds for small component.<br>Future capital bids |
| Intensify reinstatement of riparian vegetation along urban waterways and protect locally important wetlands | Section 5.4 - Water Quality and Aquatic Habitat Specific Mitigation Measures | City of Launceston - Infrastructure and Asset Network | High | Officer Time<br>Operational funds |

| Action | Document Reference | Responsibility | Priority<br>High - within one year<br>Medium - one to four years<br>Low - four years plus | Resourcing Considerations |
|---|---|---|---|---|
| Investigate options to improve water quality in Heritage Forest perimeter drain | Section 5.4 - Water Quality and Aquatic Habitat Specific Mitigation Measures | City of Launceston - Infrastructure and Asset Network | Medium | Officer Time<br>Operational funds<br>Future capital bids |
| Identify strategic locations for gross pollutant traps | Section 5.4 - Water Quality and Aquatic Habitat Specific Mitigation Measures | City of Launceston - Infrastructure and Asset Network | Medium | Officer Time |
| Implement monitoring program to assess long-term waterway health and water quality impacts/improvements (e.g. AusRivas methodology) | Section 5.4 - Water Quality and Aquatic Habitat Specific Mitigation Measures | City of Launceston - Infrastructure and Asset Network | High | Officer Time<br>Operational funds |
| Continue Involvement in Tamar Estuary River Health Action Plan projects and TEER Program. | Section 5.4 - Water Quality and Aquatic Habitat Specific Mitigation Measures | City of Launceston - Infrastructure and Asset Network | Ongoing | Officer Time<br>Council funding (TBC) |
| Re-run model with AR&R2019 storm events. | Section 5.5 - Climate Change | City of Launceston - Infrastructure and Asset Network | Medium | Officer Time |
| Develop procedure for model updates and re-runs due to capital projects and development. | Section 5.6 - Stormwater Network Changes | City of Launceston - Infrastructure and Asset Network | High | Officer Time |
| Continue to investigate future options to supplement stormwater project funding. | Section 6 - Resourcing Considerations | City of Launceston - Organisational Services Network | Medium | Officer Time |

# 8. Review of the Stormwater System Management Plan

This initial Stormwater System Management Plan is the first iteration of such a document. The SSMP has been prepared based on the relevant documentation at the time of writing, and the urban stormwater modelling completed in 2018 for this project. The planned review cycle for the Stormwater System Management Plan is four years.

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