PUBLIC SAFETY AT CATCHPITS – LESSONS FROM TRAGEDY

J. Reddish (WSP Opus), C. Mountjoy (Auckland Council), D. Blackburn-Huettner (Auckland Council)

ABSTRACT

On the 3rd June 2017 a young girl lost her life in a road catchpit in Favona, South Auckland, the second catchpit death in New Zealand following the death of a man in 2012 in a car park in Wellington. Both incidents were linked to members of the public seeking to retrieve personal items dropped into a catchpit. Auckland Council has no appetite for risks that *compromise the health, safety, and wellbeing of, or cause harm to staff, customers or the community (Auckland Council Risk Management Framework)*.

Auckland Council has an active programme of assessing hazards and risk associated with its stormwater network. A tool has been developed to standardize the assessment process and assign a hazard risk score to each asset. This assists by ensuring that the highest risk assets in each asset class are identified for appropriate safety upgrades. A substantial annual budget is allocated to upgrading assets to mitigate the identified risks. Since 2013, a programme to assess and address safety risks for stormwater ponds, manholes, open lined channels and culvert inlets and outlets has been in place.

Following this tragic death, Auckland Council and Auckland Transport undertook a review into safety at catchpits. The review is a natural progression of the Council's well-developed hazard and risk assessment programme. The completed review provided a holistic approach considering all risks, and importantly that a risk is not unacceptably increased in order to decrease another. It assessed public and operational safety risk – identifying factors influencing other key risks such as missing or dislodged catchpits, surface water catchpit hazards, and hazards to operational staff when maintaining catchpits.

The outcome of the assessment identified potential improvements to catchpit grate design – making them only openable with a special tool, similar to manholes; improvements to catchpit back entry; and ensuring a safety in design process is undertaken when selecting and locating catchpits. The difficulty in predicting the location of the future catchpit hazards means making an evidence-based decision on where to retrofit additional safety interventions cannot currently be done with confidence. Education of the community on the hazards associated with catchpits is also an important part of risk reduction, as is continually reviewing maintenance health and safety procedures with consideration of both maintenance staff and the public.

Auckland Council and Auckland Transport are implementing recommendations from the catchpit safety review. Sharing the lessons from this tragic incident is a critical step to help avoid a similar event occurring in the future.

KEYWORDS

Catchpit, cesspit, Health and Safety, Safety in Design, Auckland Council, Auckland Transport, risk assessment

PRESENTER PROFILE

James is WSP Opus Technical Principal for Catchment Management. He has over 18 years of experience across the water sector in both New Zealand and the UK. He works across all aspects of the stormwater industry, from strategic policy level guidance, catchment management, hydraulic modelling, through to detailed design and construction. He is the current Chair of the Water New Zealand Stormwater Group Committee.

1 INTRODUCTION

On the 3rd June 2017 a 17 year old girl lost her life in a road catchpit in Favona, South Auckland, the second catchpit death in New Zealand following the death of a man in 2012 in a car park in Wellington. Auckland Council has no appetite for risks that *compromise the health, safety, and wellbeing of, or cause harm to staff, customers or the community (Auckland Council Risk Management Framework)*.

Auckland Council has an active programme of assessing hazards and risk associated with its stormwater network. A tool has been developed to standardize the assessment process and assign a hazard risk score to each asset. This ensures that the highest risk assets in each asset class are identified for appropriate safety upgrades. A substantial annual budget is allocated to upgrading assets to mitigate the identified risks. Since 2013, a programme to assess and address safety risks for stormwater ponds, manholes, open lined channels and culvert inlets and outlets has been in place.

Following this tragic death, Auckland Council and Auckland Transport undertook a review into safety at catchpits. The review is a natural progression of the Council's well-developed hazard and risk assessment programme.

One of the recommendations from the catchpit safety review was that *Auckland Council communicate the findings of this report to other local authorities, who could consider how the risk profile may change with their 'standard' catchpit.* This paper presents the findings of the study so that other asset owners may take action, with the aim of avoiding a similarly tragic event occurring again.

2 CATCHPITS IN NEW ZEALAND

2.1 Catchpits in Auckland

There are approximately 118,000 catchpits in the Auckland Region, managed by Auckland Transport and Auckland Council in accordance with the Local Government Act (Auckland Council) 2009 (LGA).

A typical road catchpit is shown in Figure 1. This catchpit has been in use in Auckland for over half a century. Over the last 10-15 years a larger variety of catchpit types have developed in response to a need for improved hydraulic performance and due to changing road use e.g. cycle friendly grates. Auckland Council and Auckland Transport currently specify five different types of catchpits as suitable for public infrastructure.

Figure 1: Typical Auckland road catchpit

"Standard" 675mm x 450mm catchpit grates are now only manufactured as Class D – with a grate weighing 62.5kg. Class D catchpits are manufactured to comply with the Class D loading requirements in AS3996 - Access Covers and Grates. **Many of the catchpits historically supplied in the Auckland Region were not required to comply with this load class and therefore a variety of "standard" weights exist.**
CATCHPIT DESIGN AND SAFETY IN NEW ZEALAND

Local authorities in New Zealand specify catchpit design standards. The design standards are based on performance criteria for catchpits which consider ability to capture runoff; vehicle and bicycle safety in relation to the grate; structural strength and design life. Most catchpit designs incorporate a confined sump for the retention of silt and road gravel, which generally remains water filled and presents a drowning hazard when the grate is removed.

A variety of catchpit sizes and configurations are now available across the New Zealand market, from small, plastic grates typically used in private property, through to large reinforced concrete 'megapit' devices used to drain larger catchments or high risk flooding areas. M**ore than 24 different variations of 'standard' road catchpits are available. In most cases catchpit variations are manufactured in response to modest regional variation in specifications.**

The inherent weight of the grate is the safety design factor for restricting ease of access. Most existing catchpits grates are cast iron (CI) which has been used for many years. Some new catchpits are being manufactured with ductile iron (DI). This is due to the inherent strength of DI making it more suitable for higher load rating situations, such as container terminals, ports or transport warehouses. Ductile Iron has much more impact and fatigue resistance as opposed to the brittleness associated with CI. DI grates are generally lighter than CI grates and is often also used for 'cycle friendly' grates. Grates manufactured in the last 10-12 years are cast with bolt holes to enable them to be fixed in place to reduce theft.High capacity catchpits (e.g. megapit) are being manufactured with galvanised steel grates.

3 CURRENT PUBLIC CATCHPIT SAFETY PRACTICE

Catchpits in Auckland are safe stormwater treatment devices especially when compared with manholes, culverts, or pipe inlets/outlets due to several factors:

- Presence of open grilles allows the hydraulic pressure to be released even during a high rainfall event without causing the lid to be lifted off (unlike a solid manhole lid.
- Most existing catchpit grates around Auckland are made of cast iron and weigh around 48kg. The heavy weight makes them less accessible to public thereby reducing the likelihood of being lifted.

Catchpits are subject to significant wear (particularly from vehicles) and like all infrastructure will degrade over time and require renewal. The following list details typical modes of failure which may lead to safety hazards for members of the public and / or maintenance workers:

- Blockage - such as from accumulation of debris or litter;
- Damage – such as from material fatigue (wear and tear), incorrect maintenance procedures, or intentional vandalism;
- Stolen or missing grates;
- Unauthorised access – and being left open or replaced incorrectly;
- Grate becomes jammed preventing access for maintenance / repairs;
- Back entry becomes damaged (e.g. from vehicle collision).

New Zealand local authority design standards sampled as part of this study rarely explicitly mentioned **safety** at catchpits. Auckland Transport's Code of Practice is one of the few standards that explicitly refers to the risk of drowning at catchpits.

Countries such as Australia, UK, Canada, USA appear to follow similar design standards and have similar safety protocols. UK standard *BSEN124-1: 2015 - Gully tops and manhole tops for vehicular and pedestrian access* and *Austroads* standard in Australia explicitly reference child safety with respect to catchpits. The outcome of the standard is a similar design standard as applied in the Auckland Region, however the standard implies a risk assessment would be required to determine whether specific safety measures are required. This is similar to application of the Health and Safety at Work Act 2015 (i.e. safety in design) in New Zealand.

Based on readily available reporting, drowning at catchpits is a relatively rare occurrence. The Favona drowning is the second recent, recorded drowning in New Zealand. Both incidents were linked to members of the public seeking to retrieve personal items dropped into the catchpit. This incident prompted Auckland Council and Auckland Transport to undertake a joint risk assessment to look into the hazards, risks, and potential mitigation.

4 CATCHPIT SAFETY RISK ASSESSMENT

The catchpit safety risk assessment has sought to identify and assess public and operational safety risk associated with a 'standard' catchpits managed / maintained by Auckland Transport and Auckland Council. The study took a holistic approach to ensure

that all risks were considered, and that any other risk was not unacceptably increased in order to decrease another.

Cross-party Working Group workshops developed a risk register containing the identified existing hazards, controls and risk ratings . **In many cases the risk rating for hazards without Existing Controls would be high or extreme.** In all cases, safety risks are lower with Existing Controls in place. **This emphasises the importance of continually reviewing, monitoring, and improving the existing controls**. The importance of Existing Controls is reflected as a recommendation in Section 6.

4.1 Assessment Methodology

Auckland Council's Risk Management Framework has been adopted to assess catchpit safety risk, providing consequence and likelihood scoring criteria. The Framework is only a tool to guide decision making and has some limitations. For example, there is no differentiation between one death and one thousand deaths in the consequence assessment. Health and Safety consequence criteria is shown on Figure 2.

In applying the risk matrix, it is not appropriate to compare one risk to another – each risk should be assessed in isolation to determine whether the residual risk is acceptable (i.e. a High risk may be acceptable for one risk if all possible controls have been applied, but a Moderate risk may not be acceptable for another).

It is unlikely to be practicable to eliminate all risk or achieve a 'Low' score across all risks. Further systems or processes could be put in place to control some risks, however it is not possible to control the freewill of people.

Figure 2: Extract from Auckland Council Risk consequence template

	Insignificant/Level 1	Minor/Level 2	Moderate/Level 3	Major/Level 4	Extreme/Level 5
Financial	No impact on achievement of key performance targets. Business can continue as normal, localised failure only. Financial loss <1% operating budget.	Up to 1% impact on achievement of key performance targets Limited to a single business area of the organisation. Financial loss 1-3% operating budget.	Up to 5% impact on achievement of key performance targets Financial loss 3-6% operating budget	Up to 10% impact on achievement of key performance targets. Financial loss 6-10% operating budget. Impact to multiple and diverse areas of the organisation.	Greater than 10% impact on achievement of key performance targets. Financial loss >10% operating budget.
Skills and knowledge	Permanent staff turnover equal to or 1.25 times industry average Insignificant skill gaps	Permanent staff turnover 1.25 – 1.5 times industry average Few specialist skill gaps	Permanent staff turnover 1.5 – 1.75 times industry average Some specialist skill gaps	Permanent staff turnover 1.7 – double industry average Major specialist skill gaps	Permanent staff turnover is more than double industry average No internal or external specialist skills available
Legal	Council sued for a sum < $10,000	Council sued for > $10,000 < $100,000	Council sued for > $100,000 < $250,000 Complaint to the Ombudsman or other statutory offices	Council sued for > $250,000 < $1,000,000 Legislative non-compliance involving the prosecution or the potential for a fine or a significant criticism of Council by Judiciary or Ombudsman Adverse ruling by the Ombudsman or other statutory officer with power to investigate or make rulings.	Council sued for > $1,000,000 Legislative non-compliance involving the potential for imprisonment of a Councillor or Senior Officer. Judicial review of a Council decision on a matter relating to funding or rates.
Environment (Natural and Built)	Small localised and reversible environmental impact resulting in: • slight, short term damage to (use of) land and/or water • slight short term damage to land and/or water ecosystems • No noticeable species reduction. Occasional inconsistency with the intent of legislation, Auckland Plan, and Council's Mission, Goals and Principles	Contained and reversible (minimal) environmental impact resulting in: • localised minor reversible damage to (use of) land and/or water • localised minor reversible damage to land and/or water ecosystems. • Temporary reduction in one species Minor erosion and/or damage to property. Minor inconsistency with the intent of legislation, Auckland Plan and Council's Mission, Goals and Principles.	Measurable damage to the environment; significant corrective action resulting in: • Localised, medium term reversible damage to (use of) land and/or water • Localised, medium term reversible damage to land and/or water ecosystems. • Moderate reduction in one or more species. Moderate erosion and/or damage to property. Recovery time 1 month. Repeated inconsistency with the intent of legislation, Auckland Plan and Council's Mission, Goals and Principles.	Irreversible localised damage (major) to the environment resulting in: • Widespread long term reversible damage to land (use of) and/or water • Widespread, long term reversible damage to land and/or water ecosystems. • Significant reduction in one or more species. Severe erosion and/or damage to property. Recovery time up to 6 months. Repeated and significant inconsistency with the intent of legislation, Auckland Plan and Council's Mission, Goals and Principles	Extensive irreversible damage (widespread) to the environment resulting in: • Widespread, irreversible damage to (use of) land and/or water • Widespread, irreversible damage to land and/or water ecosystems. • Permanent loss of one or more species. Destruction of property/widespread flooding. Recovery time exceeding 6 months No recognition of the intent of legislation, Auckland Plan and Council's Mission, Goals and Principles.
Health and Safety (*Organisational and External*)	Injury requires first aid treatment, Insignificant discomfort requiring intervention e.g. workstation assessment.	Injury or illness requires treatment by a medical or other registered practitioner.	Injury or illness results in at least three days of lost time. Notice issued by regulator or Health and Safety Representative.	Injury or illness results in thirty days lost time, or a permanent disability. Organisation breaches law resulting in prosecution and penalties	One or more fatalities Considerable penalties and prosecutions. Multiple law suits and jail terms.

4.2 Risk Assessment Findings

The following key findings have been identified during the risk assessment process:

1. The Cross-party Working Group considered that when Existing Controls are in place, catchpits had no High or Extreme residual risks.

2. The likelihood of a person becoming stuck in a catchpit leading to death is considered Rare.

3. Although the most significant risk considered in this study is a member of the public trying to retrieve personal items from a catchpit, there are a number of other risks considered to have a similar risk profile based on the Auckland Council Risk Management Framework:

    a. A person falling into an open or missing catchpit grate when grate/opening is obscured by water
    b. A catchpit grate becoming blocked, causing flooding which leads to drowning on the ground surface
    c. Operation/maintenance staff working in a live road corridor and being struck by a vehicle

The Working Group agreed that it was appropriate to investigate further mitigation measures that could reduce the health and safety risk to the public from catchpits, provided such measures did not unacceptably increase other risks. A summary of the Catchpit Safety Risk Register is shown in Appendix A.

5 CATCHPIT RISK MITIGATION MEASURES

It is not always possible to eliminate risk and after implementing additional controls, as identified within the risk register (Appendix A), some level of residual risk is likely to still exist. Additional Controls have been assessed to determine if they can be practicably implemented to further reduce Residual Risk for each of the hazards.

5.1 ASSESSMENT OF POTENTIAL ADDITIONAL CONTROLS

Figure 3 summarises the process that was followed to identify and evaluate potential additional controls. A summary is provided in Table 1. The complete assessment is included in Appendix B.

Figure 3: Flowchart of additional control evaluation process

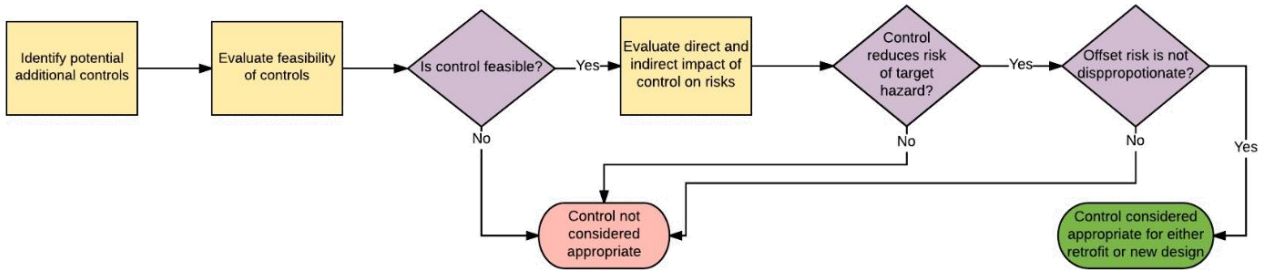

Table 1: Assessment of Potential Additional Catchpit Safety Controls

Potential Additional Control	Outcome of Assessment	Recom-mended
DANGER warning on catchpit back entry Or Contact number for retrieving items stamped on catchpit back entry	Control may provide some reduction in risk likelihood without significant increase of risk to new or other hazards. Some catchpits are already imprinted with a message 'Drains to Sea', or similar. Inappropriate discharge of pollutants into the stormwater system is a significant issue across the Auckland Region. Discharge ends up in streams and at bathing beaches. Although not specifically assessed, the environmental risk associated with inappropriate discharge of pollutants should continue to be communicated to the public. The relative benefit of a health and safety warning imprinted on catchpit back entry is considered smaller than the potential environmental benefit from 'Drains to Sea' imprinted on back entry.	No
Improved public education on catchpit issues/dangers And/or Improved public communication on advising AT/AC of missing catchpits or other hazards	Control may provide some reduction in risk likelihood without significant increase of risk to new or other hazards.	Yes
Remove/replace deciduous street trees that increase blockage risk	Removal of tree will have significant negative impact on streetscape and the environment. Creates significant additional health and safety risks to public and workers removing/replacing large number of trees. The increased risk from this control is considered disproportionate to benefits offered. Consider updating relevant Auckland Design Manual document and / or Auckland Transport Vegetation in Road Corridor Guidelines (currently in draft form) to explicitly consider selection of tree species in areas where a greater risk to the public is identified.	No, however review tree selection guidance
Use more effective inlet catchpits instead of standard catchpits	This control is already undertaken on occasion and it may continue to be appropriate for use on a case by case basis, particularly if undertaken in combination with a grate that can only be opened with a special tool (Ref 14). A site-specific assessment would be required to demonstrate that the benefits offered outweigh the constraints.	Potentially
Improve back entry design to reduce ponding	This control may be appropriate for use on a case by case basis, however requires further design and development to consider feasibility. An assessment would be required to demonstrate that the benefits offered outweigh the constraints and potential increased risks to other hazards.	No, however consider update to Code of Practice.
Avoid catchpits in cycle lanes/high cycle areas	Removal of existing catchpits unlikely to be suitable due to impact on cycleway/road operation and drainage. Control may be suitable for use in new designs on a case by case basis. An assessment would be required to demonstrate that the benefits offered outweigh the constraints and potential increased risks to other hazards. Consider expanding guidance in the Auckland Transport	

Potential Additional Control	Outcome of Assessment	Recom-mended
	Code of Practice to include requirement that designs minimise number of catchpits required in high cyclist traffic areas.	
Use continuous capture inletting or grated channels over conventional kerb and channel	Significant works required in order to replace existing road drainage. Unlikely to be suitable due to increased risk to maintenance contractors and risk posed to public and contractors from associated works. Control may be suitable for use in new designs on a case by case basis. An assessment would be required to demonstrate that the benefits offered outweigh the constraints and potential increased risks to other hazards.	
Install bolts on all catchpit grates (or only on higher priority catchpits)	Control would result in a significant increase of risk to maintenance contractors. Control unlikely to be appropriate for retrofitting or new designs. Suggest use of special tool for achieving the desired outcome from this control (refer control ref. 11)	No
Make catchpits only openable with special tool (like manholes)	This control may be suitable for retrofit on a case by case basis. An assessment would be required to demonstrate that the benefits offered outweigh the constraints and potential increased risks to other hazards. Implementation of control in new catchpit design may offer convenient method of reducing safety risk associated with unauthorised access to catchpit without significant impact of increased risk to new or other hazards.	Yes
Include an insert to capture items dropped down a catchpit	As this intervention does not isolate people from the catchpit, is not designed to provide a health and safety function (unlike a grate) and may encourage access, it is not recommended as a specific health and safety measure. Nonetheless, where a gross pollutant trap (e.g. LittaTrap or similar) can be justified on environmental risk, it is likely to have a health and safety benefit for the public. Other catchpit inserts (e.g. Enviropod or TetraTrap) would not provide the same Health and Safety benefit as they do not isolate gross pollutant (or personal items) within arm's reach.	No
Include an insert to prevent the public getting stuck headfirst (e.g. horizontal bar)	Control may help to mitigate but does not eliminate drowning hazard. This control is considered more difficult to implement relative to others which achieve the same or better outcome (e.g. catchpits openable with special tool). Control likely to have construction risks associated with it (e.g. confined space entry) and increased maintenance requirements.	No
Apply safety in design to the location and type of catchpit	Consider expanding guidance in the Auckland Transport Code of Practice to explicitly require Safety in Design for catchpits.	Yes
Use GIS information gathered on requests for service and catchpit fault to identify issue hotspots	Proactively maintaining known hotspots already occurs with respect to flooding, however there is the opportunity to take this further by considering public health and safety as well as flooding.	Yes
Review and formalize the process for maintenance contractors to report	This control likely to provide reduction in risk likelihood without increase of risk to new or other hazards. Consideration will be required of the impact on maintenance logistics.	Yes

Potential Additional Control	Outcome of Assessment	Recom-mended
and manage missing/damaged grates.		

6 MEASURES TO REDUCE PUBLIC SAFETY AT CATCHPITS

The outcome of the assessment process was a set of recommendations directly related to the tragic catchpit death. Some of these recommendations can be implemented to reduce the risk to existing assets. Some are recommendations for new installations – in particular catchpit selection process. Other safety recommendations were also identified as a result of the process.

6.1 Education

Raising awareness within the community of hazards associated with stormwater assets represents an easy-to-implement intervention which has the potential to reduce the likelihood of hazards related to drowning or falls. However, this control does not eliminate risk and should be considered along with more specific controls for higher priority catchpits.

Auckland Council currently have a process in place for members of the public to request retrieval of lost items in a catchpit as an emergency priority. At the time of the assessment this service was not explicitly advertised on their website although the enquirer is directed to call the 24/7 Council Call Centre. Call centre staff will refer to the i-Know knowledge system for clear instructions to lodge a "request for service" to the Auckland Transport Maintenance contractor. Additionally, Auckland Council have a web page dedicated to stormwater issues including flooding, blockages and missing / displaced assets (although there is no information relating to general safety issues concerning stormwater assets / catchpits).

Both Auckland Council and Auckland Transport currently have a process in place for members of the public to report missing catchpit grates. These reports are treated as an emergency incident and responded to within 1 hour.

Following issue of the Safety Review, Auckland Council and Auckland Transport have prepared a public Communication Plan that sets out how the organisations intend to improve public awareness of catchpit hazards and Council processes. This included:

1. Improved advertising of the service to retrieve lost items from catchpits and reporting missing/damaged catchpits.
2. Communicating hazards – website, schools, social media, "Our Auckland" magazine, events, Council organisation staff and contractors, etc.

The Communication Plan has been successfully implemented, with particular targeting of south Auckland initially, and will be rolled out across the Auckland Region.

6.2 Prioritisation and Feasibility Assessment

The three key risks identified through the risk assessment - A person trying to access a catchpit; a person falling into an open/missing catchpit; and surface water from a blocked catchpit - have been semi-quantitatively assessed by adapting the existing Risk Assessment for Stormwater Assets Tool and creating a GIS-based screening tool to identify higher risk catchpits. The detail of the Tool is outside the scope of this paper, however the Tool is useful in identifying hotspots where catchpits hazards have been

relatively higher over the last 2-3 years. Auckland Council and Auckland Transport intend to use the outputs from the catchpit safety screening tool to inform where further safety interventions should be considered as part of the stormwater asset renewals programme and other capital works projects.

Experience has shown that the initial identification must be confirmed by a detailed site inspection of the catchpits and local environment.

6.3 Grate Design Improvement

Upgrading existing higher priority catchpits so they can only be opened with a special tool represents an opportunity to isolate the public from the risk of drowning or falls associated with standard catchpits. This technology already exists in some overseas catchpits, however is not currently available for catchpits sold in New Zealand. This control may be suitable for retrofit to existing catchpits on a case by case basis. Discussion with suppliers has confirmed that replacement of both the catchpit grate and frame would be required.

These types of locking mechanisms can prevent unauthorised access to catchpit units, without introducing a health and safety risk to maintenance contractors. Although products do exist using this type of mechanism, no product currently exists on the market for standard catchpits.

Auckland Council have installed and are trialling a spring bar locking catchpit at two locations in South Auckland (refer Appendix B for details). With the strong support of the Local Board, a further 160 catchpits in the central Mangere area have been identified for an extended trial and installation of these is now completed.

.

Subject to a successful trial, Auckland Transport and Auckland Council will continue to work closely with suppliers to prepare a suitable specification and update the associate Code of Practice(s).

6.4 Upgrading Catchpits

Upgrading existing catchpits represents an opportunity to improve public safety at the same time as achieving other catchment management or road corridor objectives. For example:

1. Upgrade to a Street Catchpit or Megapit (which have very large inlet capacity) to reduce blockage-related risks, likelihood of catchpit damage, flooding and cycle hazard.
2. Upgrade to a Splaypit (which has no horizontal plane opening and no grate) to eliminate cycle hazards, isolate the public from drowning/falls, and reduce blockage-related risks and flooding.
3. Upgrade existing catchpits to include a LittaTrap to reduce gross pollutants entering streams and bathing beaches, whilst providing a means to capture personal items that may have dropped through the grate. However, this is not recommended as a safety measure in isolation.

These controls may be appropriate for use on a case by case basis. Images of these assets are included in Appendix C. A site assessment would be required to demonstrate that the benefits offered outweigh the constraints and potential increased maintenance. Use of splay catchpits at a particular site is sometimes limited as they can take up more space and have the potential to clash with existing utilities.

6.5 New Catchpit Installations - Code of Practice

The catchpit safety review found that Auckland Council and Auckland Transport are managing safety around catchpits in a similar manner relative to other local authorities around New Zealand, and internationally. Catchpit risks to the public, whether from access, blockage or cycling, could be kept as low as reasonably practicable at the design stage through application of Safety in Design.

6.6 Maintenance Operation Practices

Managing risk assumes Existing Controls are applied and operating effectively. Without them risk would be significantly higher. In light of the increased awareness of safety at catchpits, health and safety procedures in relation to catchpit maintenance should be reviewed for opportunities to reduce the health and safety risk to the public and maintenance contractors. This could include:

1. Review and formalise procedures for maintenance contractors to follow in the event they find a missing or damaged catchpit grate. Procedure should be established such that when a missing / damaged catchpit is found by maintenance contractors, the catchpit is made safe prior to moving on with catchpit maintenance.

2. Auckland Council currently maintain a register of reported catchpit faults which are linked to their asset ID in GIS. This data could be used to identify high priority catchpit hotspots where Additional Controls or proactive maintenance/inspection can be implemented.

3. A quality assurance loop to audit how well Existing Controls are working.

6.7 OTHER SAFETY RECOMMENDATIONS

The current standard catchpit design has a minimum 50mm back entry inlet, however this narrows significantly below the grate frame. Auckland Transport are working with suppliers to identify how the back entry on the standard catchpit could be improved to reduce the safety risks associated with blockage causing surface water ponding.

Although removal and replacement of all deciduous street trees that result in catchpit blockage is not considered practicable, the Auckland Transport Vegetation in Road Corridor Guidelines will be updated to include *a requirement to consider selection of tree species that practically minimises damage from root systems or leaf fall in order to reduce the risk of blockage and surface water hazards*.

7 CONCLUSIONS

Existing Controls do significantly reduce the safety risk to the public and operators. Most notably the catchpit grate itself is an Existing Control which helps to isolate the public from drowning and fall hazards. The Existing Controls, coupled with the extremely rare

occurrence of serious incidents, mean catchpits are, when used as designed and intended, safe devices.

Although lighter catchpit grates, such as ductile iron, or smaller grates may provide benefits such as improved strength or easier maintenance, they are also lighter, potentially making them more easily removed by the public. Bolting catchpit grates to frames is not considered a practicable solution as it increases health and safety risk to maintenance staff.

Despite implementing Existing Controls, due to the inherent nature of risk management it is often not possible to completely remove risks. Further to this, risk can change with time and environment, and controls should be regularly reviewed and updated. The catchpit safety review identified potential Additional Controls which may further reduce residual risks associated with catchpit safety hazards.

Additional Controls identified included potential improvements to catchpit grate design – making them only openable with a special tool, similar to manholes; improvements to catchpit back entry; and ensuring a safety in design process is undertaken when selecting and locating catchpits. Education of the community on the hazards associated with catchpits and providing an easy means of retrieving personal items from catchpits via a call to the Council is also an important part of risk reduction, as is continually reviewing maintenance health and safety procedures with consideration of both maintenance staff and the public.

Auckland Council and Auckland Transport are implementing recommendations from the catchpit safety review. Sharing the lessons from this tragic incident is a critical step to help avoid a similar event occurring in the future.

ACKNOWLEDGEMENTS

WSP Opus and Auckland Council would like to acknowledge the family of Violet Tupou, who so tragically lost her life.

REFERENCES

1. Opus International Consultants (2017) - 1. *Royalpark Place Catchpit Safety Review: Stage 1*.
2. Opus International Consultants (2017) – 2. *Catchpit Safety Review Stage 2: Risk Assessment.*
3. WSP Opus (2018) – *Catchpit Safety Review Stage 3: Catchpit Risk Assessment Tool.*
4. Auckland Transport (2013). *Auckland Transport Code of Practice*. https://at.govt.nz/about-us/auckland-transport-code-of-practice [downloaded: 30th October 2017].
5. Auckland Council. Risk Management Framework (provided September 2017).

APPENDIX A – SUMMARY RISK REGISTER

Ref ID #	Hazard Description	Impact	Existing Controls[1]	Likelihood	Consequence	Residual Risk Rating (RAG)
1	**Public Hazards**					
1.1	Child trapped on catchpit inlet during storm event	Could lead to injury	Catchpits cleaned twice per year, or on public call out to minimise risk of blockage. Requirements for spacing of new catchpits within Code of Practice (Auckland Transport, 2013).	1	3	Low
1.2	Person tries to open catchpit grate	Could lead to injury	Heavy catchpit grates used to mitigate against unauthorised access, makes opening difficult. Some catchpit grates are lockable.	3	3	Moderate
1.3a	Person attempts to retrieve item without becoming stuck	Could lead to injury	Heavy catchpit grate makes opening difficult.	5	1	Moderate
1.3b	Person attempts to retrieve item and becomes stuck	Could lead to death/injury via drowning or lack of oxygen	Existing system in place to enable public to contact Auckland Council and have item retrieved by maintenance personnel.	1	5	Moderate
1.4	Contact with contaminated water in catchpit sump	Could lead to illness/disease	Public isolated from sump by catchpit grate.	1	2	Low
1.5	Person falls into open/missing catchpit grate	Could lead to injury	Catchpits inspected 6-52 times per year depending upon road service level. Catchpits cleaned twice per year, or on public call out. AC/AT emergency response procedure to replace grate on public notification.	1	3	Low
1.6a	Person falls into open/missing catchpit grate when it is obscured and full of water during or immediately after a storm event.	Could lead to death (child)/injury	Catchpits inspected 6-52 times per year depending upon road service level. AC/AT emergency response procedure to replace grate on public notification	1	5	Moderate
1.6b	Person trips on dislodged/damaged catchpit grate when it is obscured and full of water during or immediately after a storm event.	Could lead to injury	Catchpits cleaned twice per year, or on public call out. AC/AT emergency response procedure to replace grate or clear blockage on public notification.	1	3	Low
1.7	Blocked catchpit grate/back entry leads to water depth hazard on ground surface	Could lead to death/injury/illness (e.g. for	Catchpits inspected 6-52 times per year depending upon road service level.	1	5	Moderate

Ref ID #	Hazard Description	Impact	Existing Controls[1]	Likelihood	Consequence	Residual Risk Rating (RAG)
		child)	Roads swept a minimum of 3 times per year. Catchpits cleaned twice per year, or on public call out.			
1.8a	Blocked catchpit inlet reduces performance of drainage network increasing the likelihood of flooding on road other than high speed road (<50km/h) leads to loss of control of vehicle or accident as a result of evasive action from driver	Could lead to injury[2]	Catchpits inspected 6-52 times per year depending upon road service level. Roads swept a minimum of 3 times per year.	1	3	Low
1.8b	Blocked catchpit inlet on high speed road (>50km/h) leads to loss of control of vehicle or accident as a result of evasive action from driver	Could lead to injury[2]	Catchpits cleaned twice per year, or on public call out.	1	3	Low
1.9a	Cyclist accident due to open/missing/dislodged/damaged catchpit grate	Could lead to injury[2]	Catchpits inspected 6-52 times per year depending upon road service level. Roads swept a minimum of 3 times per year. Catchpits cleaned twice per year, or on public call out. AC/AT emergency response procedure to replace grate on public notification.	1	3	Low
1.9b	Cyclist accident on unsafe catchpit arrangement/grate	Could lead to injury[2]	Auckland Transport Code of Practice[1] specifies cycle friendly grates to be installed in all new road construction and progressively across network (refer Section 13.5.7).	1	3	Low
1.10a	Vehicle accident on open/missing/dislodged/damaged catchpit grate – 2 Wheel Vehicle	Could lead to injury[2]	Catchpits inspected 6-52 times per year depending upon road service level. Roads swept a minimum of 3 times per year. Catchpits cleaned twice per year, or on public call out. AC/AT emergency response procedure to replace grate on public notification.	1	3	Low
1.10 b	Vehicle accident on open/missing/dislodged/damaged catchpit grate – 4 Wheel Vehicle / Bus	Could lead to injury	As per 1.10a. Additionally people wear seat belts (cars only) and have other safety features.	1	2	Low

[1] Auckland Transport Code of Practice - Chapter 13: Cycling Infrastructure Design, 2013

Ref ID #	Hazard Description	Impact	Existing Controls[1]	Likelihood	Consequence	Residual Risk Rating (RAG)
1.11	Damaged cast iron back entry – sharp edges	Could lead to injury	Catchpits inspected 6-52 times per year depending upon road service level.	1	2	Low
2	**Operations & Maintenance**					
2.1a	Contractor hurt trying to open catchpit grate while using T-bar tool	Could lead to injury	Catchpit T-bar tool, H&S training on Manual Lifting and correct PPE designed to reduce the chance of injury	1	3	Low
2.1b	Contractor hurt trying to open catchpit grate without using T-bar tool	Could lead to injury	H&S training on Manual Lifting and correct PPE designed to reduce the chance of injury	1	3	Low
2.2	Repetitive strain from opening multiple grates	Could lead to injury	Catchpit T-bar tool designed to reduce the chance of injury. Workload management.	1	3	Low
2.3a	Maintenance worker struck by vehicle in live road corridor while maintaining catchpit.	Could lead to injury	Left hand drive vehicle, sucker located on left hand side (i.e. operator excluded from live road corridor). Appropriate traffic management plans for the level of road. All operators trained to a minimum of Level 1 traffic controller. Standard operating procedures.	1	1	Low
2.3b		Could lead to injury/death	Right hand drive vehicle, sucker located at rear of vehicle. Appropriate traffic management plans for the level of road. All operators trained to a minimum of Level 1 traffic controller. Standard operating procedures.	1	5	Moderate
2.3c		Could lead to injury/death	Right hand drive vehicle, sucker located on left hand side. Appropriate traffic management plans for the level of road. All operators trained to a minimum of Level 1 traffic controller. Standard operating procedures.	1	5	Moderate

Ref ID #	Hazard Description	Impact	Existing Controls[1]	Likelihood	Consequence	Residual Risk Rating (RAG)
2.4	Malfunctioning or inappropriate use of sump cleaning equipment/truck	Could lead to injury/illness	Appropriate training/qualification/certification of personnel prior to use.	1	3	Low
2.5	Confined Space with water hazard	Could lead to injury	Correct application of work procedures and strict adherence to health and safety procedures	1	3	Low
2.6	Contact with contaminated water/debris from catchpit sump	Could lead to illness/disease	Appropriate PPE and training/qualification/certification of personnel prior to use. Maintenance contractors provided with access to first aid equipment, water, sanitiser, etc.	1	3	Low
2.7	Fall/stuck in open/dislodged/damaged catchpit	Could lead to injury	Correct application of work procedures and strict adherence to health and safety procedures	1	3	Low
2.8	Contractor damages / breaks grate / lid during catchpit maintenance	Could lead to injury	Contractor educated on correct maintenance procedures. Maintenance requirements considered in catchpit design.	1	3	Low

[1] Where applicable refer to Section 2.3 of the Catchpit Safety Review Report – Stage 2 regarding consultation with Auckland Council and Auckland Transport on maintenance and reporting schedules

2 Review of data provided from Auckland Transport has shown that no recorded deaths or serious injuries occurred in 2016 as a result of the specific hazard. Therefore, AT consider that consequence rating of 3 is appropriate. As further data becomes available these risks should be reviewed.

APPENDIX B – EXAMPLE LOCKABLE CATCHPIT GRATE PHOTOS


Date: 19 October 2017
Location: 13 Derrimore Heights, Manukau
Supplier: Pipe and Infrastructure
Description: Prototype stormwater grate - release of torsion bar using retrofitted maintenance t-bar


Date: 19 October 2017
Location: 13 Derrimore Heights, Manukau
Supplier: Pipe and Infrastructure
Description: Prototype stormwater grate - release of torsion bar using retrofitted maintenance t-bar


Date: 19 October 2017
Location: 13 Derrimore Heights, Manukau
Supplier: Pipe and Infrastructure
Description: Prototype stormwater grate - retrofitted to existing stormwater sump. installed adjacent to existing standard catchpit

APPENDIX C – EXAMPLE NON-STANDARD CATCHPIT ASSETS

Figure C1:Example MegaPit

Image Courtesy of Hynds

Figure C2: Example SplayPit

Image Courtesy of Hynds

Figure C3: Example Littatrap Catchpit Insert

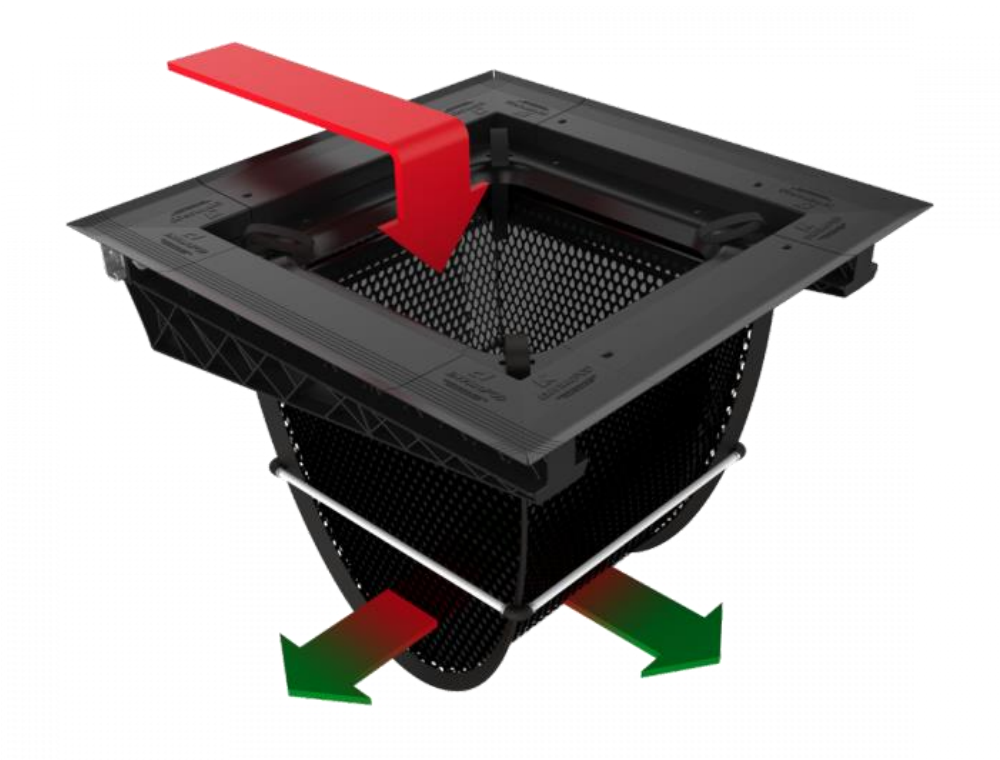

Image Courtesy of Stormwater360