Stormwater

Community Assets – At the Core of Your Neighbourhood

Willoughby City Council
20 Year Asset Management Plans

2013/2014

WILLOUGHBY CITY COUNCIL

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1. Executive Summary

This Asset Management Plan is to be read in conjunction with Council's Asset Management Policy & Strategy.

1.1. What does council provide?

Council is responsible for the stormwater drainage network within the Willoughby LGA, with the primary objective of facilitating the drainage of stormwater and where necessary, mitigate local flooding. More recently, Council has extended its responsibility to managing the re-use of stormwater.

There is approximately 165 km of stormwater conduits and 5037 stormwater pit types of varying configuration under Council's care and control, the combined replacement value of which is estimated to be $113M. In addition, as part of the total drainage network, there are also 9 Gross Pollutant Traps and 4 stormwater detention basins in the council area with an estimated total replacement value of $7M.

1.2. What does it cost?

There are several funding sources allocated for maintenance and renewal of stormwater assets, with a value of $2.83M for the 2013/2014 financial year. Unlike other asset classes, funding for stormwater assets is not constant over the financial modelling period of 20 years. This is because part of the funding for the first two years have been sourced from interest-free subsidised loans from the State Government.

Modelling of financial forecasts indicate that current expenditure translates to a life cycle expenditure of $1.7M p.a. on average for the next 20 years. When compared to the lifecycle cost of $3.9M p.a., there is an apparent funding gap of approximately $2.2M p.a. The accuracy of these forecasts will continue to be monitored and is expected to improve as updated data and assumptions are refined.

1.3. How do we measure performance?

Currently Council's performance in the management of stormwater network is measured primarily from the network condition. Defects found or reported that do not meet Council's acceptable service standards is investigated and treated after prioritisation and subject to the availability of funds.

Since stormwater conduits are largely located underground, inspection is not possible without special equipment. In 2005, Council began a CCTV inspection program of these conduits. As of July 2013, 60% of underground conduits have been inspected. This information has enabled Council to plan for future works according to needs.

Council's intent is to maintain the stormwater drainage network in partnership with other stakeholders, such as neighbouring councils and the Roads and Maritime Services to provide a low-risk exposure and functional stormwater drainage network that minimises the severity and frequency of flooding.

1.4. What are the risks?

Risk management forms the basis of the prioritisation method for stormwater renewal and maintenance works. During the 2011/2012 financial year, Council refined the prioritisation process for stormwater assets by incorporating more factors in the risk rating process. Some of these include the size and type of material of the conduits, the location, loading impacts, impact on land use and the properties that would be affected should failure occur. This risk analysis has been applied only on stormwater works that are already at or beyond the set intervention level. The result of the risk analysis is then used to determine Council's future capital works program.

Generally, maintenance and renewal works are prioritised and undertaken to minimise the risk of injury and property damage thereby minimising Council's risk exposure.

1.5. Community consultation

Community consultation specifically relating to asset management of footpaths and other asset classes was completed in 2013 as part of Council's community engagement strategy. Council also has a broad understanding of community expectations in the context of footpaths due to the regular direct contact between community members and Council.

Consultation has resulted in a change in the way stormwater defects are assessed. This followed the results of the public consultation survey in which one type of defect was deemed as more severe than Council's rating, and another type less severe. Apart from this change in rating, target levels of service assumed by Council staff initially have remained unchanged following the consultation process. In general the community's expectations about asset condition generally align with that of Council's.

1.6. What does the future hold?

Funding for stormwater works was increased by $2M over three financial years, from 2012/2013 to 2014/2015, due to the Loan Infrastructure Renewal Scheme offered by the State Government. This was essentially an interest-subsidised loan to address existing backlog on drainage infrastructure assets. This has enabled Council to carry out more works than it would otherwise have been able to. However, the financial modelling shows that there is still a funding gap for this asset class. Council will continue inspecting the remainder of the conduits to achieve better accuracy, as the current analysis involved extrapolating results from those conduits that have been inspected.

2. Introduction

This Asset Management Plan (henceforth referred to as the *Plan*) forms part of Council's Resourcing Strategy under the NSW Integrated Planning and Reporting Framework. It is to be read in conjunction with Council's Asset Management Policy and Improvement Strategy (AMIS), to which frequent reference is made to avoid repetition within the Plan. The AMIS should be consulted for relationships between this Plan and other documents in the Integrated Planning & Reporting Framework.

2.1. Background

The purpose of this Plan is to demonstrate the sustainable provision and maintenance of all of the assets covered in the Plan and the services that rely on those assets. This Plan is a working document that spells out in detail the current state of assets, future plans for their management, associated costs and performance targets. It is designed so that it may be consulted by Council staff and members of the community alike.

Willoughby City Council is responsible for the provision and maintenance of 165km of conduits in the stormwater network, 5037 stormwater pits, 9 Gross Pollutant Traps and 4 detention basins. The assets covered by this Plan are summarised in Table 2.1.

Table 2.1 Assets covered by this plan

Asset category	Dimensions/quantity	Replacement value ($millions)
Stormwater conduits	165 km	$ 92.4 M*
Stormwater pits	5037 units	$ 19.6 M**
Gross Pollutant Traps	9	$ 0.8 M***
Detention basins	4	$ 6 M****
TOTAL		**$ 119 M**

* The replacement value of $92.4 M of the stormwater conduits only includes 130km of "constructed" conduits such as pipes, open channels or rock lined creeks. The remaining 35km consists of natural creeks and overland flow paths.

** The quantity and value of the stormwater pits above includes only constructed pit types, and excludes stormwater inlets and outlets which have no physical structures.

*** Based on annual CPI rate of 3% applied to the original construction costs.

**** Estimated only.

Note that the total replacement value of $119M differs from the stormwater assets' value in Council's annual report for the 2012/2013 financial year, which does not include the detention basins.

2.1.1. Stormwater Conduits

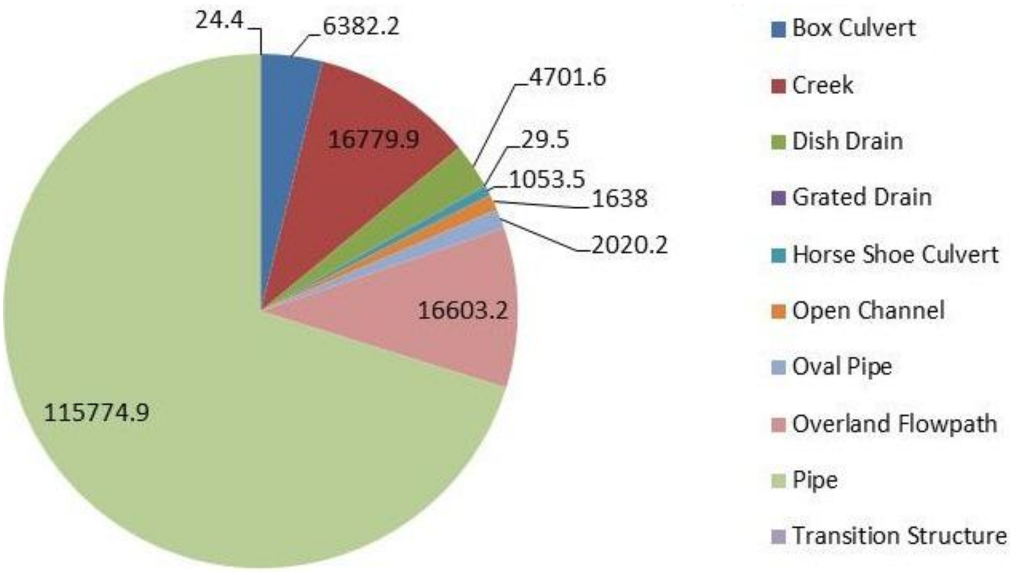

Figure 2.1 Stormwater conduits by length (km)

As shown in Figure 2.1, approximately 70% of stormwater conduits consists of pipes. These conduits which are used to convey stormwater flows can vary in cross sectional dimension and shape (see section 10 - Appendix A – Types of Stormwater Conduits).

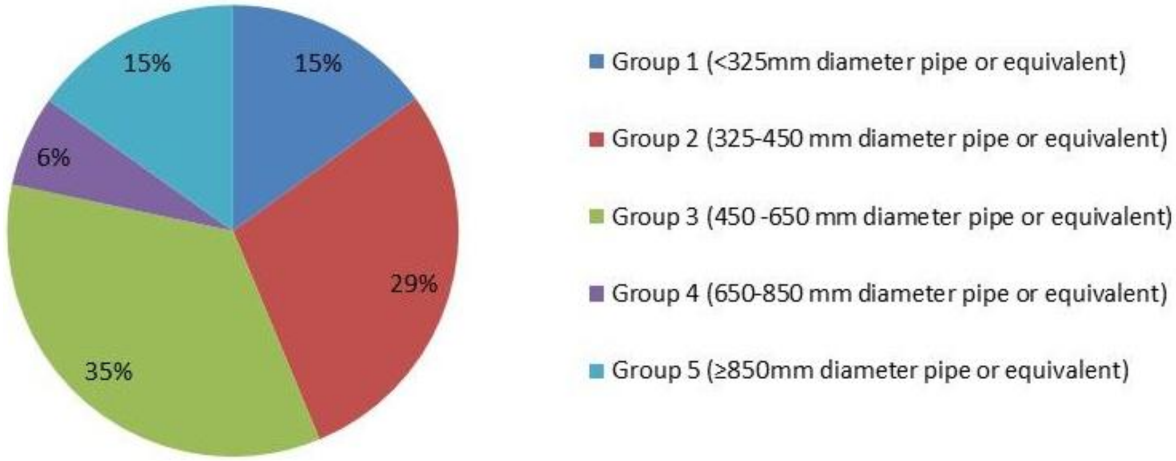

Figure 2.2 Distribution of conduit length by pipe diameter or equivalent

The distribution of conduit length by the equivalent pipe diameter is shown in Figure 2.2. Of the pipes, over 90% are concrete with other materials such as vitreous clay and mixed combinations of materials making the remainder. While new concrete pipes can have estimated lives of up to 100 years, older concrete pipes may not last this long due to inconsistently applied standards, manufacturing techniques or installation methods. Environmental conditions, such as proximity to salt water, may also affect durability.

Natural conduits such as creeks and overland flow paths also make up a large proportion of this asset class. Constructed pipelines usually direct water into these natural areas which then convey flows to the harbours. Creeks and overland flow paths are sometimes armoured to prevent bank erosion. No valuation of creeks and overland flowpaths has been carried out nor is it required for Council's financial statements.

The sizes of pipes vary greatly depending on their location in the stormwater catchments and their size. Generally in the upper reaches of the catchment the conduit sizes are smaller, typically no less than 375mm while the conduit sizes increase in the lower reaches. New pipes installed are generally rubber ring jointed concrete pipes with diameters of no less than 375mm to minimise the risk of blockages and to facilitate cleaning. Where possible, new pipelines are designed to meet the capacity requirements of 1 in 20 average recurrence interval rainfalls, or 5% probability storm.

2.1.2. Stormwater Pits

Stormwater pits are generally installed to facilitate access and cleaning purposes of the stormwater conduits, to compensate for topographical characteristics when installing pipelines, to allow stormwater to enter the conduits, or to enable a new line to be connected to existing conduits. Pits are generally rectangular chambers constructed in-ground with a lid, lintel and or grate on the adjoining gutter.

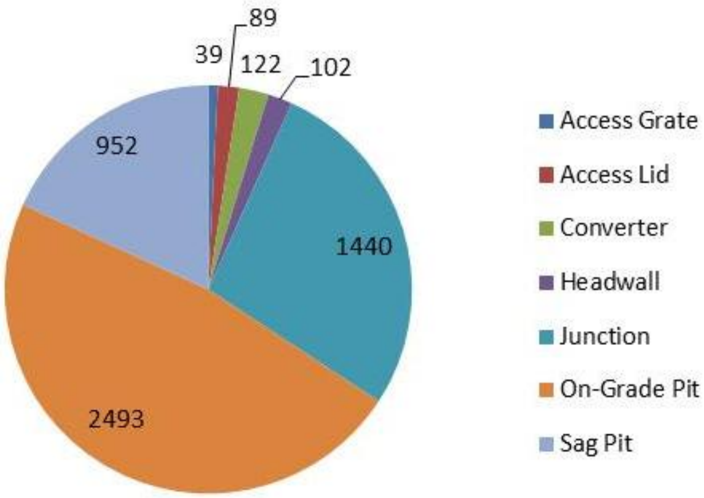

Figure 2.3 Stormwater Pits quantity

As can be seen in Figure 2.3, over 90% of the stormwater pit assets consist of constructed stormwater pits or chambers, the remainder are access lids, and headwalls. These pit chambers can vary in dimensions and are generally 900mmx900mm in dimension and from 1m-1.5m deep. The depth of the pits will depend on the pipeline it is connected to and the topography of the land, with some pits being up to 5m deep.

Council’s stormwater pits typically have a concrete base. The walls are constructed from either brick (approximately 70%) or concrete (approximately 30%) and the type of lid or entry point for storm water can vary depending on the location. The majority of stormwater pit lids are concrete with more fibreglass lids being retrofitted in recent years due to OH&S requirements. Pits with grates (approximately 50% of all pits) usually have bicycle friendly grates installed. However, there are still some pits that will need to be upgraded in the future. Approximately 80% of all pits have lintels installed on them to capture gutter flows. Generally new pits are constructed from concrete either cast in situ or are precast units. Grates, where required, will be bicycle friendly and provide easy access for maintenance crews. New lintels are generally precast . Pictures of pit types can been seen in section 11 - Appendix B – Types of Stormwater Pits.

2.1.3. Gross Pollutant Traps

Gross pollutant traps (GPT) are installed to improve stormwater quality by capturing gross pollutants that are present in stormwater flows. There are various types of structures and devices to undertake this task and they each work on differing principals. GPT are generally most effective during the “first flush” of stormwater through the stormwater network during the start of rainfall. This first flush of stormwater tends to carry large pollutants such as drink bottles, vegetation, plastic and other debris with it. Cleaning of the GPT generally takes place after heavy rainfalls to remove captured debris. More information is provided in section 12 - Appendix C – Types and Location of Gross Pollutant Traps.

2.1.4. On-site Detention Basins

Council currently has four detention basins installed to minimise the risk of flooding of downstream properties. These detention basins are located in:

- Artarmon Oval
- Chatswood Oval
- Talus Reserve, Naremburn
- Ferguson Lane, Chatswood

Typically detention basins are constructed by bulk earthworks creating a basin or ponding area that captures water during very large storms, such as a 1 in 100 average recurrence interval storm, then slowly releasing water back into the stormwater network after the peak of the storm has passed. The system at Ferguson Lane, however, is a 5000m^3 tank which has been constructed to act as a detention basin adjacent to The Concourse development for the 20 Ha catchment upstream at a cost of approximately $7 million dollars to reduce the severity of flooding within the Chatswood CBD.

With the exception of Ferguson Lane, the construction of these detention basins was carried out many years ago and hence it is difficult to determine accurately an exact replacement cost for each one. The majority of the cost to construct these above ground basins is generally contained within the bulk earthwork costs. In today’s dollars each detention basin may cost approximately $300,000 each depending on the specific project. The exception is the Ferguson Lane underground stormwater detention tank constructed for a cost of approximately $7M due to the scale of the project and the many physical constraints associated with bulk excavation and construction in an urban environment.

Apart from the areas above which have been designated as a stormwater detention basins, there are also other areas which have not been specifically designed to attenuate overland flow, but their topographies are such that they may cater for some water detention capacity.

There are other assets related to stormwater drainage that is not included in this plan. For example, kerb and gutter assets convey the stormwater run-off from road pavement to the stormwater system, however it is treated as a separate asset class. Table 2.2 lays out responsibilities for those assets not covered by this Plan.

Table 2.2 Assets NOT covered by this plan.

Asset category	Plan covering asset category	Division/branch responsible
Kerb and gutter	Kerb and Gutter Asset Management Plan	Engineering

Key stakeholders in the preparation and implementation of this plan and their respective roles are listed in Table 2.3.

Table 2.3 Key stakeholders and roles relating to asset management planning

Stakeholder	Role
Asset Management Controller	Coordinates preparation of plan, ensures links are retained between relevant asset management planning documents, assists with information flows into and from this Plan.
Infrastructure Services Director	Approval of capital programs, maintenance and inspection schedules and risk management.

Stakeholder	Role
Engineering Assets Group	Preparation of Plan, data collection and updating, long term planning and prioritisation of works.
Engineering Works Services Group	Construction and maintenance of assets.
Engineering Projects Group	Designs and consultation.
Financial Services Branch	Receipt of fair value valuations at end of financial year, provision of budgets from the long term financial plan, receipt of projections relating to expenditure gaps.
Progress associations, community	Determination of service level targets, feedback about new/upgraded assets
Councillors	Financial and planning decisions, community representation
Insurers and risk management staff	Risk management

2.2. Goals and objectives of asset management

The overarching principle, goals and objectives of asset management are those described in the AMIS and are not repeated here. Council's community strategic plan – the Willoughby City Strategy – identifies a number of outcomes in order to achieve the overall vision for the community, and any of the strategies for achieving these outcomes rely on asset management strategies. The outcomes as they relate to the assets covered in this Plan are listed in Table 2.4 along with the strategies for achieving those outcomes.

Table 2.4 Outcomes and Strategies from the Willoughby City Strategy as they relate to a

Outcome as listed in the Willoughby City Strategy	Strategies within this Plan that will assist in achieving the outcome
2.1.3 Reduce pollution	Use of Gross Pollutant Traps to reduce pollution in Willoughby's natural ecosystems. Explore alternatives to recycle stormwater use where possible, for example the on-site detention tanks at The Concourse.
4.1.1 Planning, maintenance and operation of infrastructure	Consider the whole of life costs for all existing and proposed stormwater projects. Assess the type, quantity, quality and capacity of infrastructure assets in line with projected demographic changes, climate variations and community needs. Carries out flood and floodplain risk management study as part of flood mitigation and management programs.

This Plan contains the works programs, maintenance and inspection regimes and actions for improvement that should be followed to ensure the outcomes in the Willoughby City Strategy, as they relate specifically to the assets covered by the Plan, are achieved.

2.3. Plan framework

This Plan contains the following information that will enable Council to achieve sound strategic management of its vast asset stock:

- Current and target levels of service provision and strategies to address gaps (Section 3)
- The impacts of current and future demand on the delivery of services and strategies to address them (Section 4)

- Activities associated with managing Council's assets throughout their life cycles (Section 5)
- A summary of the funds required to provide services and meet targets (Section 6)
- A summary of current business processes and asset management practices (Section 7)
- Actions to ensure improved management of the assets covered by this Plan (Section 8)

2.4. Core and advanced asset management

The difference between core and advanced asset management is explained in the AMIS.

This Plan has been prepared using an advanced, or bottom-up, approach. Data is available concerning the dimensions, and value of all assets covered by this Plan. Approximately 60% of assets in this class have been inspected and condition assessed to date, and this quantity will increase over time. As a comparison, two years ago this data was available for only 52% of assets. Sampling and extrapolation have been used to estimate the condition of the remainder of the assets where information is not yet known. This data has formed the basis for all planning and financial projections. Data concerning the performance of Council's assets will improve assumptions relating to financial projections, but these data are not currently available. This Plan will therefore become more advanced each time it is revised.

3. Levels of Service

The level to which services are provided by Council, termed *levels of service*, is an important factor in asset management planning. Council needs to know the type of assets required to deliver certain services, how many of them are needed, where they should be located, the quality that is expected from them, the level of maintenance required and the level of risk that might be considered acceptable. There are financial implications for all of these decisions.

The AMIS provides all necessary detail about Council's approach to determining target levels of service. Only information relating specifically to the assets covered by this Plan can be found in this Section.

3.1. Legislative requirements

While most levels of service are set in consultation with the community, the provision of certain services and assets must take place according to existing legislation. The legislative requirements that relate to this Plan are listed in Table 3.1

Table 3.1 Legislative requirements impacting on management of assets covered by this Plan

Legislation	Impact on management of assets
NSW Local Government Act 1993	Sets out role, purpose, responsibilities and powers of local governments including the preparation of a long term financial plan and resourcing strategy in conjunction with asset management plans for sustainable service delivery.
Roads Act 1993	Sets out the role and responsibilities of road authorities and the rights of members of the public who use public roads.
Road Transport (General) Act 2005	Provides for the administration and enforcement as well as review of the road transport legislation, ultimately aiming to improve road safety and transport efficiency.
Road Transport (Safety and Traffic Management) Act 1999	Provides for a system of safety and traffic management, ultimately aiming to improve safety and efficiency of transport on roads and road related areas, and the efficiency of road transport administration.
Disability Services Act 1993	Sets out principles to be applied with respect to persons with disabilities and objectives for service providers and researches, and provides for funding of appropriate disability services and research and development activities.
Disability Discrimination Act 1992 Disability Discrimination and Other Human Rights Legislation Amendment 2009	Sets out responsibilities to ensure persons with disabilities have the same rights and access to the provision of goods, facilities and services.
Occupational Health and Safety Act 2000	Sets out responsibilities to secure the health, safety and welfare of persons at work.
Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000	Sets out the responsibilities for environmental planning between the different levels of government in the state in managing, developing and conserving resources to promote social and economic welfare of the community and a better environment.

3.2. Customer research and expectations

Council has undertaken a comprehensive community engagement program to determine the community's level of satisfaction with, and expectations for, Council's assets. The results of a detailed survey in 2013 indicated that levels of satisfaction with each major asset class were overwhelmingly high. These are summarised in Figure 3.1.

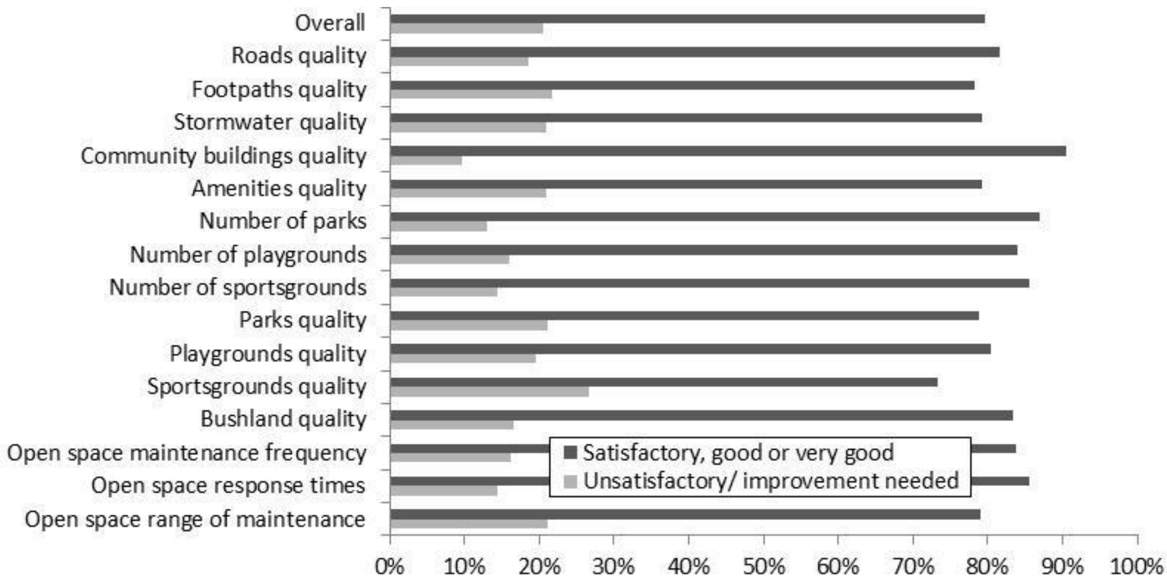

Figure 3.1 Levels of satisfaction with Council's assets (100+ surveys completed in 2013)

Expectations for assets were determined through comments from the same detailed survey as well as an online forum with high participation and consultation with a panel of 40 community members who had the opportunity to become well informed about Council's assets and asset management processes.

Results from the community engagement program show that there is an approximately 80% satisfaction rate in the quality of stormwater drainage assets in the Council's area, which is similar to the average for all Council's assets.

3.3. Target levels of service

Based on the results of community engagement throughout 2013, target levels of service have been adopted by Council for assets covered by this Plan. These targets relate to the physical condition and appearance of assets, and drive renewal or rehabilitation programs. More detailed findings have resulted in a change of condition assessment method. This followed the results of the public consultation survey in which one type of defect was deemed as more severe than Council's rating, and another type less severe. This change is now reflected in all forecasts and projections

Figure 3.2 Target levels of service for assets covered by this Plan.

Asset type, category or hierarchy	Target level of service
Stormwater conduits	Intervention is triggered when stormwater conduits have degraded to Condition 4 or worse, subject to prioritisation of works.
Stormwater pits	Intervention is triggered when stormwater pits have degraded to Condition 4 or worse, subject to prioritisation of works.

Levels of service also need to be identified for factors other than physical condition and appearance. For the assets covered by this Plan, measures of service delivery that have not yet been developed but which are relevant include:

- Quantity & location
- Capacity
- Functionality
- Responsiveness
- Legislative compliance

These factors are already taken into account informally in everyday management, but have not been formally documented or measured. In broad terms the targets for these measures of service delivery are described and compared to current performance in Table 3.2 Target and current level of service in the next section.

3.4. Current levels of service

Target level of service which has been formally documented and applied in Council's operation is to intervene when a footpath segment reaches condition 2 or worse. Currently there are existing segments of footpaths that are at or beyond this intervention level. However, at current funding, the target level of service of condition of not having any footpath segments beyond condition 2 should be achieved by the end of the 20 year financial modelling period.

Other measures of level of service have not yet been developed, but the table below describes these measures in general sense with a target level and compare them to the current performance.

Table 3.2 Target and current level of service

Service Criteria	Level of Service	Measurement Scale	Technical Performance Target	Current Performance
Quality	Physical condition	0-5 rating scale based on the severity of defects	Minimise number of stormwater assets in Condition 4 or worse within the next 20 years.	30% of stormwater conduits are at Condition 4 or worse.
	Cleanliness	% of pipeline cross section blocked & reduced pit inlet capacity.	No conduit or pit capacity is to be reduced by more than 50%.	Of the inspected pipelines this target is being achieved. There are deficiencies in available resources to inspect the large quantity of pits Council has in operation each year. Pit cleaning is focused at known problem locations.
	Aesthetic condition	Repairs are currently undertaken based on physical condition and risk. Aesthetic condition is not a factor in prioritising stormwater works	N/A	N/A
Quantity	Sufficient numbers of pipes and pits.	Y/N	Y	Number of CSR's relating to local flooding issues are low indicating that the current level of service is acceptable.
Capacity	Adequate capacity to minimise the risk of flood damage.	Assessment through the flood risk management plan.	Minimise the risk of flood damage to properties and personal injury.	To be determined in future risk management plan processes.

Service Criteria	Level of Service	Measurement Scale	Technical Performance Target	Current Performance
Functionality	Fitness for purpose	Stormwater asset is appropriate for the location.	Stormwater asset is appropriate for the location.	All new assets are installed to contemporary standards and guidelines. There may be some older assets that require upgrading to meet current standards.
Responsiveness	Inspect, make-safe or repair	Response times and number of insurance claims received by Council	High-risk safety issues* attended to within 24 hours. Other stormwater issues to be inspected within 2 weeks, and if appropriate works will be prioritised within allocated budgets. No insurance claims received by Council	Number of claims received by Council is over the last few years is to be reviewed.
Legislative compliance	Compliant	Y, N or N/A	Y	Any new stormwater assets constructed are based on relevant standards and hence are compliant. Some existing assets, due to site constraints and standards at the time of construction may not meet all legislative requirements.

*High risk safety issues refers to issues that Council is made aware of that may cause property damage or personal injury during flooding, or as a result of catastrophic damage to assets.

4. Future demand

This section assesses current and likely future demand, and presents demand management strategies to ensure that the needs of the community continue to be met.

4.1. Demand forecast

Factors affecting demand include population change, changes in demographics, seasonal factors, consumer preferences and expectations, economic factors, environmental awareness, changing land use, etc.

The NSW Department of Planning, through the NSW State Plan, the Sydney Metropolitan Strategy, and the Inner North Subregional Strategy, has identified requirements for Willoughby Council to provide for increased population and employment capacity. The Inner North Subregional Strategy in particular has identified Chatswood as a major shopping and business centre. This may require zoning changes in Council's Local Environmental Plan (LEP). The population is forecast to increase to approximately 78,000 between 2010 and 2031, which equates to a total increase of 13.40%[1]. Employment is expected to increase by approximately 16,000 during the same period.

The table below shows in more details the projected population growth and the impacts on service delivery in the future.

Table 4.1 Population Growth and Impact on Services

Demand factor	2010	2030	% change
Population			
0 to 4 years	4,878	5,055	+3.6
5 to 11 years	5,519	6,010	+8.9
12 to 17 years	4,294	4,857	+13.1
18 to 24 years	6,330	7,249	+14.5
25 to 34 years	11,206	12,109	+8.1
35 to 4 9 years	16,467	17,252	+4.8
50 to 59 years	8,248	9,517	+15.4
60 to 69 years	5,773	7,195	+24.6
70 to 84 years	4,954	7,404	+49.5
85 and over years	1,462	1,532	+4.8
Total Population	**69,133**	**78,181**	**+13.1**

Increasing population indicates that there will be requirements for more housing into the future, which may impact on the increase of impervious area in the future. Existing Council policies on stormwater re-use and on-site detention basin should offset the increased runoff and demands on the stormwater network. More details on this can be found in the next section.

[1] Willoughby City Council Population Forecasts (http://forecast2.id.com.au/Default.aspx?id=234&pg=5000)

4.2. Demand management plan

Increasing population and urban development generally result in an increase in impervious area. As a result, less rain water will percolate into the ground and more will become stormwater runoff and make its way overland into Council's stormwater network. To help counteract this, Council has over the past decade implemented various policies designed to minimise the impact on its stormwater network. One of the first policies adopted was the stormwater on-site detention policy, where stormwater runoff from impervious areas is directed into a water storage facility within the property and slowly released out to the Council stormwater network generally at a flow rate that has been calculated to be compatible with the capacity of the existing Council stormwater network. In theory, as more on-site detention systems are installed around the city, the notional capacity of Council's stormwater network should also increase. A more recent policy is the adoption of rainwater tanks within new developments, sometimes in combination with on-site detention tanks. Rainwater tanks serve the dual purpose of encouraging stormwater re-use and acting as a type of detention tank.

The best way for Council to manage future demands and overland flooding is a multi level approach. The first is to encourage on-site detention systems and rainwater tanks to reduce the impact of overland flows on the stormwater system. The second is to encourage more soft landscaping areas within properties. The third is through a floodplain risk management process to determine ways to manage the risk of flooding. Additionally strategies such as large scale stormwater reuse, natural area management, particularly of riparian zones where appropriate measures would further assist in managing overland flows and reducing its effects.

Council is also currently pursuing strategies to maximise the reuse and recycling of stormwater at several sites and will continue to do so where possible. The largest project of its kind is the dual use stormwater detention (flood mitigation) and re-use tank that has been constructed at The Concourse site.

Other significant stormwater reuse project that is being proposed is at Artarmon Oval. Funding has been allocated for the 2010/2011 financial year to install flow meters and water sampling devices in the creek at Artarmon Reserve & develop a design for a harvesting & water filtration system. Construction is likely to commence in the 2013/2014 financial year if the flow data indicates that such a scheme is economically and environmentally viable.

4.3. Changes in technology

Technological changes and improvements are forecasted to affect the delivery of services covered by this plan as indicated in the table below.

Table 4.2 Changes in technology and forecast effects on service delivery

Technology change	Effect on Service Delivery
Implementation of asset management system	Key areas of concern in service delivery will be identified and addressed as implementation progresses and more data becomes available on level of service criteria. Service provision is also expected to become more efficient, enabling increased service delivery.
Improvements in data capture, analysis and monitoring	Accurate and up-to-date asset registers will lead to more accurate works planning and financial data. This will allow a more pro-active approach in asset management.
Changes in construction and material technology	Improved construction and/or material technology may extend the life of stormwater drainage assets and may well result in more cost-efficient repair methods.

4.4. New assets from growth

In general, there are several drivers for the construction of new stormwater assets. These are development works, works required as determined by flood risk management plans and water quality and re-use schemes as part of Councils environmentally sustainable strategy.

New development works to cater for increasing population, as discussed in section 4, generally result in an increase in impervious area. New stormwater assets or upgrading of existing assets may be necessary by developers and may be part of the condition of development consent.

As part of its responsiblilty, the Engineering Services Branch carries out detailed flood and floodplain risk management studies; and develop plans for each catchment. This process will take several years to complete due to budget limitations and irregularity of grant funding from State Government agencies. New works that are recommended from these plans will be prioritised and carried out within the constraints of the budget.

It is anticipated that the cost of water to Council, like all utilities will rise over time. In accordance with Councils city strategy, Council is investigating water re-use schemes or alternatives such as laying synthetic turf to reduce its dependence on potable water supplies. The city strategy also promotes clean environments which may result in the installation of gross pollutant traps.

5. Lifecycle management plan

This section details how Council plans to manage and operate the assets covered by this Plan to achieve target levels of service (Section 3.3).

5.1. Background data

5.1.1. Physical parameters

Council is responsible for the stormwater drainage network in Council's LGA, which include stormwater conduits and pits, Gross Pollutant Traps and detention basins and tank. Stormwater conduits may include built assets, such as pipes and culverts, or natural assets such as creek. For a summary of the dimensions and replacement cost of these assets refer to Table 2.1. The figure below shows the stormwater network within the LGA.

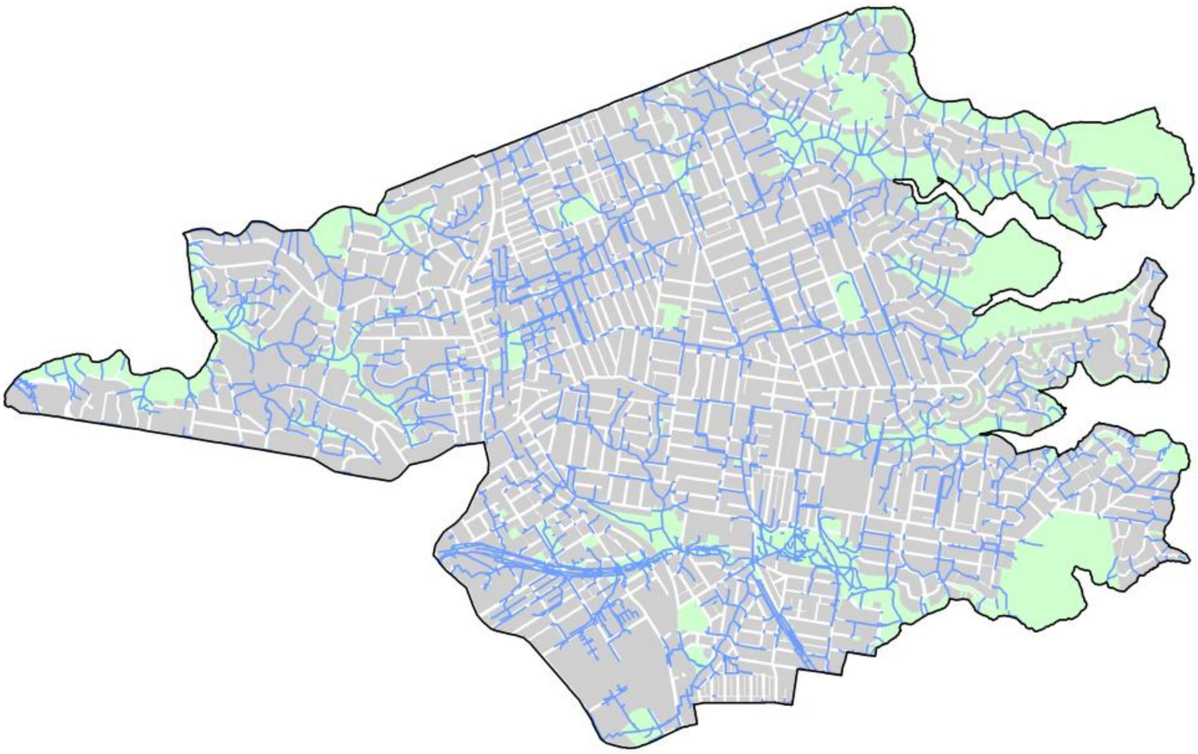

Figure 5.1 Stormwater network map (The blue line denotes the various types of stormwater conduits).

Data collection for the assets covered by this Plan has been completed but confidence in the data varies depending on method of collection. Types of assets covered and the status of data are provided in Table 5.1.

Table 5.1 Data available for the assets covered by this Plan.

Asset category	Data confidence	Status of data
Stormwater conduits	60%	Underground conduits need to be inspected using CCTV. As of 30 June 2013, 60% of the conduits have been inspected and the inspection program is ongoing. For the rest of the conduits, sampling based on known data and extrapolation has been used for the modelling.
Stormwater pits	33%	Where possible, stormwater pits are inspected at the same time CCTV inspections are carried out. Currently approximately a third of the stormwater pits have been confirmed and inspected.

Asset category	Data confidence	Status of data
GPT	90%	Data on locations and types are accurate.
Detention basins	90%	Data on locations are accurate.

Council will continue to carry out CCTV inspection on the stormwater network. As data is collected, accuracy in reports and forecasting would also be improved, as this reduces the need to extrapolate the data on assets that have not yet been inspected.

5.1.2. Asset capacity and performance

Stormwater drainage systems are designed to convey stormwater runoff to receiving waters such as creeks and rivers, and eventually to the harbour. It is accepted that in a large storm such as a 1 in 100 average recurrence interval (ARI) storm, the piped drainage systems will not be able to cope with the volume of water; and the water will travel overland to the lowest point of the catchment. This can be seen in the results of the stormwater overland flow study that was carried out and reported to the Corporate & Transport committee on 18/7/2010. It should be noted that a 1 in 100 ARI storm (or 1% Annual Exceedance Probability) is not a measure of how often a storm would occur. It is more a measure of the statistical intensity of rainfall that is produced during a storm event.

The Willoughby LGA stormwater network was designed and installed generally 70 years ago and in some cases earlier than that, long before the current guidelines or standards were developed. As a result this means that in certain locations, Council's stormwater system would most likely not meet current design standards, as is the case for most older suburbs in Sydney.

It is not economically feasible for Council to consider upgrading its existing conduits to accommodate flows to meet higher intensity storms particularly those that exceed flow intensities of a 1 in 20 ARI storm. Apart from the high costs, installing larger pipes in most cases is not feasible because of the presence of other underground service utilities.

5.1.3. Asset condition

The distribution of condition ratings of the stormwater conduits covered by this Plan is shown in Figure 5.2. Note that, for stormwater assets, this only represents the 60.4% of the stormwater conduits where condition data is available. Council rates the physical conditions based on a standard 0-5 scale, where zero represents a brand new asset and five is the end of the expected life. For detail regarding the condition rating scale, see the AMIS. For details on the stormwater conduit physical condition rating, see section 14 - Appendix E - Asset assessment manual.

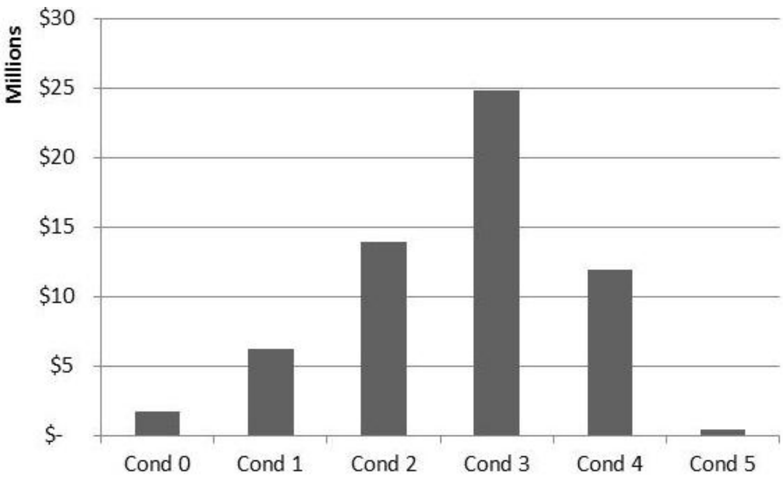

Figure 5.2 Distribution of physical condition ratings

Approximately 21% of the stormwater conduits are at condition 4 and 5, which is at and beyond intervention level. Most of the remaining conduits are in condition 3, which reflects a “moderate” condition rating.

5.1.4. Asset valuations

Council values all assets at Fair Value. The assumptions and calculation methods associated with valuations are documented in Council’s Asset Valuation Methodology. Valuations for the assets covered by this Plan are provided in Table 5.2.

Table 5.2 Valuations for assets covered by this plan

Asset type	Current replacement cost	Depreciated replacement cost (fair value)	2012/13 depreciation expense
All assets covered by this Plan	$ 112.8 M	$ 78.6 M	$ 1.4 M

Indicators of Council’s financial sustainability can be derived from fair value figures. These are reported in Table 5.3.

Table 5.3 Financial sustainability indicators for assets covered by this Plan

Indicator	Calculation method	Working	Result
Asset consumption	2012-2013 depreciation / depreciable amount * 100%	=$1.4M / $109.9M * 100%	1.2%
Asset renewal	2012-13 renewal spend / depreciable amount * 100%	=$156k / $109.9M * 100%	0.14%
Asset upgrade	2012-13 capital spend / depreciable amount * 100%	=$226k / $109.9M * 100%	0.2%

The ratios in the table above indicate that stormwater assets are currently being renewed at a rate only approximately one-eighth of the rate at which it is being consumed, which means it will not be sustainable in the long term. Lifecycle analysis, which are discussed in section 6.2, show similar results, i.e. there is a significant lifecycle gap.

5.2. Risk management plan

An assessment of risks associated with service delivery from infrastructure assets has identified critical risks to Council. The risk assessment process is documented in the AMIS and identifies credible risks, likelihood of risk events occurring and consequences should the event occur.

Risk management forms the basis of the prioritisation method for stormwater renewal and maintenance works. During the 2011/2012 financial year, Council refined the prioritisation process for stormwater assets by incorporating more factors in the risk rating process. Some of these include the size and material of the conduits, the location, loading impacts, impact on land use and the properties that would be affected should failure occur. Details of this risk analysis and prioritisation process can be found in Appendix F – Prioritisation methodology and Risk Management Process.

This risk analysis has been applied only on stormwater works that are already at or beyond the set intervention level. The result of the risk analysis is then used to determine Council's future capital works program, which can be found in Appendix D – Capital works program.

5.3. Expenditure plan

Expenditure is calculated over a 20 year period based on current levels of expenditure and projections of funds required to meet target levels of service.

The following table lists the various stormwater funding sources as well as its budgeted amounts for the 2013/14 financial year. Where funding source does not occur every year, this is indicated in the table.

Table 5.4 Funding sources for stormwater assets

Funding sources	2013/2014 budget
Drainage Administration	$ 648k
Stormwater Management Service Charge	$ 672k
Priority Improvement Projects	$ 220k
Floodplain Risk Management Plan and Study	$ 193k Includes carryover from previous year, and $0 from 2014/2015 onwards.
Capacity Upgrade – S.94	$ 50k
Local Infrastructure Renewal Scheme (LIRS) Loan from the State Government with subsidised interest to fund existing backlog.	$ 900k LIRS budget spreads across three years; $100k in FY 2012/2013, $900k in 2013/2014, and $1M in 2014/2015.

Two levels of funding are considered:

(1) the base case, where expenditure follows current trends;
(2) the sustainable case, where target levels of service are achieved and funding shortages may exist.

The types of expenditure covered include maintenance and operational, renewal, upgrade, new and disposal. These are defined in the AMIS. The method of predicting future expenditure to achieve target levels of service and the assumptions applied to modelling techniques are also explained in the AMIS.

All maintenance, renewal, upgrade and new work is carried out in accordance with the standards and specifications:

- Willoughby City Council's Standard Specifications and Drawings
- Relevant Australian Standards
- Willoughby City Council's Development Control Plans

5.3.1. Maintenance and operational expenditure projections

Activities included as maintenance and operational expenditure are defined in the AMIS. The past *actual* maintenance expenditure (as opposed to the allocated maintenance budget) trend for the assets covered by this Plan is shown in Table 5.5 and does not include operational expenditure.

Table 5.5 Actual maintenance expenditure history

Financial year	Maintenance expenditure ($'000)	Comment
2006-2007	902	Includes maintenance and some renewal works.
2007-2008	981	Includes maintenance and some renewal works.
2008-2009	688	Includes maintenance and some renewal works.
2009-2010	890	Includes maintenance and some renewal works.
2010-2011	1950	Includes the construction of On-Site Detention Tank at The Concourse.
2011-2012	767	Maintenance only.
2012-2013	1105	Change in Special Schedule 7 reporting method, includes maintenance and renewal.

Annual maintenance expenditure is currently equivalent to 1% of the total replacement value reported in Table 2.1.

Maintenance expenditure is expected to increase in line with increases to asset stock through upgrade and new capital works. If new or upgraded works are added to the asset stock, there will be a maintenance shortfall if maintenance budget is not increased to represent the 1% of these, as calculated above. In order to be financially sustainable, maintenance expenditure needs to be maintained at least at the current ratio to total asset stock replacement value. Financial modelling forecasts that the current funding levels (base case) is the same as the projected required maintenance funding (sustainable case) as shown in Figure 5.3.

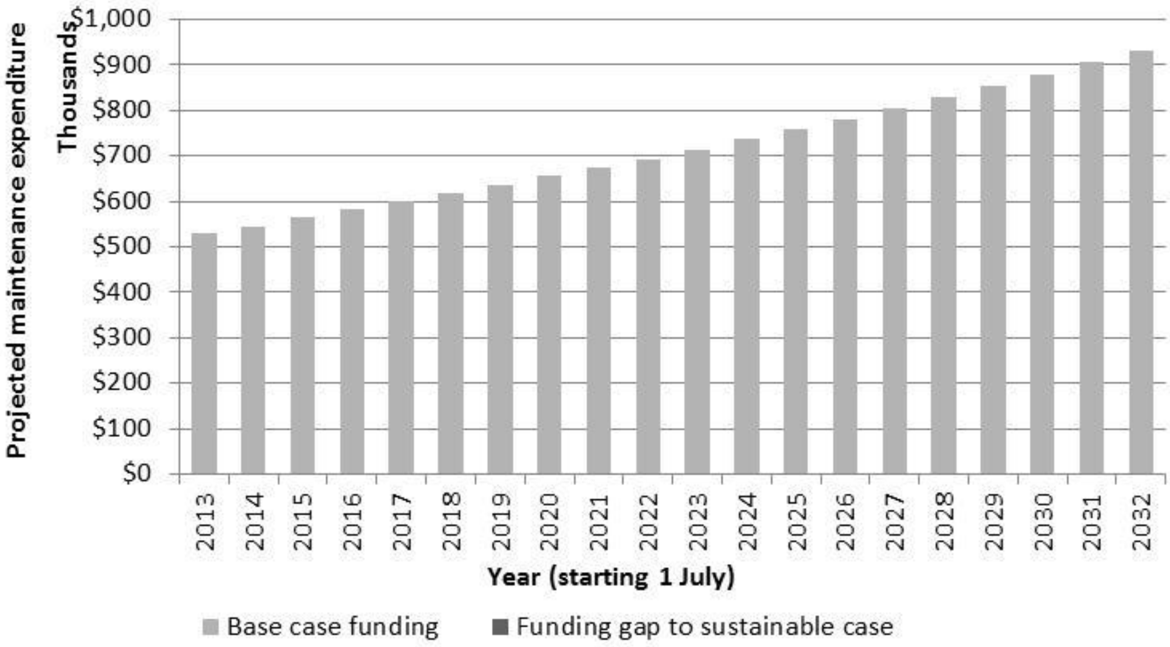

Figure 5.3 Projected maintenance expenditure under the base and sustainable cases

Maintenance expenditure is also expected to increase as asset condition declines. The link between maintenance expenditure and asset condition will be determined following further data analysis.

5.3.2. Renewal expenditure projections

Renewal expenditure depends on levels of service and projections are calculated using modelling techniques and assumptions documented in the AMIS. As of 30 June 2013, 21% of Council's stormwater conduits are at or beyond the adopted intervention level of Condition 4. Regardless of existing backlogs, additional renewal expenditure may be required in the future as a large number of assets reach their intervention point at the same time. Planning for these periods of intense expenditure is crucial. The modelling technique does have limitations which are also documented in the AMIS but still provides a good estimate of long term average funding requirements.

For stormwater conduits, the cost of renewals is based on the estimated replacement costs of the assets, taking into account the type, material and length of the conduits. Stormwater pits have not been incorporated into the modelling of expenditure projections. The difference between current funding levels (base case) and projected required renewal funding (sustainable case) is shown in Figure 5.4.

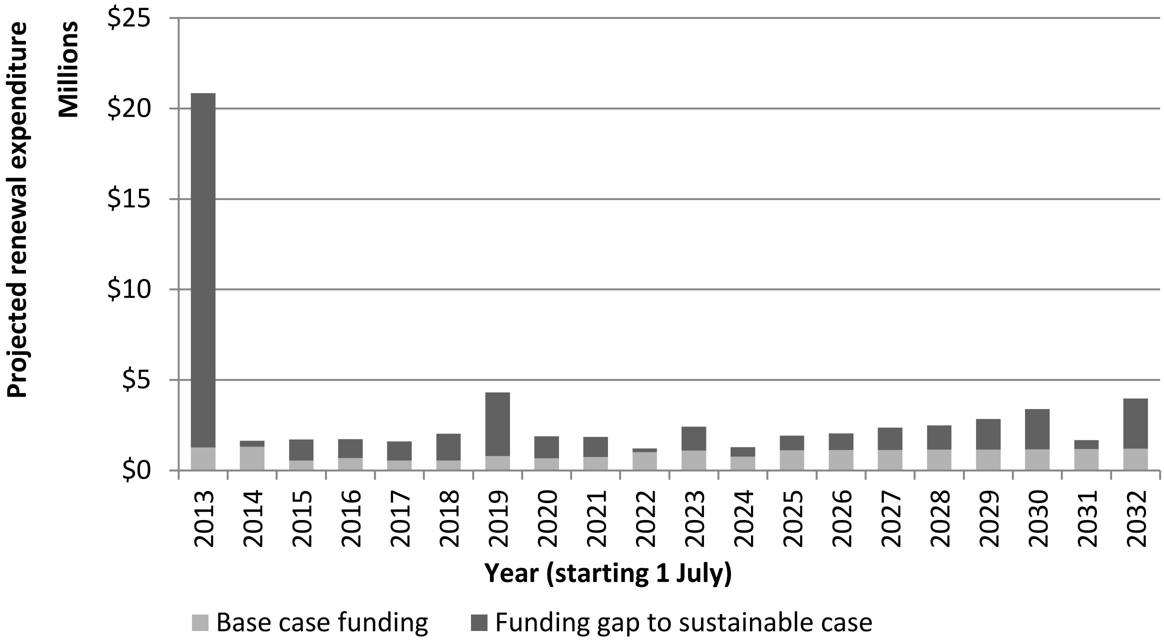

Figure 5.4 Projected renewal expenditure under the base and sustainable cases.

Where funding shortages mean that renewals cannot be completed in a timely fashion, the asset pool is expected to decline in condition overall. Figure 5.5 shows the expected degradation in the condition of the asset pool, shown as the distribution of condition by replacement value. As shown, under current funding it is estimated that approximately 40% of the stormwater conduits will be in condition 4 or worse at the end of the 20 year period. Deteriorated stormwater assets may carry a significant risk with severe consequences, such as flooding or pipe collapse.

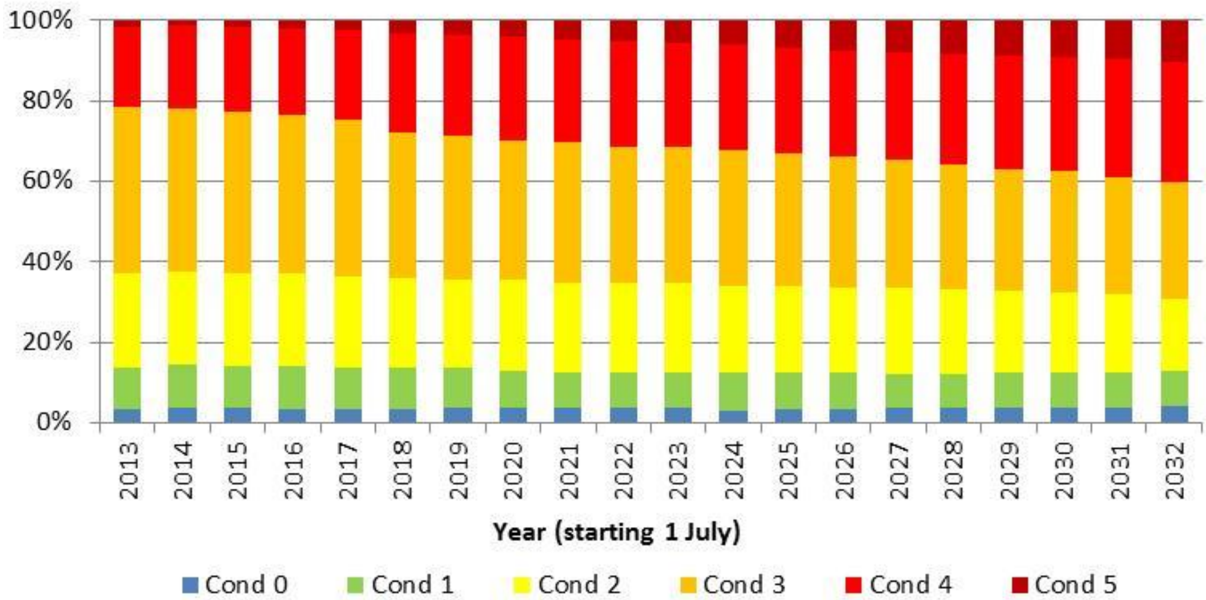

Figure 5.5 Projected asset average condition and distribution under the base case funding

Where renewal funding falls short of requirements, a prioritisation method is applied to ensure that the highest risk and therefore the highest priority assets are renewed first or, in the absence of high risk assets, renewals are carried out in the most financially efficient manner possible. Prioritisation methodology for stormwater assets is risk based, and the details can be found in section Appendix F – Prioritisation methodology and Risk Management Process.

Low cost renewal methods will be used wherever practical. For example, where the defects in the pipes are localised, patching option may be a more cost effective option compared to replacement of the whole segment of the pipe.

5.3.3. New and upgrade expenditure projections

New or upgrade capital works are defined in the AMIS. For the assets covered by this Plan, new and upgrade works are considered on a case by case basis. For example, if a pipe is due for renewal, Council may take this opportunity to do upgrade works if this is found to be the most appropriate option following detailed investigations.

It should be noted that, since new and upgrade expenditure adds to the asset stock, increases in maintenance and probably also operational expenditure can be expected in conjunction with all capital projects.

5.3.4. Disposal plan

Disposals are defined in the AMIS. Assets identified for possible decommissioning and disposal are shown in Table 5.6 below.

Table 5.6 Assets identified for disposal

Asset	Reason for disposal	Timing	Cash flow from disposal*
Stormwater pit and pipeline draining Abbot Rd between Barton St and McMillan Road	Acquisition by other government body	To be determined	To be determined

*Plus sign indicates a profit; negative sign indicates a cost to Council.

5.4. Summary of future costs

For each of the funding scenarios (base case and sustainable case) the total projected expenditure is displayed in Figure 5.6 and Figure 5.7. Base case funding for renewal works mean that Council is already facing a shortage of funds for the assets covered by this Plan. Over the 20 year period, this shortage amounts to a total of $44M or an average of $2.2M per year.

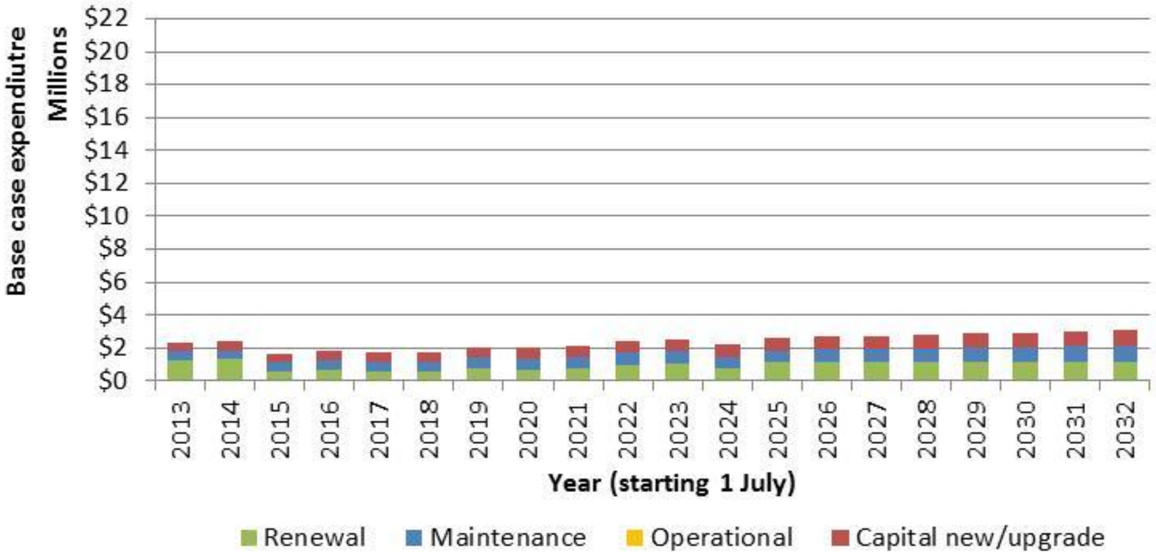

Figure 5.6 Projected 20 year asset expenditure under the base case

Figure 5.7 Projected 20 year asset expenditure under the sustainable case

The spike in the first year of modelling represents the funding required to address existing backlog by applying treatment to ALL assets that are at or beyond the intervention level.

These financial projections involve many assumptions, as detailed in the AMIS, and will be continually refined.

6. Financial summary

This section contains the financial requirements resulting from all the information presented in the previous sections of this asset management plan.

6.1. Financial statements and projections

Total projected expenditure under each of the two financial scenarios are presented on a single set of axes in Figure 6.1. Expenditure is not broken down into types.

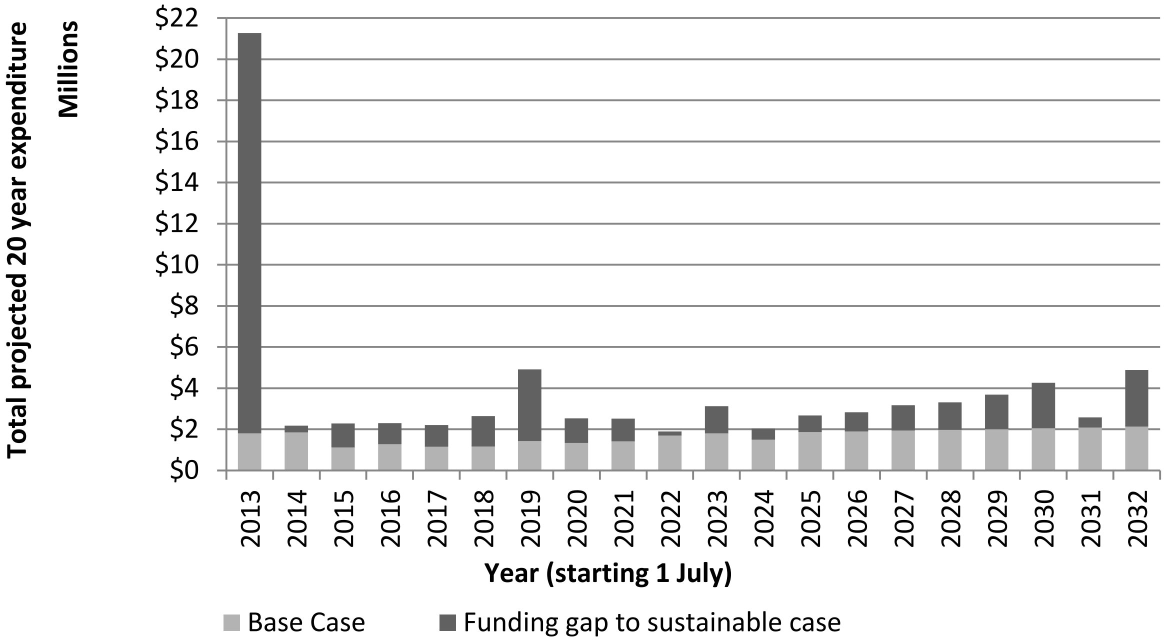

Figure 6.1 Projected 20 year expenditure for assets covered by this Plan

Inflation has been applied at a rate of 3% per annum but no allowance for discount rates has been made.

6.2. Life cycle costs and sustainability

Life cycle cost is the average annual cost of meeting target service levels. Life cycle costs include periodic asset renewals and regular maintenance, and operational expenditure where relevant. Life cycle cost can be calculated on an individual asset basis, and the total compared to current levels of expenditure for an indicator of financial sustainability.

A gap between life cycle cost and current expenditure gives an indication of whether the community is currently paying their share of the assets being consumed. Life cycle costing will be refined with each reiteration of this Plan as more information is collected about asset inventories, treatment costs and asset degradation. Life cycle costs for the assets covered by this Plan are provided in Table 6.1.

Table 6.1 Life cycle cost analysis

Life cycle cost (annual)	Life cycle expenditure (annual)	Life cycle gap
$ 3, 863k	$ 1, 670k	$ 2, 193k

The analysis of life cycle cost shows that under current funding scenario, there is funding gap of approximately $2.2M p.a. before a sustainable scenario is achieved for this asset class.

This Plan is the key to addressing the life cycle gap because it provides guidance on future levels of service and resources required to provide those services.

6.3. Funding strategy

The information from this Plan, including funding gaps, feeds directly into Council's Long Term Financial Plan (LTFP). The LTFP should be consulted for all funding strategies.

6.4. Valuation forecasts

Asset replacement values will increase as additional assets are added to the asset stock. New stormwater assets may be added from time to time as described in section 4.4. Depreciation expense will vary according to the expenditure level, since depreciation patterns vary throughout the life cycle of assets. Fair value is expected to increase in line with additions to the new asset stock, but if assets are not renewed in a timely fashion the overall fair value is more likely to drop. Table 6.2 compares the current and projected total replacement cost, depreciation expense and written down value of the stormwater conduits under each of the two expenditure cases (base and sustainable). Note that stormwater pits, GPT and detention basins have been excluded from the modelling.

Table 6.2 Asset valuation forecasts under the base and sustainable cases

Financial case	Year	Replacement cost	Annual depreciation expense	Written down value (fair value)
Base case	1	$ 98,124 k	$ 980 k	$ 68,797 k
	20	$ 97,396 k	$ 922 k	$ 62,470 k
Sustainable case	1	$ 98,120 k	$ 980 k	$ 68,794 k
	20	$ 98,120 k	$ 644 k	$ 81,817 k

Funding under sustainable case would result in much higher fair value of stormwater conduits and less depreciation expense by the end of the modelling period compared to the base case. This indicates that the conduits will be in better condition overall under the sustainable case.

6.5. Key assumptions made in financial forecasts

The broad assumptions applied to all asset classes in producing financial forecasts are described in the AMIS. Assumptions that relate specifically to this asset class are as follows:

- Repair or renewal work results in asset condition being restored to condition 1.
- Repair cost is based on the type and material of the assets, and assumed to be full length replacement.

Accuracy of future financial forecasts may be improved in future revisions of this asset management plan by the following actions:

- Continued revision of assumptions relating to valuations such as useful life, pattern of consumption and residual values.
- Comparison with IPART cost benchmarking which is due to be published during the 2013.2014 financial year and making adjustments as necessary
- Comparison with other Councils and discussions in Asset Management forums, bearing in mind that factors like useful life, residual values and replacement costs may vary from Council to Council depending on the location and renewal policy of each one.

7. Asset Management Practices

This section summarises Council's current asset management practices in terms of software systems and business processes. All information that applies to Council as a whole can be found in the AMIS. Only information relating specifically to the assets covered by this Plan is covered here.

7.1. Accounting/financial systems

Capital thresholds have been developed for most infrastructure assets to determine whether expenditure is classed as maintenance or capital. This information is held in Council's asset valuation methodology. However, for stormwater projects, the type of works is determined on a case by case basis, usually towards the end of the year. This is due to each stormwater project being unique depending on the nature of works and its location, and typically involves several assets. For example, a pipe replacement may also involve some pit renewals or repair, additional pits construction, or pavement restoration.

7.2. Asset management systems

Council is in the process of implementing Infor Public Sector Suite as its corporate asset management system. Details of Council-wide implementation, including integration with other Council systems, can be found in the AMIS.

The status of asset management system implementation for the assets covered by this Plan is behind that of other infrastructure assets. The stormwater network assets have not been loaded into the Asset Management System, as changes occur as a results of CCTV inspections that take place every week. Data is held in the GIS system until the stormwater network mapping is complete and accurate, or until the GIS and AM system can be synchronised, thereby avoiding the need to update data in both systems.

7.3. Information flow requirements and processes

The key information flows *into* this asset management plan are:

- Data from the asset register on size, age, value, condition, remaining life (see asset valuation methodology);
- Unit rates for treatments/replacements and asset consumption patterns (see asset valuation methodology)
- Adopted service levels (Section 3.3 of this Plan)
- Projections of various factors affecting future demand for services (Section 4.1 of this Plan)
- Available budgets from the long term financial plan
- Long term capital project planning
- Outputs from renewal modelling
- Data on new assets acquired by Council and future disposals

The key information flows *from* this asset management plan are:

- The works program
- The annual operational plan and budget
- The 4 year delivery program
- Required funding to address any renewal and maintenance gaps for the long term financial plan

Business processes in relation to the assets covered by this Plan are continually being improved

7.4. Standards and guidelines

This Plan has been prepared under the Division of Local Government's Integrated Planning & Reporting Framework with guidance from the IPWEA International Infrastructure Management Manual.

8. Plan Improvement and Monitoring

This section deals with the improvement of this Plan and the management of assets covered by this Plan, including performance measures, an action plan for improvement and review procedures.

8.1. Performance measures

The effectiveness of this Plan can be measured in the following ways:

- Integration of the contents of this Plan with the other documents that constitute the Integrated Planning and Reporting Framework, particularly the Resourcing Strategy.
- The level of deviation from previously published capital works programs and budgets.
- Improvement in data confidence.

8.2. Action plan for improvement

Actions that can be undertaken to ensure this Plan is improved in the future are listed in Table 8.1

Table 8.1 Action plan for improvement

Task #	Task description	Officer Responsible	Resources required
1	Review conduit condition rating methodology. The current methodology puts emphasis on the severity rather than the extent of the conduit defects. In the future, for a rating that affects more accurately the actual condition, a method involving a combination of both severity and extent of the conduits will be developed. This will also enable a more accurate estimate of cost of repair.	Engineering Assets Group	Staff
2	Develop funding strategy improvement plans for stormwater pits as information becomes available on current expenditure.	Engineering Assets Group, Finance	Staff, funding
3	Develop funding strategy improvement plans for gross pollutant traps and on site detention basins.	Engineering Assets Group, Finance	Staff, funding
4	Review the IIMM 2011 edition and IPWEA Stormwater Practice Notes and make modifications as appropriate.	Engineering Assets Group	Staff

Improvement in Council-wide asset management practices, business processes, workflows and systems is detailed in the AMIS.

8.3. Monitoring and review procedures

This Plan will be reviewed in November and December annually during the preparation of the annual budget and amended to recognise any changes in levels of service and/or resources available to deliver those services as a result of financial decisions in the long term financial plan.

9. References

NSW DLG Integrated Planning and Reporting Manual
http://www.dlg.nsw.gov.au/dlg/dlghome/Documents/Information/Intergrated%20Planning%20and%20Reporting%20Manual%20-%20March%202013.pdf

Willoughby City Strategy 2013-2029
http://www.willoughby.nsw.gov.au/Community/Community-Planning/Willoughby-City-Strategy/

Willoughby City Council Delivery Program 2013-2017 and Operation Plan
http://www.willoughby.nsw.gov.au/About-Council/Forms-Policies---Publications/delivery-program-and-operational-plan-2010-2014/

Willoughby City Council Resourcing Strategy
http://www.willoughby.nsw.gov.au/About-Council/Forms-Policies---Publications/resourcing-strategy/

10. Appendix A – Types of Stormwater Conduits

<table>
<tr>
<td>

Pipe</td>
<td>

Open channel</td>
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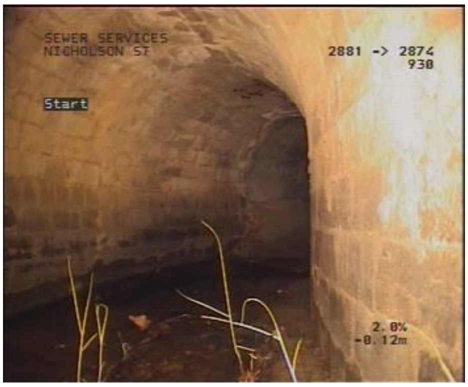
<tr>
<td>

Box culvert</td>
<td>

Horse shoe culvert</td>
</tr>
<tr>
<td>

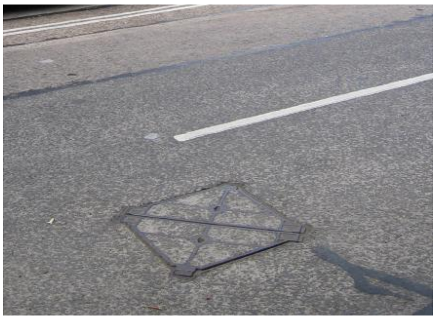
Oval pipe</td>
<td>
Dish drain</td>
</tr>
<tr>
<td>Overland flowpath</td>
<td>Converter</td>
</tr>
<tr>
<td>Creek</td>
<td></td>
</tr>
</table>

11. Appendix B – Types of Stormwater Pits

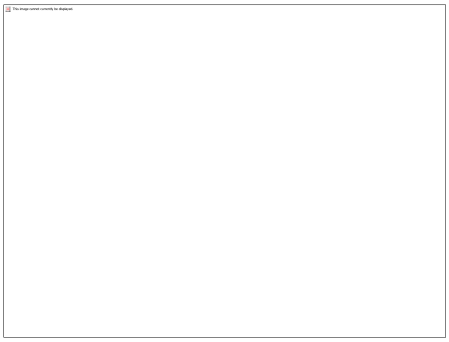
<table>
<tr>
<td>On-grade pit

A pit with inlet, on grade.</td>
<td rowspan="2">Junction

No inlet, chamber present.</td>
</tr>
<tr>
<td>Sag pit

A pit with inlet at a low point.</td>
</tr>
<tr>
<td>Access lid

An entry point into a main pipeline or culvert without an inlet or chamber.</td>
<td>Converter

An outlet that reduces pipe diameter to kerb height without a chamber.</td>
</tr>
<tr>
<td>Access grate

An entry point to a main pipeline or culvert with an inlet without a chamber.</td>
<td>Headwall

A wall structure at a pipe, usually leading into an open creek.</td>
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</table>

12. Appendix C – Types and Location of Gross Pollutant Traps

GPT are installed in the stormwater collection system to minimise pollutants reaching and polluting downstream waterways. GPT generally collect larger sized items, such as bottles, leaves and plastic bags. There are nine GPT of various types, sizes and constructed from various materials maintained by Council with a total installation cost of $867,000. The current replacement value of these GPT is estimated to be approximately $1M. Individual GPT construction costs vary within a range of between $2,000 and $250,000 for each GPT. These GPTs are listed in the table below.

Table 12.1 Gross Pollutant Traps in Willoughby LGA

 Trash rack at 4th Ave.	Type	Trash rack
	Location	4th Ave, Willoughby East
	Installation date	Early-mid 1990s
	Installation cost	$10,000 (at the time of construction)
	Catchment area	157 ha
	Type	Pit insert trash screen
	Location	Oliver Rd, Chatswood
	Installation date	1994
	Installation cost	$2,000 (at the time of construction)
	Catchment area	
 Deep pit and steel basket at Coorabin Road.	Type	Deep pit and steel basket
	Location	Coorabin Rd, Northbridge
	Installation date	June 1996
	Installation cost	$15,000 (at the time of construction)
	Catchment area	8.55 ha

Baramy at Eastern Valley Way being cleaned.

Type	Baramy BBC trap
Location	Eastern Valley Way, Roseville
Installation date	September 2000
Installation cost	$80,000 (at the time of construction)
Catchment area	115.4 ha

Ski jump at McCabe Place being cleaned.

Type	Ski jump
Location	McCabe Place, Chatswood
Installation date	August 2001
Installation cost	$30,000 (at the time of construction)
Catchment area	21.7 ha

Baramy at Crick St being cleaned.

Type	Baramy
Location	Crick St, Chatswood
Installation date	March 2002
Installation cost	$180,000 (at the time of construction)
Catchment area	201.7 ha

Baramy at Grandview St prior to being cleaned.

Type	Baramy
Location	Grandview St, Naremburn
Installation date	November 2002
Installation cost	$140,000 (at the time of construction)
Catchment area	263.5 ha

<table>
<tr><td rowspan="5">
CDS units being installed</td><td>Type</td><td>2 CDS® units</td></tr>
<tr><td>Location</td><td>Ferguson Lane, Chatswood</td></tr>
<tr><td>Installation date</td><td>April 2010</td></tr>
<tr><td>Installation cost</td><td>$250,000
(at the time of construction)</td></tr>
<tr><td>Catchment area</td><td>19 ha</td></tr>
<tr><td rowspan="5">
CDS unit being installed</td><td>Type</td><td>CDS®</td></tr>
<tr><td>Location</td><td>Ferguson Lane, Chatswood</td></tr>
<tr><td>Installation date</td><td>December 2010</td></tr>
<tr><td>Installation cost</td><td>$160,000
(at the time of construction)</td></tr>
<tr><td>Catchment area</td><td>0.7ha</td></tr>
</table>

In addition to the GPTs listed above, there is another GPT located off Francis Road in Artarmon. This GPT has not been included in Council's list, as the ownership and maintenance responsibility is still being determined.

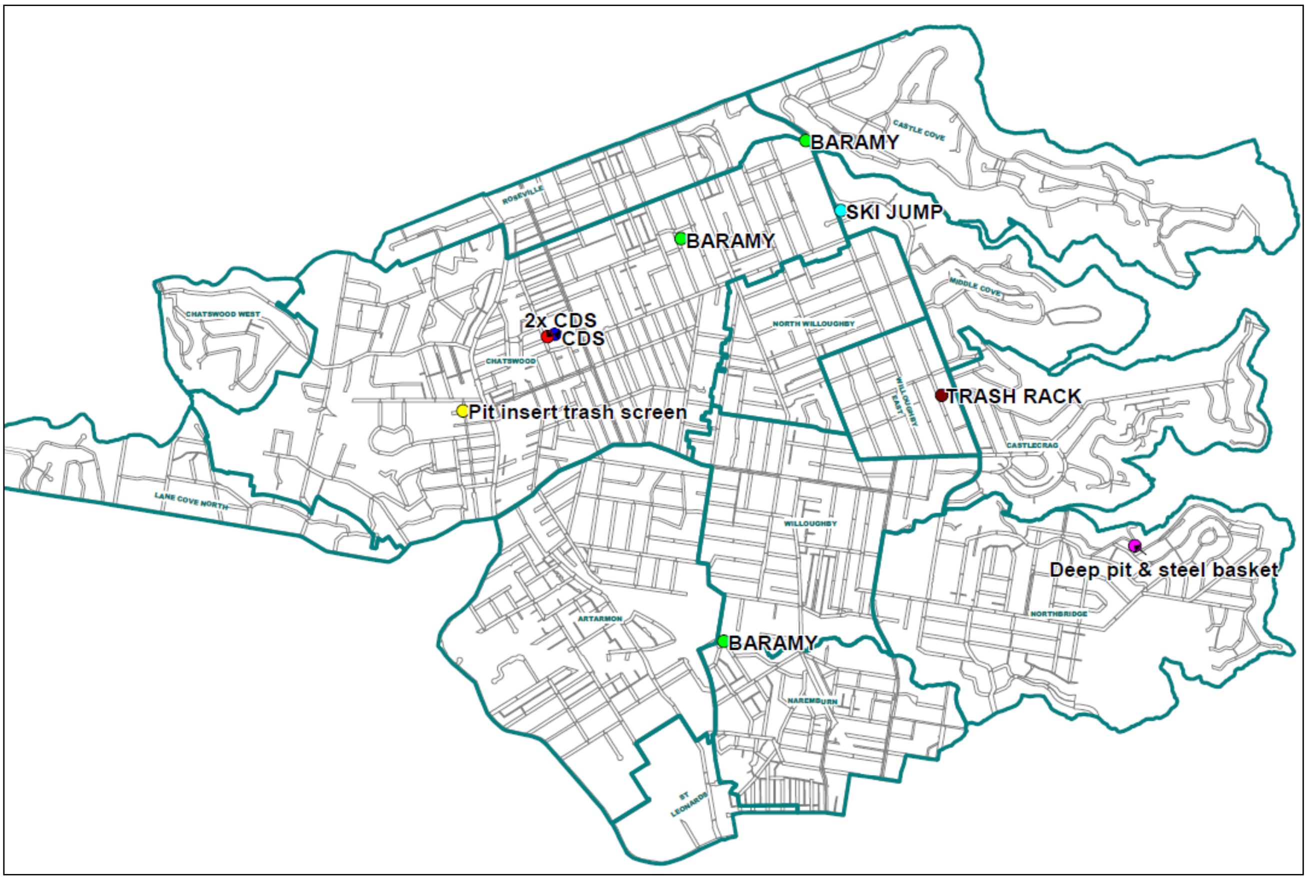


Figure 12.1 Locations of GPTs in WIlloughby LGA

The majority the above GPTs are of the dry type; with collected items stored above standing water levels and the device designed to be self-draining. With the exception of the CDS units. Maintenance activity of the GPT mostly involves GPT cleaning, particularly after heavy rainfall. Cleaning may be undertaken by either contractors under a maintenance contract or Council staff, depending on the type of GPT. From time to time, minor repairs to the structures are required, either from rust or damage from debris.

Future plans include investigating and documenting more details on cleaning costs, optimising cleaning cycle, and the quantity and type of waste removed during cleaning.

13. Appendix D – Capital works program

This appendix lists all capital works projects identified in asset management plans for the five years beginning 2013/14. The types of works included are renewal of existing assets, upgrade of existing assets and purchase/construction of new assets. These are presented according to the two financial cases covered by the Long Term Financial Plan:

- **Base Case** – works that will almost certainly take place if funding continues at present levels
- **Sustainable case** – works that either could not be carried out, or would be carried out later than is ideal, without a special rate variation.

Whilst reviewing this list of works, it is very important to note that it does not represent a prescriptive capital works program. The proposed year of works is listed against each item based on current priorities. As asset degradation and use profiles can only ever be estimated rather than accurately predicted, it is likely that priorities will shift over time. Each proposed work will require on-site investigation before determining its final inclusion in the works program, and the condition of many assets will be reassessed in this financial year. This may result in considerable variation of proposed works, depending on actual asset degradation.

It is standard practice for Council staff to review such lists of Capital works at budget time each year, and often much more frequently for network assets such as footpaths. As such, this list should be considered an indicator of the *quantity* and *distribution* of works that are likely to be undertaken. The accuracy of these capital works programs decreases with each subsequent year. Nonetheless, long-term planning and identification of these projects is an essential part of ensuring that Council attains financial sustainability.

The following table provides the 5-year total expenditure for stormwater drainage works by ward. These have been compiled to provide an overview by ward.

Table 13.1 Summary of capital works by ward

Asset class	Ward	Projects total value over 5 years (Base case)	Additional projects value over 5 years (Sustainable case)
Stormwater drainage	West Ward	$527,532	$534,008
	Sailors Bay Ward	$910,035	$674,252
	Middle Harbour Ward	$1,583,111	$1,120,268
	Naremburn Ward	$1,194,951	$734,018

Works are presented in a tabular fashion by year. "Year 1" is the 2013/14 financial year, "Year 2" is the 14/15 financial year, and so on. All works listed consist of partial or complete pipe renewal. Data for stormwater is summarised at the ward level for each year of the works program, because no meaningful location data can be provided for stormwater pipes. This is because any given pipe can traverse a number of roads and/or properties. The number of pipes likely to be renewed has been indicated.

13.1. Base Case

The table below shows the list of capital works program for stormwater works, summarised by the ward for each year.

Table 13.2 Capital works program in base case summarised by ward

Ward	Year	Value of projects	Number of pipes
Middle Harbour Ward	1	$201,511	12
Naremburn Ward	1	$489,298	16

Ward	Year	Value of projects	Number of pipes
Sailors Bay Ward	1	$103,676	6
West Ward	1	$431,573	17
Middle Harbour Ward	2	$225,791	19
Naremburn Ward	2	$669,143	32
Sailors Bay Ward	2	$287,072	16
West Ward	2	$99,565	5
Middle Harbour Ward	3	$123,625	5
Naremburn Ward	3	$114,757	8
Sailors Bay Ward	3	$214,140	14
West Ward	3	$35,352	4
Middle Harbour Ward	4	$76,605	7
Naremburn Ward	4	$301,045	13
Sailors Bay Ward	4	$96,591	7
West Ward	4	$210,269	16
Naremburn Ward	5	$291,370	7
Sailors Bay Ward	5	$192,348	9
West Ward	5	$51,898	3

13.2. Sustainable Case

The table below shows the additional projects that would be carried out if funding as per sustainable case was available.

Table 13.3 Additional capital works program in sustainable case summarised by ward

Ward	Year	Value of projects	Number of pipes
Middle Harbour Ward	5	$1,120,268	66
Naremburn Ward	5	$534,008	51
Sailors Bay Ward	5	$674,252	48
West Ward	5	$734,018	52

14. Appendix E - Asset assessment manual

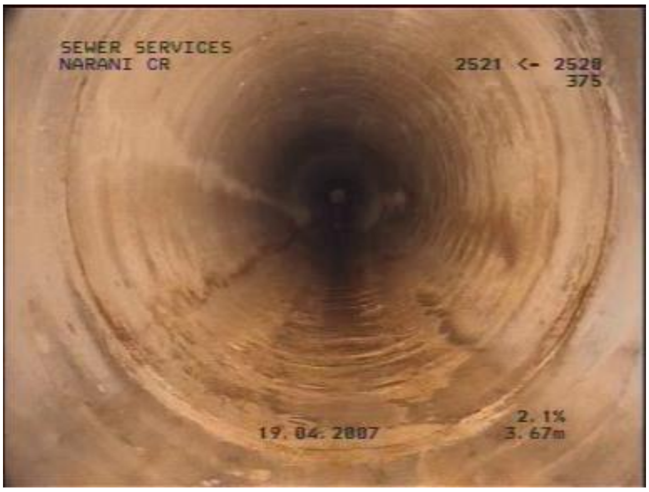
Condition assessment is based on defect type and extent, also identified as “condition state”.

State 8 (Asset Condition rating 1) – Good condition

This state includes relined pipes.

- Good condition

Record the length of the CCTV footage.



State 7 (Asset Condition rating N/A) – Conduit requires cleaning.

If the camera is unable to pass over a blockage or obstruction that could be cleaned by high pressure water jetting or root cutting and the majority of the conduit (<75%) is unable to be condition assessed. E.g. if the pipe is 50 m long and tree roots stop the camera 5m into the CCTV survey then it should be marked state 7.

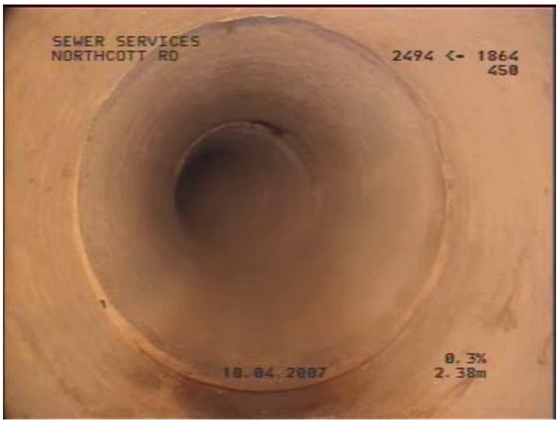
- Cleaning required

Note that if a blockage is present the estimated % of blocked cross section area, at the worst location, is to be recorded.

State 6 (Asset Condition rating 2) – Generally good condition with minor defects present

Any conduit with minimal cracking, open or displaced joints, holes or defects requiring minimal works, usually treated by relining or patching.

- Slightly displaced joint (~0.2 –0.5 X pipe thickness). – Record No of joints affected
- Slightly opened joint (~0.2 – 0.5 X pipe thickness). - Record No of joints affected
- Minor localised cracking less than 1m long (typically one or two cracks). - Record No of joints or locations affected
- Broken/ damaged joint Minor (Hole diameter approx < 0.3 X pipe diameter) - Record No of joints affected



Slightly Displaced Joint

Superficial

Broken/ damaged joint Minor

State 5 (Asset Condition rating 2.5) – Minor Defects

Any conduit that shows no major distress but has minor open or displaced joints, minor cracking, minor invert erosion or multiple exposed reinforcement areas or minor pipe joint damage, usually treated by relining.

- Medium displaced joint (~0.5 – 1.0 X pipe thickness) – Record No Joints affected
- Medium opened joint (~0.5 – 1.0 X pipe thickness) – Record No Joints affected
- Exposed reinforcement / Surface Damage (includes spalling) – Record Length Affected.
- Broken/ damaged joint (hole diameter approx 0.3 – 0.6 X pipe diameter) – Record No Joints affected
- Invert Erosion – Minor (NO holes in invert that allows water to flow out of pipe) – Record Length Affected.
- Minor Rubber ring joint failure (ring hangs down <25% diameter of pipe)
- Minor Object intrusion (object intrudes <25% diameter of pipe)
- Utility in conduit not affecting flow.

If the camera is unable to travel through the conduit then estimate from the video footage the length or no joints affected. You may need to enter 100% of length.

Invert Erosion - Minor

Exposed reinforcement / Surface Damage

Broken/ damaged joint

Medium displaced joint

Medium Open Joint

Exposed reinforcement / Surface Damage

Minor rubber ring joint failure

Minor object intrusion

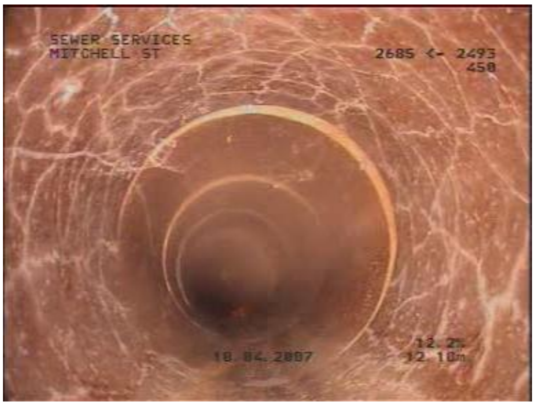
Service not affecting flow

State 4 (Asset Condition rating 3) - Cracking

Conduit showing significant cracking and may require replacement or relining.

- Crocodile cracking
- Longitudinal cracking.
- Circumferential cracking
- Quadrant Cracking

Record the length affected. If the camera is unable to travel through the conduit then estimate from the video footage the length affected. You may need to enter 100% of length.

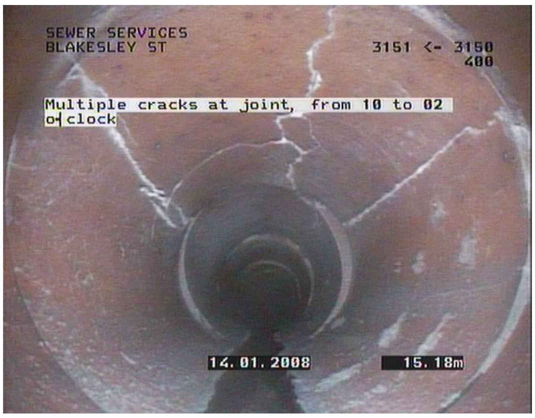


Crocodile Cracking

Crocodile Cracking

Quadrant Cracking

Circumferential Cracking



Longitudinal Cracking

State 3 (Asset Condition rating 4) – Large point location defects

Any Conduit That Has Major Displaced Joints or Open Joints. This type of defect is usually treated by either replacing or realigning the affected segment of pipe. If the pipe joint is open and not misaligned then generally either a point patch liner can be installed or the pipe excavated and a concrete bandage installed around the line.

- Large displaced joint (~ 1.0 - 2.0 X pipe thickness)
- Large opened joint (~ 1.0 - 2.0 X pipe thickness)
- Large Rubber ring joint failure (ring hangs down >25% diameter of pipe)

Record the number of pipe joints/locations affected. If the camera is unable to travel through the conduit for example due to a large offset joint, then estimate from the video footage if the issue appears to be continuous through the pipe. You may need to enter 100% of length affected. If you can see that it only appears to be one or two joints affected then just list the number of joints.

Large Displaced Joint

Large Displaced Joint

Large Rubber ring joint failure

Large open joint

State 2 (Asset Condition rating 4) - Extreme Joint Misalignment or Damage

Any conduit that is showing an extreme amount of localised damage, e.g. extremely open or displaced joints, or damage to the pipe. This type of defect is usually treated by either replacing or realigning the affected segment of pipe. If the pipe joint is open and not misaligned then generally either a point patch liner can be installed or the pipe excavated and a concrete bandage installed around the line.

- Extreme Broken/ damaged section (hole diameter > 0.6 X pipe diameter)
- Extreme displaced joint (> 2.0 X pipe thickness)
- Extreme opened joint (> 2.0 X pipe thickness)
- Large Object intrusion (object intrudes >25% diameter of pipe)
- Utility Service in conduit affecting flow.

Record the number of pipe joints or locations affected. If the camera is unable to travel through the conduit for example due to a large offset joint, then estimate from the video footage if the issue appears to be continuous through the pipe. You may need to enter 100% of length affected. If you can see that it only appears to be one or two joints affected then just list the number of joints.

Extreme Broken/damaged Section

Large Object intrusion

Extreme displaced joint

Utility Service in conduit

State 1.5 (Asset Condition rating 4) – Major Invert Erosion

Any conduit that is showing major erosion. The conduit invert may be missing in places or possibly intermittent holes present. Usually treated by replacement or relining. The cost of relining and replacement are similar, for modeling purposes the replacement rate of the pipe will be used.

- Invert Erosion – Major (must have holes in invert)

Record the length affected. If the camera is unable to travel through the conduit then estimate from the video footage the length affected. You may need to enter 100% of length.

State 1 (Asset Condition rating 4) – Deformed

Any conduit where the shape is deformed, usually accompanied by heavy cracking indicating overloading of the pipe. Generally treated by replacement.

- Deformed.

Record the length affected. If the camera is unable to travel through the conduit then estimate from the video footage the length affected. You may need to enter 100% of length.

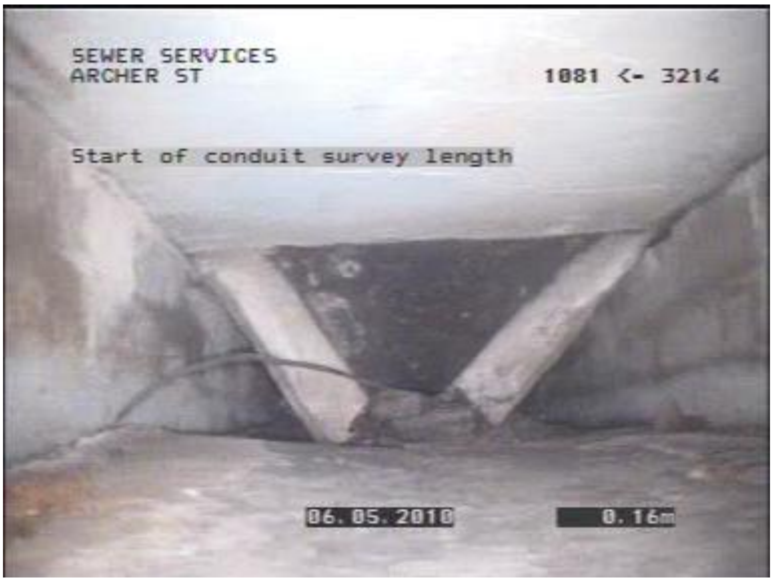
State 0.5 (Asset Condition rating 5) – Collapsed

Any conduit that has collapsed. Usually treated by replacement.

A round pipe may be deformed into a oval shape, if the shape of the cross section is no longer approximately oval in shape, than the pipe can be considered to be collapsed.

- Collapsed.

Record the length affected. If the camera is unable to travel through the conduit then estimate from the video footage the length affected. You may need to enter 100% of length.



History of changes

- 23/10/13 – State 3 (Asset Condition Rating 3) – Large Point location defects was changed to Asset Condition Rating 4 after community consultation
- 23/10/13 – State 4 (Asset Condition Rating 4) – Cracking was changed to Asset Condition Rating 3 after community consultation

15. Appendix F – Prioritisation methodology and Risk Management Process

This prioritisation rating methodology was written based on IPEWA Condition Assessment & Asset Performance Guidelines - Practice Note 5 STORMWATER DRAINAGE and modified for Council's use. Please note that this rating system only applies for conduits that have been inspected by CCTV and given a condition rating.

The priority of conduit works is determined by its risk score which is calculated by:

$$Risk = Likelihood\ of\ Failure\ \ L\ \ \times Consequence\ of\ Failure\ (C)$$

Higher likelihood and consequence factors lead to a higher risk score. Prioritisation is determined primarily by the risk level, ranging from L to VH (see Table 15.4 Risk Level), then to further refine the works listing, priority is given to works with risk score in descending order.

Note that in addition to the prioritisation process, there will be other factors taken into account, which may result in repair works being undertaken out of the order of the risk score. For example, urgent works may need to be undertaken immediately following a pipe failure, or Customer Service Requests may highlight problems with particular sections of the stormwater network which had not been inspected or which may have deteriorated at a faster rate than previously estimated. In addition, the available budget will impact on works that can be undertaken.

Likelihood of Failure (L)

The likelihood is calculated by considering the factors such as the amount of loading on the conduit, the location of the conduit, the strength of the conduit material and how much traffic loading is anticipated to occur the conduit.

Please refer to the map indicating industrial areas and the commercial cores.

Table 15.1 Likelihood of Failure

Factor	Score	Comments
Location of Conduit (see **Figure 16.1** below)		**Each conduit will experience different loading depending on the traffic volume.**
Within rail corridor	5	Loading due to trains.
Transverse road low point	5	Regular loading from vehicles.
Transverse road branch	5	Regular loading from vehicles.
Longitudinal under road pavement	5	Regular loading from vehicles.
Longitudinal within 0.5m of K&G	4	Some loading from vehicles but vehicles less likely to be driving on the conduit.
Transverse road open space - park	3	Heavy vehicles regularly used for maintenance in parks.
Transverse private property	2	Maintenance vehicles exert loading on the driveway. Generally light vehicles.
Transverse building within 5m of pipe	2	Maintenance vehicles exert loading on the driveway. Generally light vehicles.
Longitudinal or transverse under nature strip	2	Vehicles entering properties, or parking. Generally light vehicles.

Factor	Score	Comments
Transverse 75% conduit length covered by building	1	Minimal loading by vehicles possible.
Transverse road open space - bushland	0	No maintenance vehicles.
Conduit material		**The stronger the materials, the less likelihood of failure there is.**
Vitrified Clay	5	
Cast in Place Concrete	4	
Sandstone	4	
PVC	4	
Brick	3	
Relined Pipe	2	
Concrete	1	
Loading on conduit		**NAASRA class values can be found in the road database.**
State Road	6	
Within rail corridor	6	Loading due to trains.
NAASRA - Class 6	5	
NAASRA - Class 7	4	
NAASRA - Class 8	3	
NAASRA - Class 9	2	
Private Property	1	
Nature Strip	1	
Open Space - park	1	
Open Space - bushland	0	
Land use impact on conduit		**Additional points are given to conduits that are located near or under rail lines, industrial or commercial areas. These conduits would experience more loading than conduits that are located in a residential street.**
Within rail corridor	2	
Industrial Area	2	
Commercial Core	1	
Other	0	
Conduit within 5m proximity of large trees		**Conduits that are located under or near large trees are more likely to be blocked or have accelerated damage due to tree roots penetrating into the pipe.**
More than one large tree parallel to pipe	2	
Pipe runs transverse to trees	1	
Other	0	

Factor	Score	Comments
Asset Condition rating		**Values taken from the CCTV database.**
Collapsed (state 0.5)	5	
Deformed (state 1), Major Invert Erosion state (1.5), Major Joint Misalignment or Damage (state 2), Cracking (State 4)	4	
Large Point Location Defects (3)	3	
Cracking (State 4)	2	
Minor Defects (State 5)	2.5	
Generally Good Condition With Minor Defects Present (6)	2	
Conduit Requires Cleaning (State 7)	0	
Good Condition (State 8)	1	
Maximum Score	**25**	
Minimum Score	**2**	

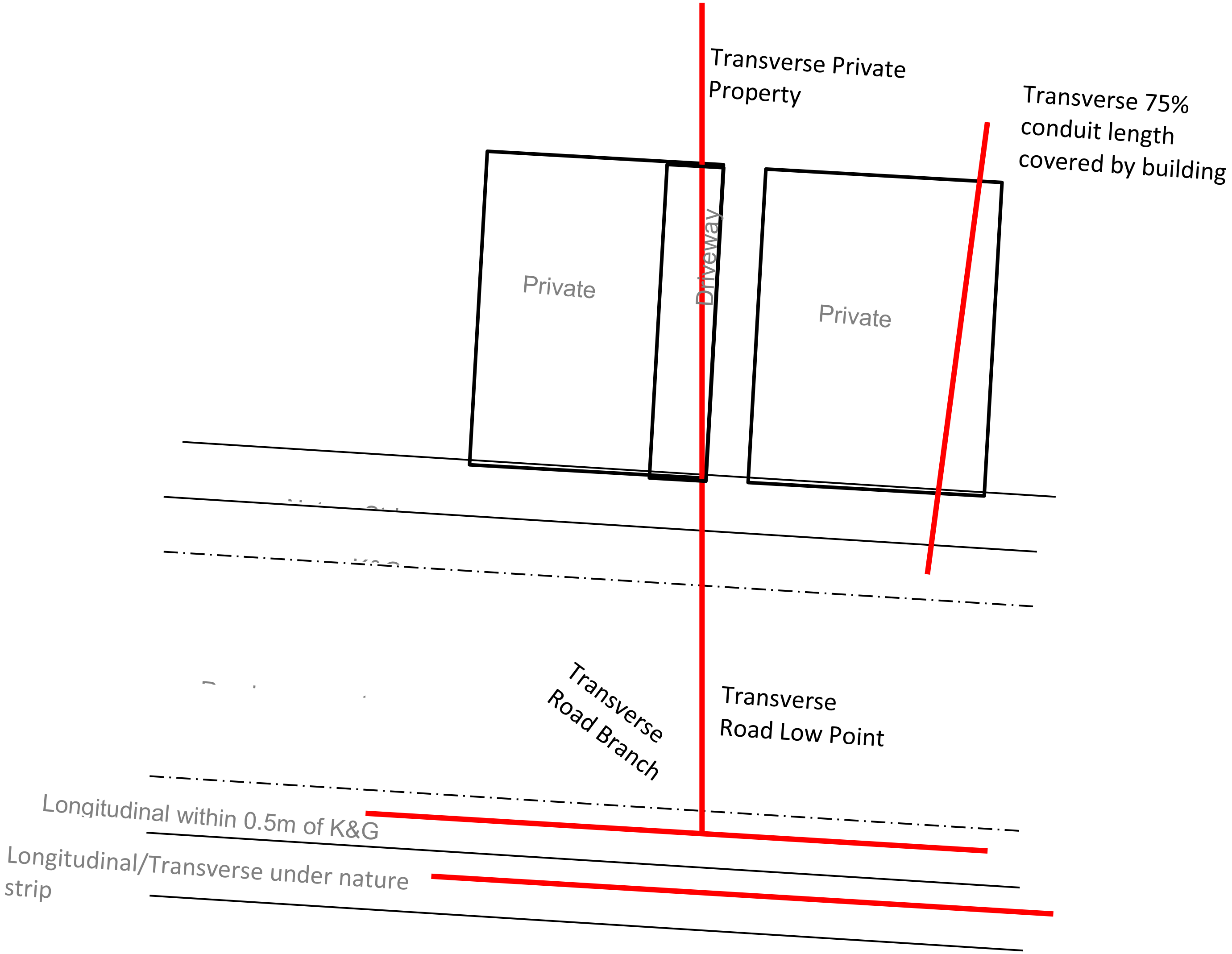


Figure 15.1 Location of Conduit

Consequence of Failure (C)

The consequence of failure factors are related to the possible scenario downstream of where the conduit has failed. Here you will need to take into consideration the type of property downstream of conduit as well as conduit size.

The contours in the GIS system are used to determine the direction of the flow of flood water.

Exponare will be used to determine the area of land affected for residential and commercial properties by clicking on each land parcel to find the area.

Table 15.2 Consequence of Failure Scoring

Factor	Score	Comments
Property/Area Affected if pipe fails		
State Road	5	Major traffic disruptions.
Within rail corridor	5	Train services would be affected.
NAASRA - Class 6 road	5	
Large commercial property	5	Affected land area is >750 m^2.
Land with utilities	5	Power substation, telecommunications, railway stations, Sydney Water pumping stations.
NAASRA - Class 7 road	4	
Small commercial property	4	Affected land area is <750m2.
Large or more than two Residential properties affected downstream	4	Affected land area is >750m2, or it is an apartment block, villa, townhouses.
NAASRA - Class 8 road	3	
Small Residential properties	3	Affected land area is <750m2 land area.
NAASRA - Class 9 road	2	
Nature Strip	1	
Open Space - park	1	
Open Space - bushland	1	
Impact of flooding on downstream area/properties		**Conduits are given extra points if there are properties downstream that will be affected by the flow.**
Within rail corridor	2	May disrupt train services
Under habitable, commercial building	2	
Transverse low point pipe or first or second conduit segment downstream of low point	2	Water flows towards low point, magnitude of flooding would be greater.
Private land affected	1	If the conduit runs beside the building or through the backyard of a property.
Under non-habitable building	1	An example would be a garage.
Under intersection, or intersection is located one or two conduit segments downstream	1	An intersection would experience more traffic than a quiet residential road
None	0	eg. water does not flow across trafficable lane, or building is not flooded

Cross-sectional area		**Values taken from stormwater database.** **For conduits that do not have a circular cross-section, convert the dimensions to cross-sectional area.**
≥900mm diameter (≥636 172mm²)	3	
375-900mm diameter (110 446 – 636 172 mm²)	2	
≤375mm diameter (≤110 446 mm²)	1	
Maximum Score	**10**	
Minimum Score	**2**	

Risk Rating and Associated Scores

The risk range is from Low Risk to Very High Risk and the score ranges from 1-200

Table 15.3 Risk Rating

		Consequences (C)				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood (L)	**Score**	**1-2**	**3-4**	**5-6**	**7-8**	**9-10**
Rare	**1-5**	L (1-10)	L (3-20)	M (5-30)	M (7-40)	H (9-50)
Unlikely	**6-10**	L (6-20)	L (18-40)	M (30-60)	M (42-80)	H (54-100)
Possible	**11-15**	L (11-30)	M (33-60)	M (55-90)	H (77-120)	H (99-150)
Likely	**16-20**	M (16-40)	M (48-80)	H (80-120)	H (112-160)	VH (144-200)
Almost Certain	**21-25**	M (21-50)	M (63-100)	H (105-150)	VH (147-200)	VH (189-250)

Table 15.4 Risk Level

Level Risk		**Action Required**
VH	**Very High Risk**	Immediate corrective action required
H	**High Risk**	Prioritised action required
M	**Medium Risk**	Planned action required
L	**Low Risk**	Manage by routine procedures

Example

- The first conduit has the total Likelihood score of 9 and the total Consequence score of 5. The Likelihood is **Possible** and Consequence is **Moderate**, from the matrix this classes the first conduit as **High Risk**.
- The second conduit has the total Likelihood score of 11 and the total consequence score of 6. The Likelihood is **Possible** and the Consequence is **Moderate**, from the matrix this classes the second conduit as **High Risk**.

Since these two conduits have the same risk rating, you prioritise the work by calculating the risk score. $Risk = Likelihood\ of\ Failure\ \ L\ \ \times Consequence\ of\ Failure\ \ C$

For the first conduit: $Risk = 9\ \times 5 = 45$

For the second conduit: $Risk = 11\ \times 6 = 66$

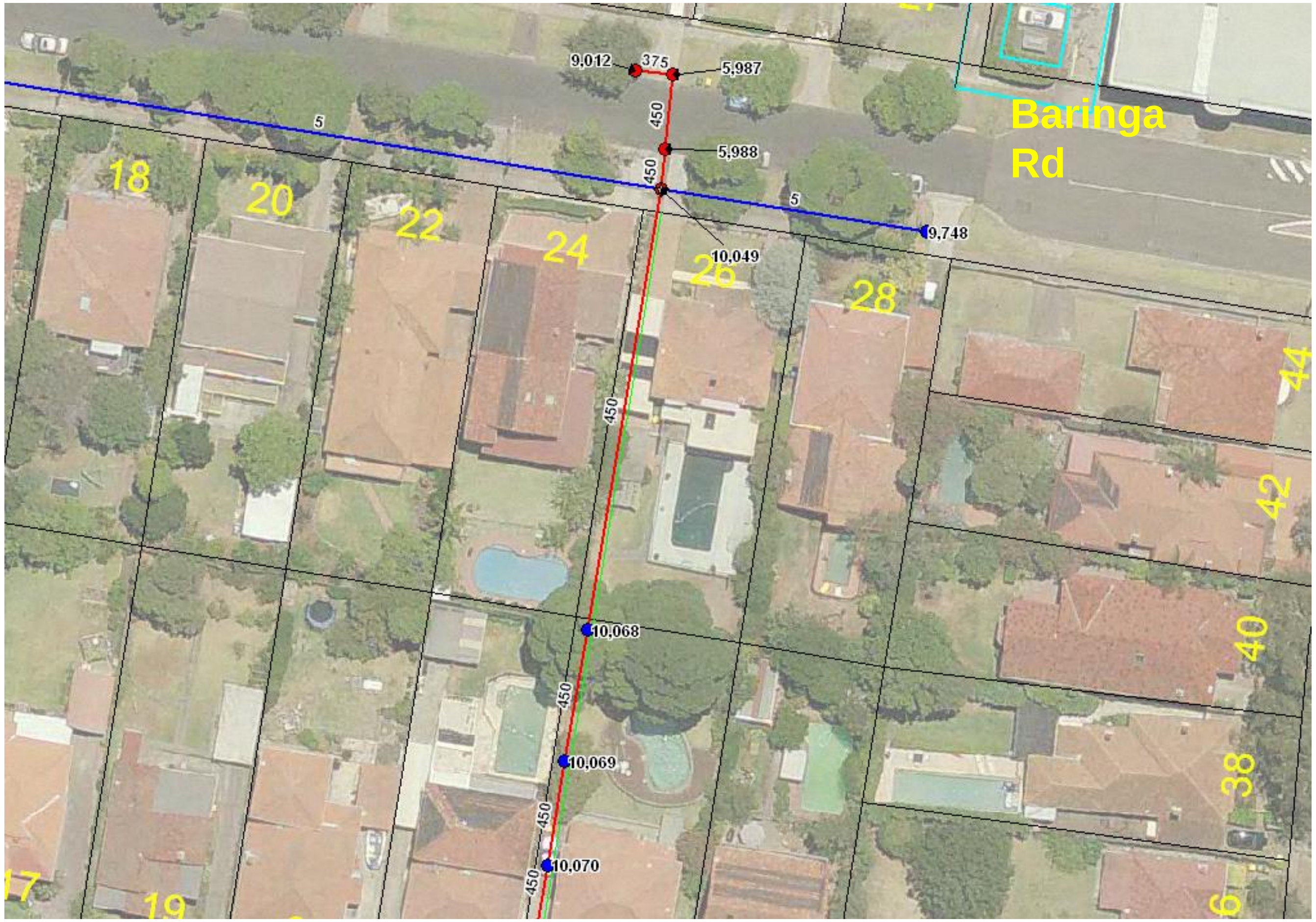
Based on the risk scores, the second conduit has higher priority than the first conduit even though both of them have the same risk rating.

References:

IPEWA Condition Assessment & Asset Performance Guidelines - Practice Note STORMWATER DRAINAGE

Drainage Works Priority provided by North Sydney Council

16. Appendix I - Stormwater worksheet example



Project No.	XXXX
Asset	10049-10068
Length Affected (m):	46.3m
Location:	24 Baringa Rd, Northbridge
Primary failure mode:	Invert erosion – Major
Conduit Type:	Pipe
Conduit Size (mm):	450mm

	Likelihood						Consequence		
Factors	Asset condition rating	Location of conduit	Loading on conduit	Land use impact on conduit	Conduit within 5m proximity of large trees	Conduit Material	Cross-sectional area	Property/area affected if pipe fails	Impact of flooding on downstream area/properties
Description		longitudinal within 0.5m of K&G	Private Property	Other	Other	Concrete	375-900mm diameter	Large or more than two Residential properties affected downstream	Under habitable, commercial building
Score	4	4	1	0	0	1	2	4	2
Total	10						8		
Riak Level	VH / H / M / L								

Likelihood x Consequence	80

Initial Recommendation:	Reconstruct / Reline / Point Repair / No Work Required Recommendation by: Ron / Dennis Conduit upgrade to be considered? Y / N Comments:
If conduit upgrade possible as above, is upgrade recommended for hydraulic reasons? Y / N If yes, prepare detailed construction plan.	Recommended upgraded size (mm): Reason for upgrade OR reason for not upgrading?
Recommended scope of works / comments:	
Detailed construction plan required / Basic construction GIS plan required	

Comments: