




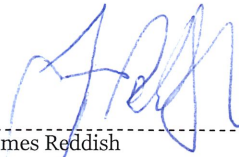
**Royalpark Place
Catchpit Safety
Review
Stage 1**



Royalpark Place Catchpit Safety Review

Stage 1

Prepared By


 

Amanda Dewasara/James Reddish
Graduate Environmental Engineer/Principal
Environmental Engineer

Opus International Consultants Ltd
Auckland Environmental Office
The Westhaven, 100 Beaumont St

PO Box 5848, Auckland 1141
New Zealand

Reviewed By

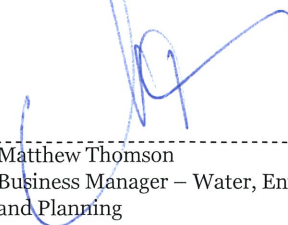


Annise Raea
Work Group Manager – Water Resources and
Land/Water Management

Telephone: +64 9 355 9500
Facsimile:

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Approved for
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Matthew Thomson
Business Manager – Water, Environmental Services
and Planning

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Executive Summary

The purpose of this report is to undertake a technical review of the catchpit linked to the tragic death of a young woman on 3rd of June 2017 in a road catchpit on Royalpark Place in Favona, Mangere.

Following this incident, a Terms of Reference was developed and agreed between Auckland Council and Auckland Transport to determine the scope of the review. This report has followed the scope of the Terms of Reference (dated 6th July 2017) as follows:

1. Technical overview of the road catchpit involved in the incident.
2. Research and review of previous similar incidents both nationally and internationally
 - a. Learnings
 - b. Responses
3. Review of current best safety practice
 - a. Literature/internet review of current and best safety practice with respect to street catchpits by reviewing design standards, codes and policies from around NZ and selected international examples
4. Summary of relevant Auckland Council and Auckland Transport policies, technical standards and practices
5. Findings

Catchpits across New Zealand typically incorporate the same features, however there is a wide range of catchpit grate and back entry arrangements available in the market. **The catchpit at Royalpark Place involved in the recent drowning was typical of catchpits found across the Auckland Region**, with a 675mm x 450mm cast iron grate, 100mm back entry, and 1.25m deep structure and approximately 340mm deep sump below the outlet, that would result in a 340mm permanent water depth in the sump. **The catchpit grate weight of 48kg indicates it is Class C (or equivalent)**, which was commonly used across Auckland. **This standard type of catchpit is now only manufactured as Class D (based on loading requirements), weighing 62.5kg. Lower class catchpits are no longer manufactured for the Auckland market, however many are still in use across the Region.**

There are approximately 118,000 catchpits across the Auckland Region managed by Auckland Council and Auckland Transport. Catchpits in Auckland by nature are safe stormwater treatment devices especially when compared with manholes, culverts, or pipe inlets/outlets. Missing catchpit grates are treated as an emergency incident and responded to within 1 hour. Auckland Council will retrieve items lost down a public drain or catchpit at no charge within 4 hours.

Based on readily available reporting, **drowning at catchpits is an extremely rare occurrence**. The Royalpark Place drowning is the second recent, recorded drowning in New Zealand associated with a catchpit. Both incidents were linked to members of the public seeking to retrieve personal items dropped into a catchpit. **It is therefore appropriate for the hazards, risk, and potential mitigation to be further reviewed (i.e. a catchpit risk assessment).**

The review of customary practice of Councils around the country indicates **Auckland Transport's Code of Practice is one of the few standards that refer to the risk of drowning at**

catchpits. The review has shown that **Auckland is managing safety around catchpits in a similar manner in comparison to other local authorities around New Zealand, and internationally. The UK standard and Austroads standard in Australia explicitly references child safety with respect to catchpits.** The outcome of these standards is a similar design approach as applied in the Auckland Region, however the UK 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. **The role of Safety in Design in catchpit specification can be considered as part of a further catchpit risk assessment.**

Suppliers can and do offer a range of measures that could be taken to reduce safety risk to the public at catchpits, such as back entry grilles, alternative sump designs, bolting down, litter traps, retrofitted safety grates, or operational response procedures. **The suitability of these measures should be reviewed as part of a further risk assessment, however they will need to be considered in the context of potential to increase other risks, such as public safety due to flooded streets or operator safety in maintaining catchpits.**

1 Introduction

The purpose of this report is to undertake a technical review of the road catchpit linked to the tragic death of a young woman on 3rd of June 2017 in a road catchpit on Royalpark Place in Favona, Mangere.

Following this incident, a Terms of Reference (Appendix B) were developed and agreed between Auckland Council and Auckland Transport to determine the scope of the review. This report has followed the scope of the Terms of Reference (dated 6th July 2017) as follows:

1. Technical overview of the road catchpit involved in the incident.
2. Research and review of previous similar incidents both nationally and internationally
 - a. Learnings
 - b. Responses
3. Review of current best safety practice
 - a. Literature/internet review of current and best safety practice with respect to street catchpits by reviewing design standards, codes and policies from around NZ and selected international examples
4. Summary of relevant Auckland Council and Auckland Transport policies, technical standards and practices
5. Findings

This review is focussed on public safety and not the occupational safety of Council staff or contractors working on or installing or maintaining stormwater catchpits

2 Background

As defined by Auckland Council Glossary of Stormwater Terms March 2016, a catchpit is a stormwater device composed of a grate, small chamber and sediment trap. Catchpits may be owned privately or publicly and are usually associated with drainage of roading or hardstanding areas.

There are approximately 118,000 catchpits in the Auckland Region, managed by Auckland Transport and Auckland Council in accordance with Section 45 of the Local Government Act (Auckland Council) 2009 (LGA). Auckland Transport carry out maintenance work above the grate. All below-grate maintenance work is carried out by Auckland Council Healthy Waters, in accordance with the LGA and Stormwater Bylaw. Approval is required from Auckland Transport and Healthy Waters for any work affecting the road drainage system, as well as from Watercare in combined sewer areas.

2.1 Standard Catchpit Parameters

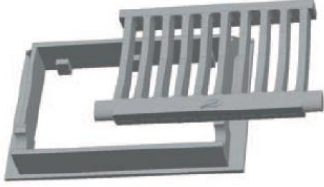
A typical road catchpit is as shown in Figure 2.1. This catchpit has been in use in Auckland for over half a century. Over the last 10-15 years a larger variety of catchpit types have developed in response to a need for improved hydraulic performance and due to changing road use e.g. cycle friendly grates. 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 with galvanised steel grates used to drain larger catchments or high risk flooding areas. Auckland Council and Auckland Transport currently specify five different types of catchpits as suitable for public infrastructure (refer Appendix A).

Figure 2-1: Typical Auckland road catchpit

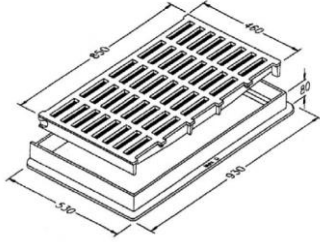


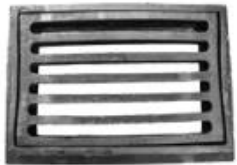




Table 2.1 provides an overview of the types of catchpit grates typically used for road drainage in New Zealand. A wider range of sizes and materials are also available for private drainage.

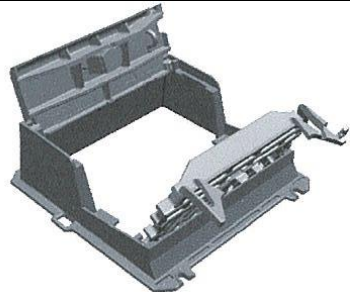

Table 2-1: Typical Grates and Frames

Dimensions (mm)	Grate Image	Catchpit grate type	Catchpit Grate Material	Weight	
				Grate and Frame (kg)	Grate Only (kg)
675 x 450		Auckland Standard (No longer manufactured) Royalpark Place catchpit	Cast Iron		48
		Auckland UBER Hydro	Ductile Iron	72	41.5
		Heavy Duty Class D	Cast Iron	119	62.5
		Whangarei NZTA	Cast Iron	116	64.5

Dimensions (mm)	Grate Image	Catchpit grate type	Catchpit Grate Material	Weight	
				Grate and Frame (kg)	Grate Only (kg)
675 x 580		Bay of Plenty	Cast Iron	122	-
660 x 445		Hamilton CC	Cast Iron	118	60
650x425			Cast Iron	76.8	-
645 x 425		Napier	Cast Iron	93	62
640 x 410		Palmerston North	Cast Iron	73	41
800 x 500		Auckland Manning Grate	Ductile Iron	66.2	47

Dimensions (mm)	Grate Image	Catchpit grate type	Catchpit Grate Material	Weight	
				Grate and Frame (kg)	Grate Only (kg)
		Auckland Tasman Grate	Ductile Iron	61.7	42.5
760 x 410		Manawatu/ Horowhenua	Cast Iron	45	-
615 x 360		New Plymouth	Cast Iron	No frame	45
593 x 387		Dunedin	Cast Iron	130	45
593 x 387		Queenstown	Cast Iron	137	56
585 x 365		Wellington	Cast Iron	71	32

Dimensions (mm)	Grate Image	Catchpit grate type	Catchpit Grate Material	Weight	
				Grate and Frame (kg)	Grate Only (kg)
534 x 355		Invercargill	Cast Iron	85	27
500 x 450		Christchurch	Cast Iron	95	37
450x450		Auckland Field Catchpit	Cast Iron	69	
		Hydro Field Catchpit	Ductile Iron	55	
620x610		Tempo 500A Lay-back - torsion bar locking arrangement	Ductile Iron	44.7	N/A
500 x 680 and 500 x 500		Tempo Kerb (small subdivisions)	Ductile Iron	86	N/A

Dimensions (mm)	Grate Image	Catchpit grate type	Catchpit Grate Material	Weight	
				Grate and Frame (kg)	Grate Only (kg)
620x610		Tempo 500T Straight - torsion bar locking arrangement	Ductile Iron	44.7	N/A
680x500		TempoPlus A Lay-back - torsion bar locking arrangement	Ductile Iron	79	N/A

Note: Not all variations of size shown in Table 2.1 Weights have been provided by catchpit suppliers.

“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 had a correspondingly lower weight** (*telecoms Steve Martin, Hygrade Products, 29/08/17*).

Despite the large variety of catchpit grille types, typical catchpits are predominantly made up of the same features (refer Figure 2.2):

1. A cast iron grate to collect runoff. The grate is heavy, and contractors usually use a specialist tool to enable access for maintenance. Most existing catchpits around Auckland are made of cast iron (CI) which has been used for many years. Some new catchpits are being manufactured with ductile iron (DI). This was 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 cast iron (*email correspondence 31/07/17, Steve Martin, Hygrade Products*). DI is often also used for ‘cycle friendly’ grates and is also generally lighter than cast iron grates (refer Table 2.2). High capacity catchpits (e.g. megapit) are being manufactured with galvanised steel grates. Grates manufactured in the last 10-12 years are cast with bolt holes to enable them to be fixed to avoid theft.
2. A ‘back entry’ inlet to collect higher flows during more intense rainfall events. A minimum 50mm through to a typical maximum of 150mm. Typically these have an opening of 100mm. This opening is consistent with the 100mm spacing for vertical components specified in the Fencing of Swimming Pools Act 1987.

3. A reinforced concrete chamber, typically 1.4-1.8m deep.
4. The chamber includes a sump below the outlet pipe. Silt and sediment within runoff can settle and be collected within the sump, rather than discharge into the downstream environment. The sump is typically 450mm above the floor of the pit, however this can vary depending on the level of the outlet pipe. The sump is normally part full with water.

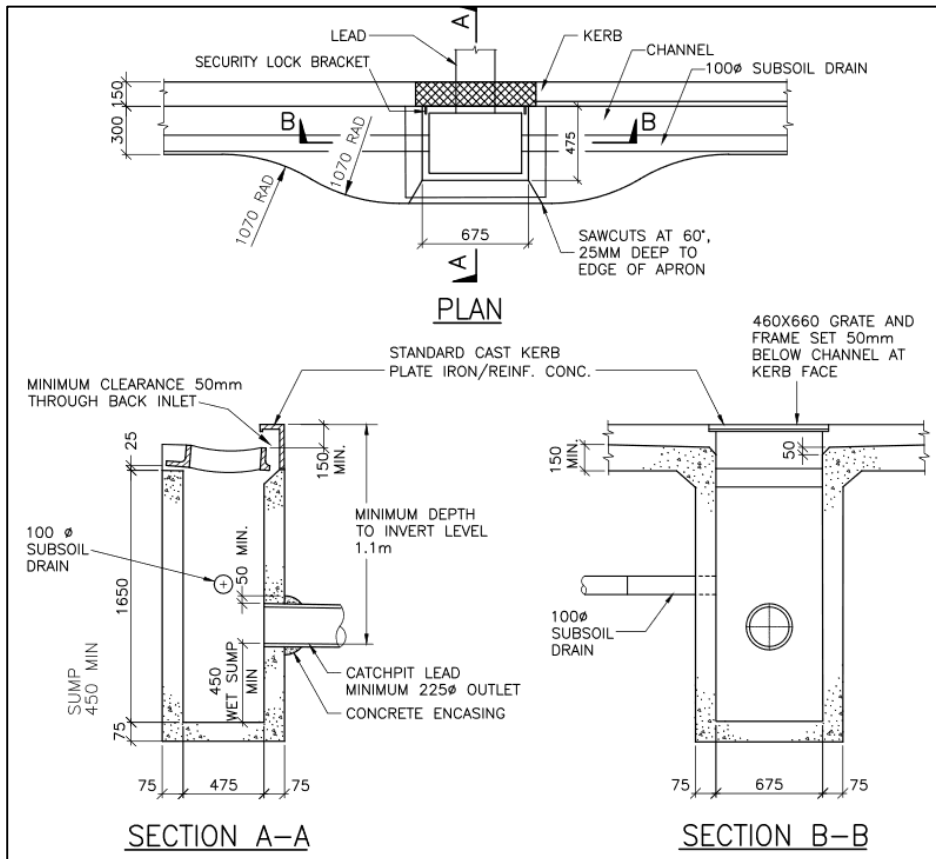


Figure 2-2: Standard Catchpit detail
(Auckland Transport Code of Practice 2013- Road Drainage)

Standard catchpit drawings provided by Auckland Transport are attached in Appendix A.

2.2 Royalpark Place Catchpit

The Royalpark Place catchpit is typical of standard catchpits found across the Auckland Region. The parameters of the catchpit involved in the recent incident are described in Table 2.3. The location consists of two adjacent catchpits (a double catchpit) linked by a small section of pipe.

The catchpit grate weight of 48kg indicates it is effectively a Class C (or equivalent). The standard type of catchpit is now only manufactured as Class D, weighing 62.5kg. The lower class catchpits are no longer manufactured for the Auckland market (telecoms Steve Martin, Hygrade Products, 23/08/17).

Table 2-2: Parameters of the catchpit in Royalpark Place

Parameter	Dimension
Grate Size	675 x 450 mm
Catchpit Box Internal	650 x 450 mm
Grate material	Cast Iron
Grate weight	48 kg
Depth	1.25m (approx)
Sump	340mm (approx)
Back Entry	100mm



Figure 2-3: Photos of the stormwater catchpit involved in the recent incident in Favona, Mangere

2.3 Catchpit Inspection and Maintenance

2.3.1 Inspection and Reporting Programme

Roads are inspected by drive-by vehicle inspection frequently by Auckland Transport, depending upon road hierarchy:

- Regional arterial or collector roads (Service Level 1 to 4) are inspected weekly
- Local roads (Service Level 5) are inspected fortnightly
- Low traffic volume roads (Service Level 6,7 and 8) are inspected bi –monthly.

Any missing catchpit grates are replaced as part of these inspections.

Road sweeping occurs frequently, and at least 3 times per year. Any missing catchpit grates are reported as part of this for replacement.

All catchpits are cleaned twice per year (refer Section 2.2.3). Catchpit maintenance is recorded and date stamped using GPS in an Auckland Council's geospatial dataset.

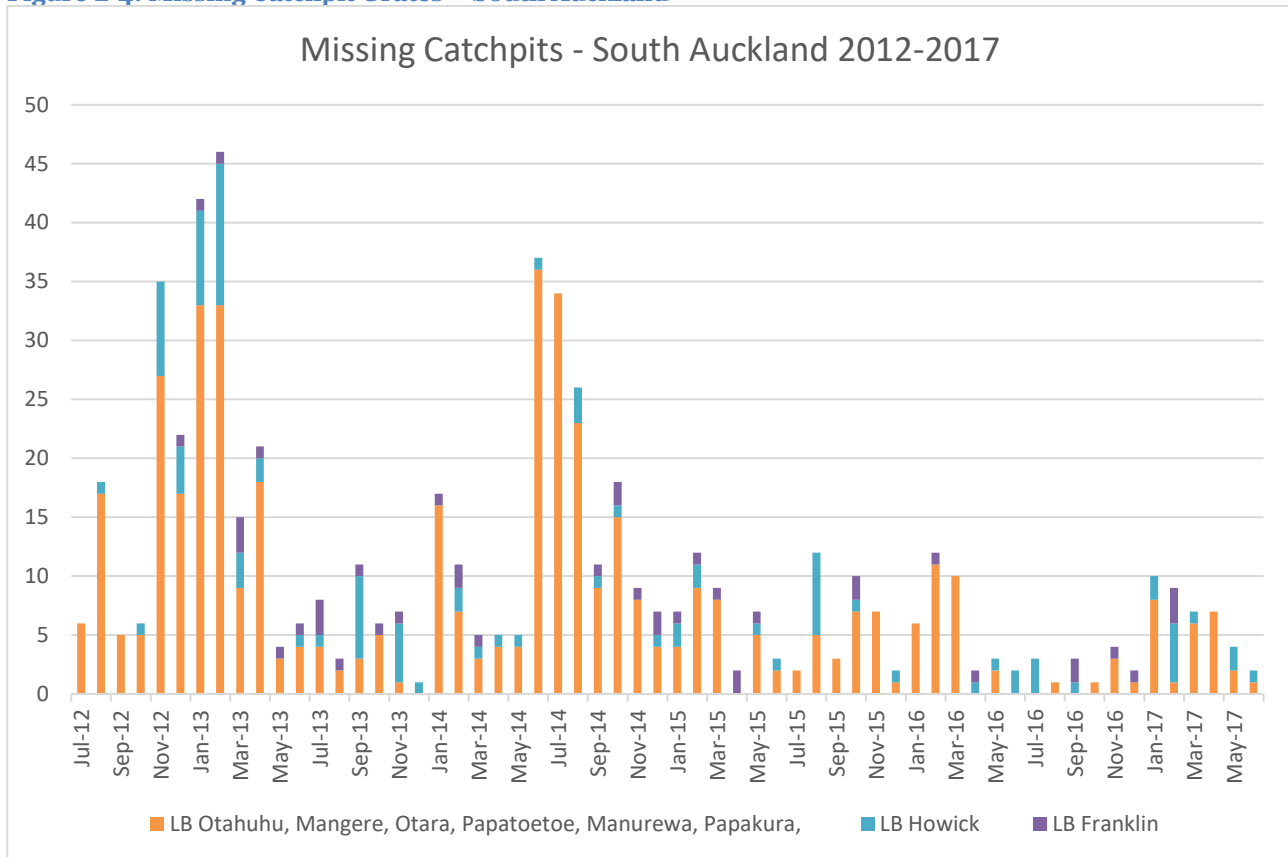
Royalpark Place would be classified as SL6 (local sealed road with low traffic volumes) and would be inspected at least 11 times per year:

- 6 times by Auckland Transport maintenance contractors when they do their routine inspections
- 3 times by Auckland Transport maintenance contractors when they do their road sweeping
- 2 times per year by the Auckland Council Healthy Waters maintenance contractor when they carry out catchpit cleaning.

2.3.2 Missing Grates

Catchpit grates occasionally go missing across the Auckland Region. AT report 599 grates that have gone missing in South Auckland over the last five years (Figure 2.4). There has been a general reduction in number of catchpit grates going missing potentially due to a drop in the price of scrap metal over the same period.

Figure 2-4: Missing Catchpit Grates – South Auckland



Data Source: Auckland Transport, 2017

In addition, Auckland Council Healthy Waters department have replaced 52 missing grates across the region over the same period. Auckland Transport has advised there are approximately 31,500 catchpits in the South Auckland urban area, therefore approximately 0.4% of South Auckland's catchments have gone missing on average per year over the last 5 years.

Missing catchpit grates represent a significant safety risk to the public. If a missing grate is reported by the public, Auckland Transport treat it as an emergency incident and responded to within 1 hour.

2.3.3 Retrieving Items Lost in Catchpits

Auckland Council will retrieve items lost down a public drain or catchpit at no charge. This process involves:

1. A customer contacts the Auckland Council Call Centre.
2. A call centre operator will log a request, including details on the asset and location.
3. The call centre operator will contact the relevant maintenance contractor.
4. The contractor will contact the customer to confirm a time to meet on site.

Auckland Council has a 4 hour response KPI to this request.

This service and process is not explicitly advertised (such as on Auckland Council's website).

2.3.4 Catchpit Maintenance

Catchpit cleaning in Auckland is undertaken by a specialist Roadside Sump Cleaning Vehicle (RSCV) (Figure 2.5).

The usual procedure followed by contractors when cleaning catchpits is:

- a) The RSCV is parked in close proximity to the catchpit.
- b) The grate on the sump is opened by hand using a special tool to hook and pull up the grate.
- c) Next the drop pipe will be lowered into the sump until it gets to the bottom of the sump or to a build-up of sediment.
- d) The vacuum system is turned on and sediment sucked into the lower end of the drop pipe and into the truck until all debris is removed.
- e) If necessary, a water blaster can be used to assist in cleaning the sides of the sump.
- f) When all cleaning has been completed, the grating on top of the sump is replaced.
- g) Sump contents are disposed of at a specialist facility.

Catchpit maintenance is recorded and date stamped using GPS in an Auckland Council's geospatial dataset.

Figure 2-5: Roadside Sump Cleaning Vehicle



According to maintenance records, the Royalpark Place catchpit was last cleaned on 16th March 2017. No faults were reported at this time. No blockages have been reported in the local area over the last five years (email correspondence, Andrew Skelton, 1st August 2017).

3 Previous Public Safety Incidents with Catchpits

This section provides a summary of readily available, relevant, records of previous public safety incidents involving catchpits, including lessons learnt and responses – where these are recorded. It was only possible to find **one recent previous incident involving public safety at a catchpit** in New Zealand or internationally, however it is possible there are more recorded incidents that are not readily accessible for review. There are a number of recent incidents involving the public falling, or being swept into, manholes or inlets. These incidents are not included in this review as they present a significantly different public safety risk.

There have also been incidents involving the public falling into unsecured manholes for telecommunication infrastructure, however these have not been assessed as part of this study as the primary water hazard does not exist.

3.1 Stormwater Catchpit Incident, Barnett Street, Wellington, 14th January 2012

On 14 January 2012, a 43-year-old man drowned after falling into a stormwater catchpit in the car park in Barnett Street, Wellington. Coroner Garry Evans' report stated that the man fell into the stormwater culvert (sic) in an attempt to retrieve his car keys which he had dropped down the culvert. The culvert was covered with a hinged metal grate. He was believed to have lifted the metal grate and reached in for his keys, lost his balance and fell head first into the water. Coroner's report states that Detective Senior Sergeant Thornton had concluded that it was probable the man's judgement at the time he attempted to recover his keys was severely affected by the alcohol he had consumed. His body was recovered by police the next day after a call received from a woman who had parked her car in Barnett Street.

Figure 3-1: Site of drowning.
Image courtesy of stuff.co.nz



Mr. Thornton's report shows the stormwater catchpit had water at a depth of 1.2m. He has stated that the man was unable to extract himself after falling into the culvert (sic) and appeared to have then been asphyxiated by the water in the culvert. A few hours after the incident a parking warden noticed that the metal grate had been lifted exposing the culvert. He had also seen a pair of boots in the drain but did not inspect the boots. He had closed the grate as he was concerned that a member of the public might accidentally fall into the exposed culvert. Coroner Garry Evans had concluded the man's loss of balance and his fall into the open catchpit was related to the alcohol he had consumed and, probably, his tiredness. Thereby **no recommendation was made to Wellington City Council in the circumstances.**

This incident appears to be directly relevant to the current review, concerning a street catchpit.

Wellington catchpits are a different design and configuration to Auckland, but the basic components and corresponding hazards are similar (i.e. confined space and sump with water hazard).

4 Current Catchpit Safety Practice

Road catchpits in New Zealand are generally managed by the Roading/Transport group/department of a local authority, as the vast majority are located on roads. Catchpits located in other land uses (e.g. parks) may be the responsibility of either the stormwater/water department or the parks department of the local authority. Catchpits located in private property are usually the responsibility of the landowner.

Local authorities in New Zealand specify catchpit design standards. The design standards are based on performance criteria for catchpits which consider:


1. Ability to capture runoff;
2. Vehicle and bicycle safety in relation to the grate;
3. Structural strength and design life.

Although there are some design differences, these design standards are generally consistent resulting in broadly similar products being used across the country. New catchpit units used or adopted by local authorities in New Zealand are expected to conform with the local design standard.

During the review of these accepted design standards, particular focus has been placed on general safety measures together with a more detailed review of safety procedures and practices within the asset group of catchpits. A summary of the main catchpit safety procedures and policies for different local authorities in NZ are described in Table 4.1.

Table 4-1: Local and International Safety Procedures and Policies

Standard	Document	Safety Commentary
New Zealand		
Kaipara District Council	Kaipara District Council Engineering Standards 2011	No explicit catchpit safety references or requirements found in this document.
Auckland Council	Stormwater Code of Practice, November 2015	<i>catchpits shall not be placed in the direct path of pedestrian movement.</i>
Auckland Transport (Auckland)	Auckland Transport Code of Practice 2013	<p><i>Provide for the safety of the public from being swept into the stormwater system: openings must not pass an object greater than 100 mm least dimension. Opening must be sufficiently small to prevent entry of debris that would clog the stormwater system, or must include a screening element to protect the discharge pipe from debris entry</i></p> <p><i>Any catchpits located on a road where cyclists may travel close to the drainage channel line must be provided with inlets that are cycle-friendly</i></p> <p><i>Where other catchpit types are used, the grate must be replaced by one that is approved by AT, and the apron must be reshaped to the same profile as the road and the frame must be not more than 5 mm below the level of the road.</i></p>

Standard	Document	Safety Commentary
		<i>Any catchpits in locations subject to foot traffic must be provided with inlets that are pedestrian friendly. This includes paths, plazas, shared use areas and pedestrian crossing areas.</i>
Nelson City Council	Nelson City Council Engineering Standards 2003	It is stated that every inlet to a piped stormwater system needs to be provided with a suitable inlet structure and grill. For deep trap sumps and catchpits, additional protection should be provided against the risk of blockage.
Hamilton City Council	Infrastructure Technical Specifications 2013	No explicit catchpit safety references or requirements found in this document.
Wellington City Council (Wellington Water)	Wellington Regional Standard for Water Services 2012	Although not explicitly covered in their standards, Porirua City Council, and now Wellington Water, regularly retrofit magnetised safety grilles to the catchpit back entry. This is primarily to reduce blockage risk within the downstream stormwater system.
Christchurch City Council	Infrastructure Design Standard- Part 5: Stormwater and Land Drainage 2013	No explicit catchpit safety references or requirements found in this document.
Dunedin City Council	Dunedin Code of Subdivision and Development 2010	No explicit catchpit safety references or requirements found in this document.
International		
Australia	Austrroads Guide to road design- Part 5A: Drainage-Road Surface, Networks, Basins and Subsurface 2013	<p><i>Even though past history has shown the likelihood to be low, the consequences of a child being swept down a flooded kerb and into a stormwater inlet can be extreme.</i></p> <p><i>It should be noted that a maximum clear opening of 88 mm is required where it is necessary to exclude the entry of the torso of a child (based on test procedures in AS 4685.1/2004). Such consideration applies in parks, schools and childcare centres. Consideration should be given to the use of grilles across the drainage pit opening as a prevention measure, if applicable.</i></p>
USA	US Department of transportation- Maintenance of drainage features for safety 2009	<p><i>When bicycle traffic exists, grates should prevent the tires of a bicycle from slipping into and being caught in the grate. Therefore, bicycle safe grates should be used whenever bicycle traffic is expected. With a flush bicycle-safe grate, a bicycle tire cannot get caught in the grate because of the cross pattern of supports which results in only small openings. (Refer Figure 4.1)</i></p>  <p>Figure 4-1: Bicycle safe grate with drop inlet (Pg. 17, US Department of transportation- Maintenance of drainage features for safety)</p>

Standard	Document	Safety Commentary
UK	BSEN124-1: 2015 - Gully tops and manhole tops for vehicular and pedestrian access	<p>Child safety <i>Where required by specific provisions in the place of intended use child safety features and/or devices shall be incorporated in the design of manhole tops and/or gully tops. The resistance of covers or gratings to removal by children shall be met by one of the following means:</i></p> <p><i>a) mass of the individual covers or gratings; b) securing feature; or c) locking accessory</i></p> <p><i>Where a locking accessory or securing feature is used, it shall be designed so that the cover or grating cannot be easily opened with objects readily accessible by children.”</i></p> <p><i>The resistance of covers or gratings to removal by children shall be tested per:</i></p> <ul style="list-style-type: none"> <i>– sufficient mass, or</i> <i>– sufficient pull-out-force.</i> <p>Note: no guidance is provided regarding what constitutes sufficient mass to render the pit safe.</p>
UK	BSEN124-2: 2015 - Gully tops and manhole tops for vehicular and pedestrian access	<p>Durability of effectiveness of child safety characteristics <i>Durability of the child safety characteristics concerning the resistance of manhole tops and gully tops against the removal by children is ensured by re-inspecting the weight or the locking accessory or the securing feature, as appropriate, is still functional after testing the securing in accordance with EN 124-1:2015</i></p>
Canada	Stormwater Management Guidelines for the Province of Alberta 1999	No explicit catchpit safety references or requirements found in this document.

5 Findings

1. Catchpits across New Zealand typically incorporate the same features, however there is a wide range of catchpit grate and back entry arrangements available in the market. There is an increasing trend towards more cycle friendly grates, as well as ductile iron grates, which are lighter than the historically used cast iron grates.
2. **The catchpit at Royalpark Place involved in the recent drowning was typical of catchpits found across the Auckland Region, with a 675mm x 450mm cast iron grate and 100mm back entry. The catchpit grate weight of 48kg indicates it is Class C (or equivalent), which was commonly used across Auckland. This standard type of catchpit is now only manufactured as Class D, weighing 62.5kg. Lower classes of catchpits are no longer manufactured for the Auckland market, however many are still in use across the Region.**
3. Catchpits in Auckland by nature are safe stormwater treatment devices especially when compared with manholes, culverts, or pipe inlets/outlets due to several factors:
 - Presence of safety grilles allows the hydraulic pressure to be released even during a high rainfall event without causing the lid to be lifted off as in the case of a manhole lid.
 - Most existing catchpit grates around Auckland are made of cast iron which weighs around 48kg. The heavy weight makes them less accessible to public thereby increasing public safety.

The increasing trend towards using ductile iron grates makes them more accessible to the public, but is driven by OSH needs of maintenance personnel, coupled with a larger grate for increased water capture (*telecoms Steve Martin, Hygrade Products, 29/06/2017*).

4. Based on readily available reporting, **drowning at catchpits is a relatively rare occurrence**. The Royalpark Place 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. **It is therefore appropriate for the hazards, risk, and potential mitigation to be further reviewed.**
5. The review of customary practice of the former and existing Councils in the Auckland Region included literature/internet based review of design standards, codes and policies from around NZ. **Auckland Transport's Code of Practice is one of the few standards that explicitly refers to the risk of drowning at catchpits**. The review has shown that **Auckland is managing safety around catchpits in a similar manner in comparison to other local authorities around NZ.**
6. A similar outcome was shown after reviewing international standards, codes and policies. Most 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. **The role of Safety in Design in catchpit specification can be considered as part of a further catchpit risk assessment.**

7. Suppliers can and do offer a range of measures that could be taken to reduce safety risk to the public at catchpits, such as back entry grilles, alternative sump designs, bolting down, litter traps, retrofitted safety grates; or operational response procedures. The suitability of these measures should be reviewed as part of a further risk assessment, however will need to be considered in the context of potential to increase other risks, such as public safety due to flooded streets or operator safety in maintaining catchpits.

6 References

Local Council Publications / Design Standards

1. Auckland Council - *Stormwater Code of Practice- Section 3: Design*
2. Hamilton City Council - *Hamilton City Council ITS- Stormwater Section*
3. Christchurch City Council - *Waterways, Wetlands and Drainage Guide 2003, Safety*
4. Christchurch City Council - *Construction Standard Specifications, Part 3: Utility Drainage*
5. Wellington City Council – *Wellington Regional Standards for Water Services 2012*
6. Dunedin City Council - *Code of Subdivision Development August 2010*
7. Tauranga City Council – *Tauranga City Infrastructure Development Code 2011*
8. Kaipara District Council - *Kaipara District Council Engineering Standard 2011*
9. Kapiti Coast District Council - *Subdivision development- Principles & Requirements 2011*

Local Authorities Publications / Design Standards

1. Auckland Transport- *Auckland Transport Code of Practice (ATCOP)- Road Drainage*
2. Auckland Transport- *Auckland Transport Code of Practice (ATCOP)- Road Drainage Drawings*
3. Watercare - *Watercare Code of Practical Land Development Subdivision May 2015*

Local Research Papers & Reports

1. Coroner G L Evans, “Certificate of Findings, Aisling Symes, an infant”
2. Coroner Garry Leslie Evans, “Certificate of Findings, Peter Black”
3. Jonathan E. Jones, James Guo, Ben Urbonas, and Rachel Pittinger, “Essential Safety Considerations for Urban Stormwater Retention and Detention Ponds”
4. MWH, “Stormwater Assets Public Safety Assessments prepared for Hamilton City Council Jan 2011”

International standards / publications

1. Austroads Guide to Road design- Part 5: Drainage- General and Hydrology Considerations
2. Austroads Guide to Road design- Part 5A: Drainage- Road Surface, Networks, Basins and Subsurface
3. Austroads Guide to Road design- Part 5B: Drainage- Road Surface, Networks, Basins and Subsurface
4. Austroads – *Safety Provisions for Floodways Over Roads*
5. US Department of Transportation – A guide for local street and highway maintenance personnel
6. US Department of Transportation – Urban Drainage Design Manual 2009
7. British Standard- BSI Standards Publication 124: 1 2015- Gully tops and manhole tops for vehicular and pedestrian areas
8. British Standard- BSI Standards Publication 124: 2 2015- Gully tops and manhole tops for vehicular and pedestrian areas
9. Queensland Urban Drainage Manual- Volume 1 Second Edition 2007
10. City of Gold Coast Stormwater Safety Education Program
11. Canada- Stormwater Management Guidelines for the Province of Alberta 1999
12. Canada- Municipality of Clarington: Engineering design standard and drawings- revised 2010

Supplier Product Information Sheets

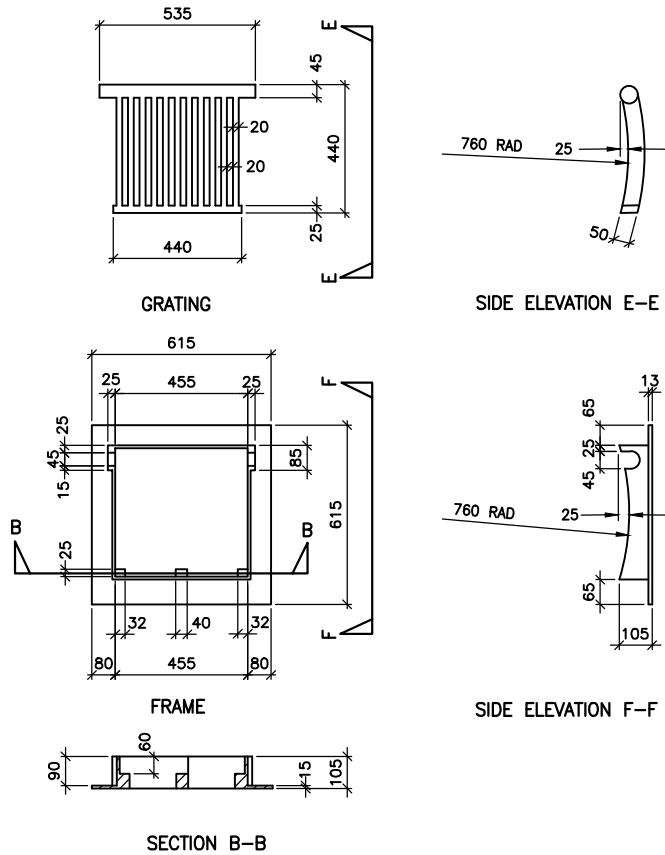
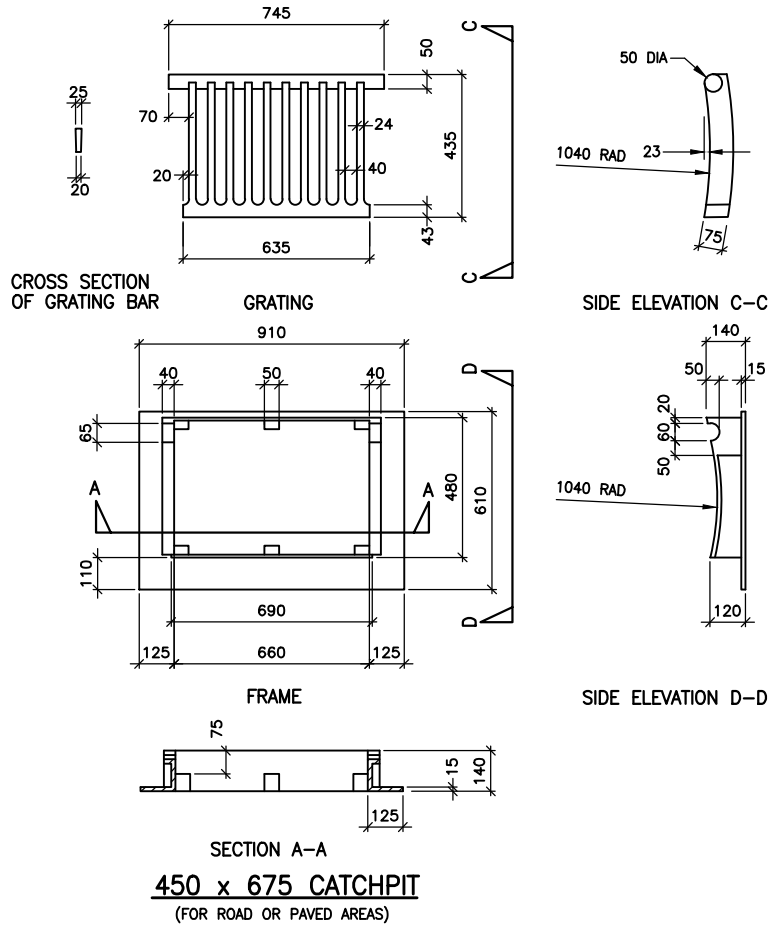
1. Hynds hydro stormwater grate and frame - <http://www.hynds.co.nz/product/hydro-stormwater-grate-and-frame/>
2. Humes frames and grates - <http://www.humes.co.nz/products/frames-and-grates>
3. Technical Guide 5.1- Hynds Cesspit Units Flat Top and Back Entry- <http://www.hynds.co.nz/product/cesspits/>
4. Humes streetwear brochure, <http://www.humes.co.nz/products/frames-and-grates>

Media Articles

1. Brittany Keogh, “Teenager found dead in stormwater drain in South Auckland” New Zealand Herald, Sunday June 4 2017, http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11869086

2. Hannah Martin and Jarred Williamson, “Teenage girl found dead in stormwater drain described by neighbours as 'loving, playful'” Stuff.co.nz, Sunday June 4 2017, <http://www.stuff.co.nz/auckland/93325134/teenage-girl-found-dead-in-stormwater-drain-described-by-neighbours-as-loving-playful>
3. Newshub staff, “Woman found dead in Mangere storm water drain” Newshub, Saturday June 3 2017, <http://www.newshub.co.nz/home/new-zealand/2017/06/woman-found-dead-in-mangere-storm-water-drain.html>
4. Radio New Zealand, “Teenager's body found in stormwater drain” Radio New Zealand, Sunday June 4 2017, <http://www.radionz.co.nz/news/national/332284/teenager-s-body-found-in-stormwater-drain>
5. Jessie Chiang, “Teen's death in drain: 'Someone's got to take responsibility’” Radio New Zealand, Sunday June 7 2017, <http://www.radionz.co.nz/news/national/332487/teen-s-death-in-drain-someone-s-got-to-take-responsibility>
6. Michelle Duff, “Drowned man had been at brothel” Stuff.co.nz, Wednesday February 5 2014, <http://www.stuff.co.nz/national/9689005/Drowned-man-had-been-at-brothel>
7. Ian Steward, “Inquest into Aisling Symes’ death Stuff.co.nz, Wednesday May 25 2011, <http://www.stuff.co.nz/national/5053834/Inquest-into-Aisling-Symes-death>
8. Newsweek Staff, “Manhole covers stolen for scrap metal”, Sunday May 18 2008, <http://www.newsweek.com/manhole-covers-stolen-scrap-metal-89575>
9. Sally Brooks, “Inquest into drowning death of eight-year-old Richard Baird calls for regular inspections of drain system”, Tuesday October 14, 2014, <http://www.abc.net.au/news/2014-10-14/drain-death-inquest-wraps-up/5813256>

Appendix A – Auckland Transport Standard Catchpit Details

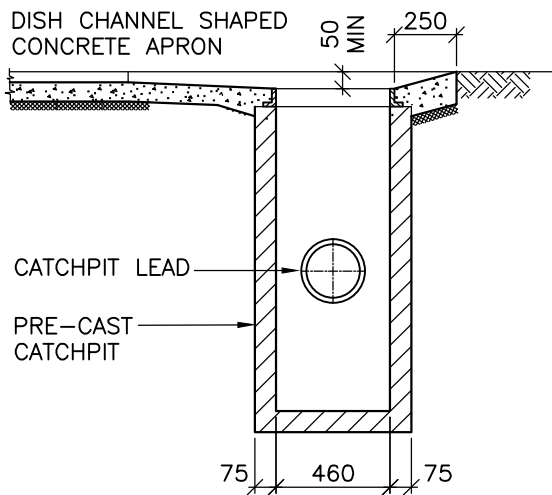


REVISION	BY	DATE

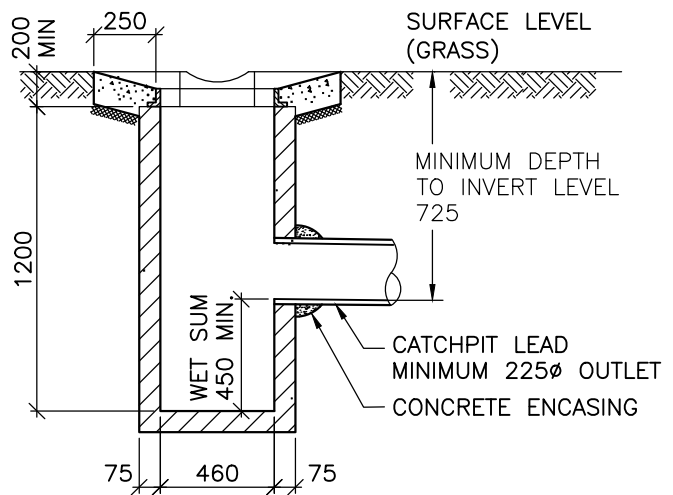


AUCKLAND TRANSPORT CODE OF PRACTICE	
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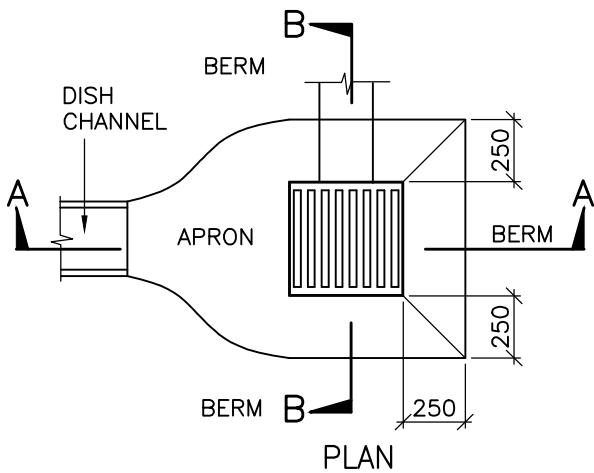
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VERSION	



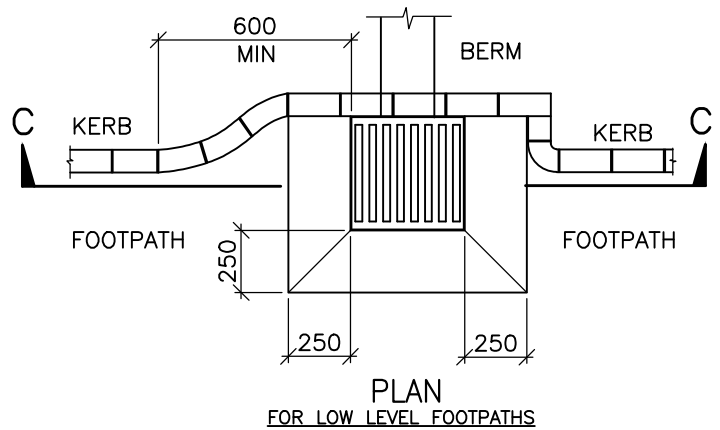
SECTION A-A



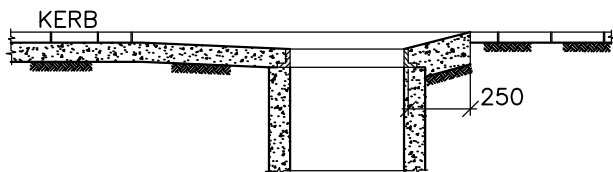
SECTION B-B



PLAN



PLAN FOR LOW LEVEL FOOTPATHS



SECTION C-C

NOTES

1. Concrete 25MPa, Fair faced finish.
2. Cast Iron hardware to be supplied ex. approved Foundry.
3. Half syphon to be used in combined catchment areas only.
4. Catchpits to be 1.4m deep.
5. For design purposes, inlet capacity = 10 l/s
6. Nominal Dimensions only. Refer "Manufacturers Precast Field Catchpit Specifications". Minimum wall thickness 75 mm, Sump depth 450 min. Minimum depth to catchpit lead invert 725mm in grassed areas.
7. Increase class of pipe where minimum cover of 900mm cannot be achieved for Catchpit leads.

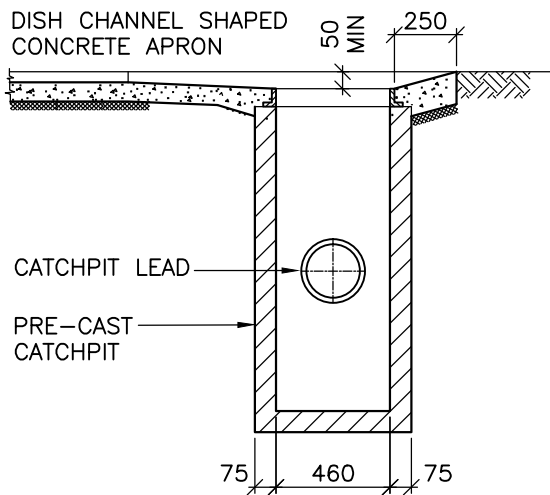
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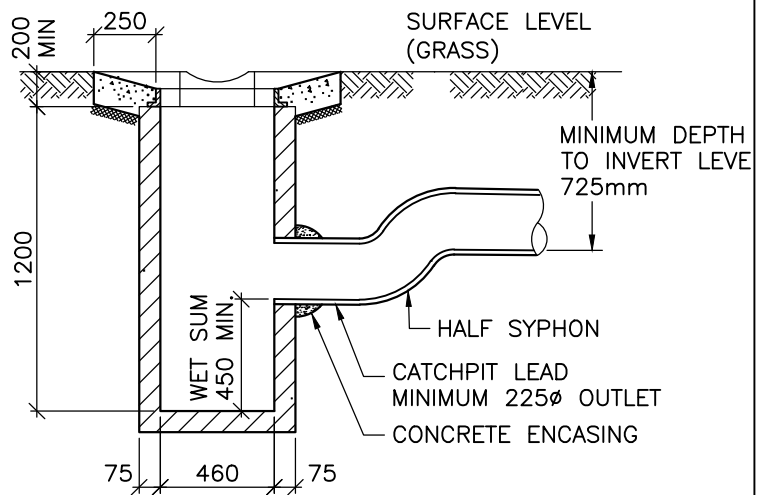
AUCKLAND TRANSPORT
CODE OF PRACTICE

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**FIELD CATCHPIT
440 x 440**

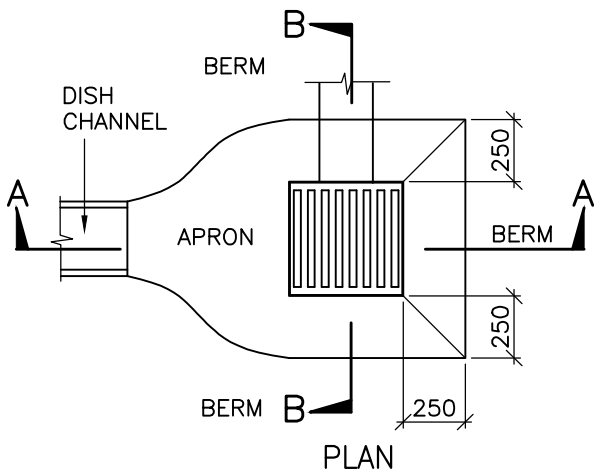
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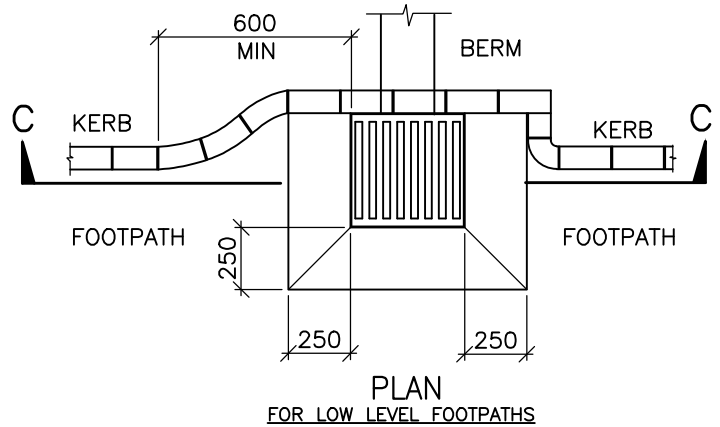
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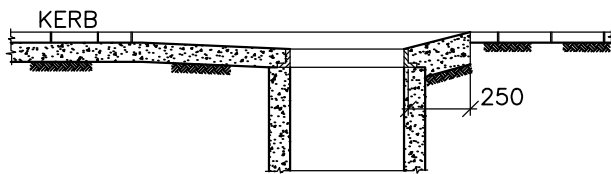
SECTION B-B



PLAN



PLAN FOR LOW LEVEL FOOTPATHS



SECTION C-C

NOTES

1. Concrete 25MPa, Fair faced finish.
2. Cast Iron hardware to be supplied ex. approved Foundry.
3. Half siphon to be used in combined catchment areas only.
4. Catchpits to be 1.4m deep.
5. For design purposes, inlet capacity = 10 l/s
6. Nominal Dimensions only. Refer "Manufacturers Precast Field Catchpit Specifications". Minimum wall thickness 75 mm, Sump depth 450 min. Minimum depth to catchpit lead invert 725mm in grassed areas.
7. Increase class of pipe where minimum cover of 900mm cannot be achieved for Catchpit leads.

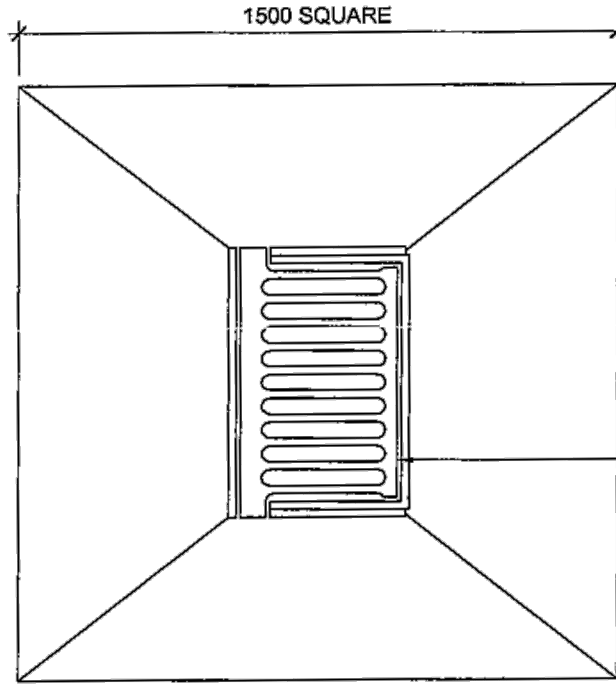
REVISION	BY	DATE



AUCKLAND TRANSPORT
CODE OF PRACTICE

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**FIELD CATCHPIT
440 x 440
with HALF SYPHON**

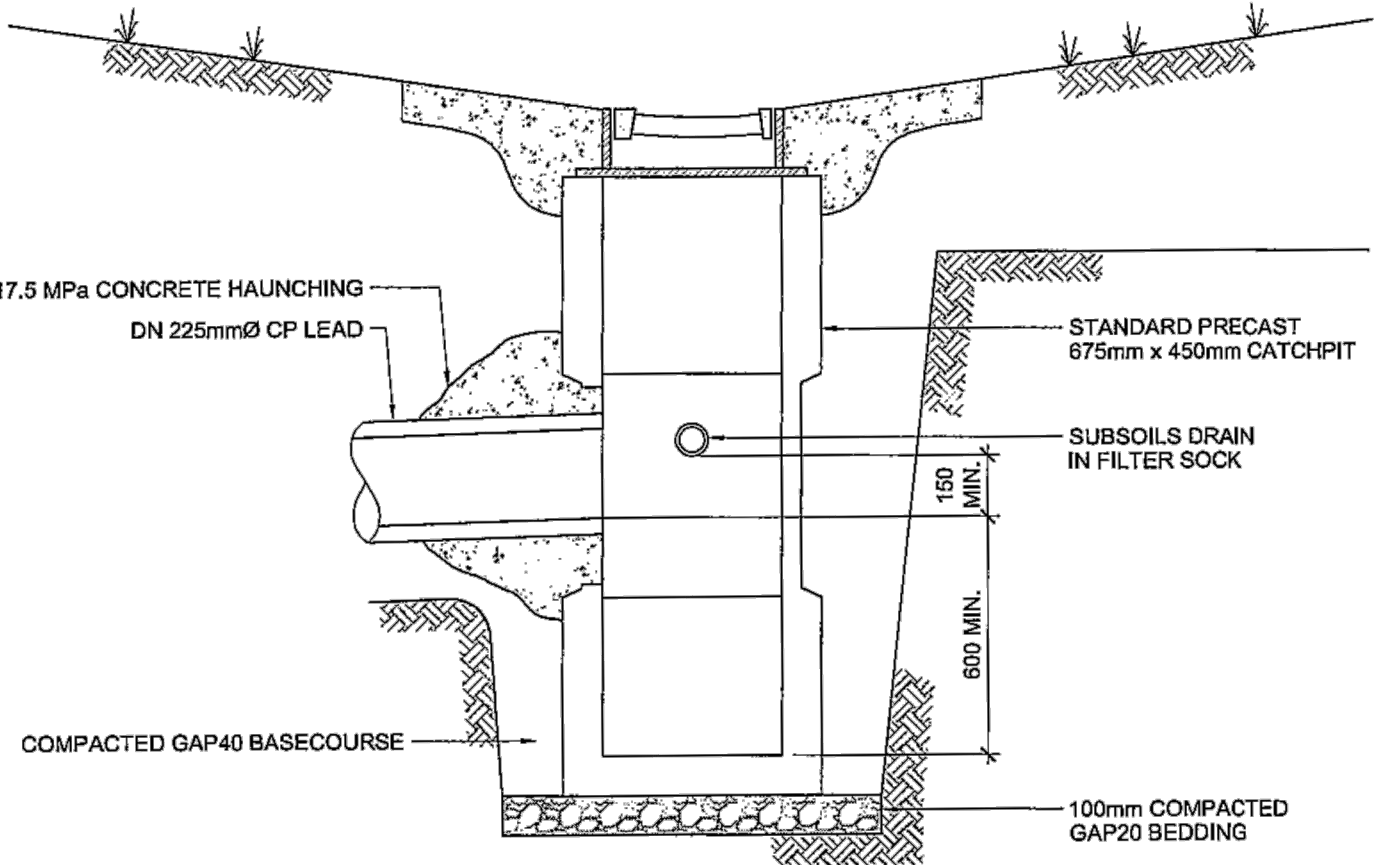
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DRAWING No.
RD032
VERSION



CONCRETE 100mm THICK WITH ONE LAYER OF STEEL MESH

675mm x 450mm HEAVY DUTY CAST IRON CATCHPIT GRATING AND FRAME. NOTE THAT CAPTIVE GRATES ARE REQUIRED

PLAN



SECTION A-A

NOTES

1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.
2. ALL CONCRETE TO BE ORDINARY GRADE, 17.5MPa AT 28 DAYS.
3. ALL PIPES TO BE FINISHED FLUSHED WITH INSIDE WALL OF CATCHPIT

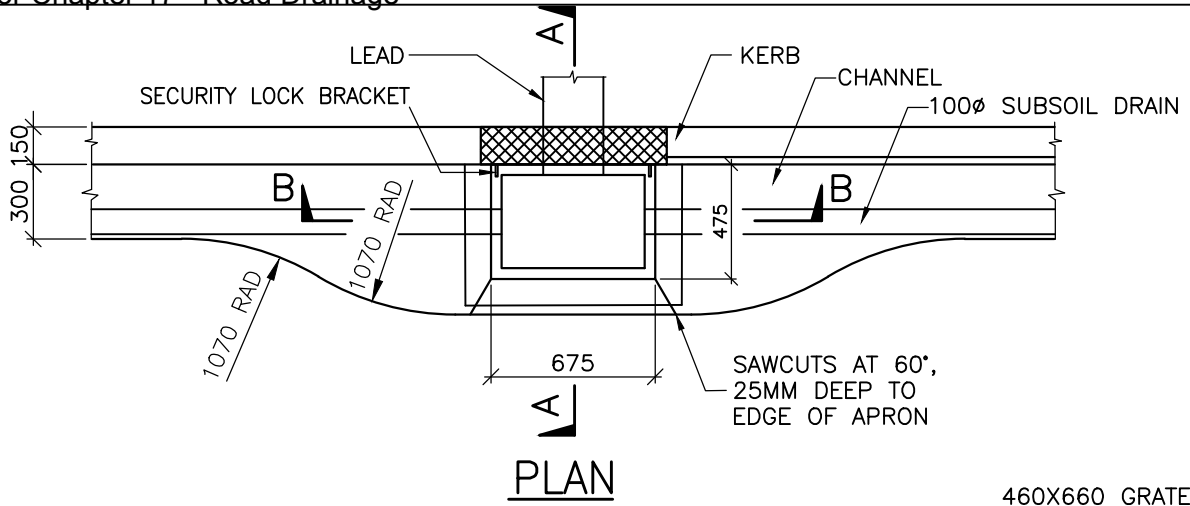
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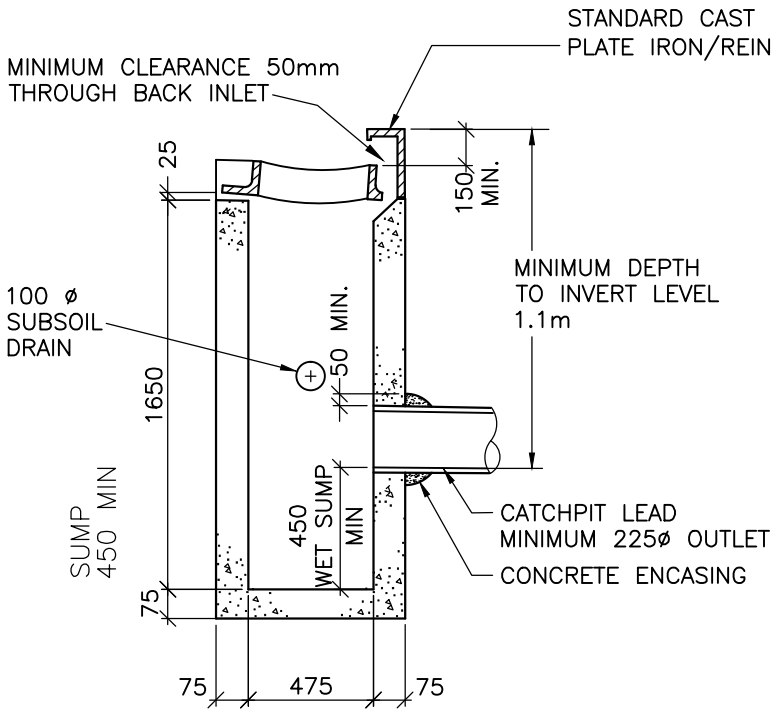
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CODE OF PRACTICE

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675 x 440**

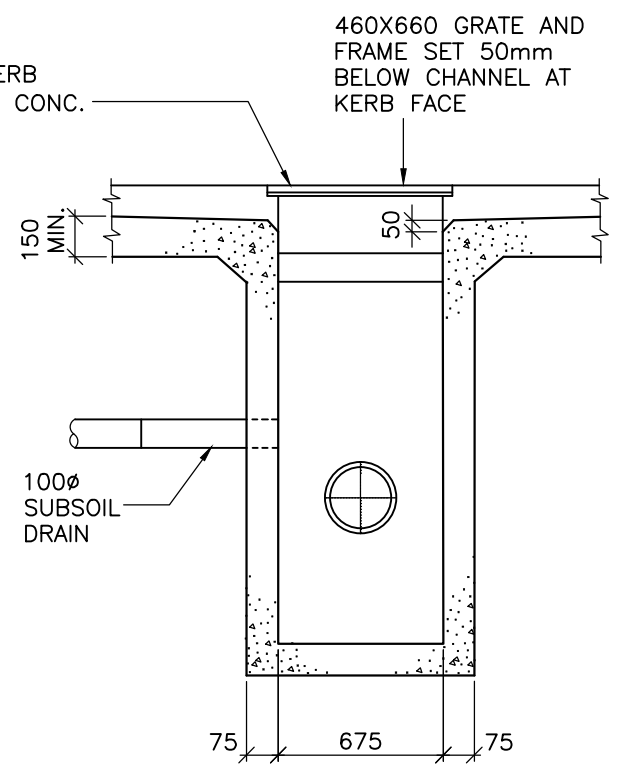
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DRAWING No.
RD033
VERSION



PLAN



SECTION A-A



SECTION B-B

NOTES

1. Concrete to be 25MPa. Fair faced finish.
2. Cast Iron hardware to be supplied ex. approved Foundry. To include security lock bracket.
3. Where double pits are required, two back inlet units may be installed side by side.
4. For concrete kerbs and for bluestone kerbs use cast-iron back inlet.
5. Nominal Dimensions only – refer Manufacturers "Precast Back Entry Catchpit" specification. Minimum wall thickness 75 mm, sump depth 450 min. Minimum depth to catchpit lead invert 1.1m.
6. Increase Class of pipe for catchpit lead if cover under carriageway < 1.2m

1. For Design purposes, entry flow to catchpit = 16–18 l/s.
2. See table below for Catchpit Efficiency Guide for gradient of channel flow.

Channel Gradient	% of water collected
1%	82.3
2%	78.2
3%	76.5
6%	71.7
8%	64.6
12%	59.8

REVISION	BY	DATE



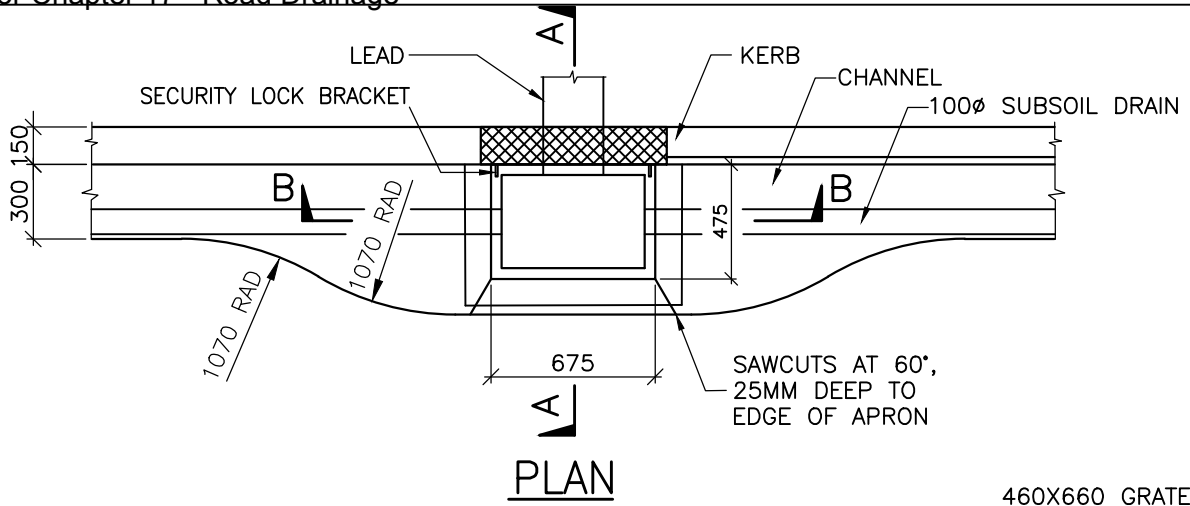
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CODE OF PRACTICE

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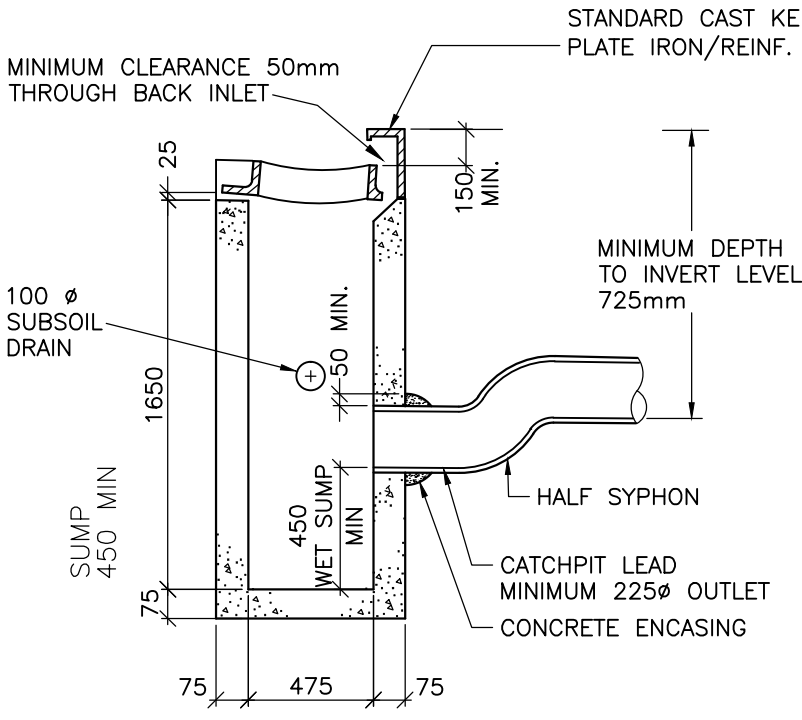
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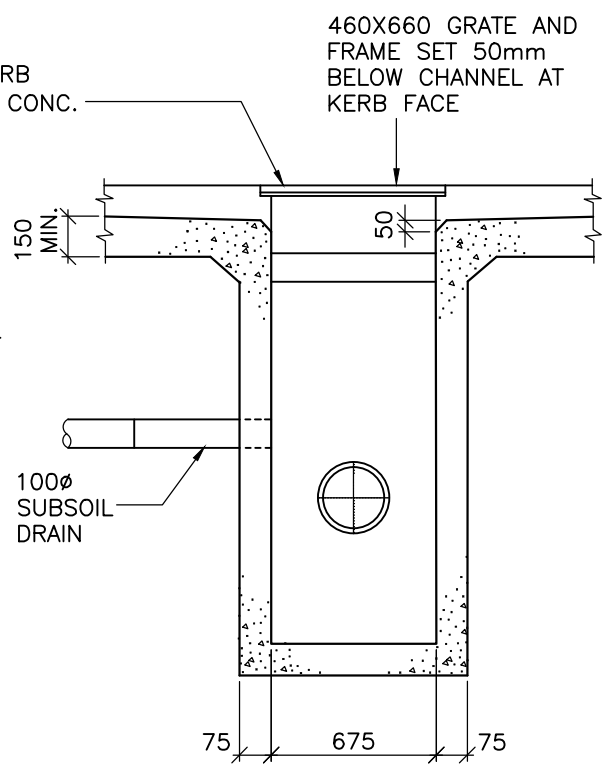
VERSION



PLAN



SECTION A-A



SECTION B-B

NOTES

1. Concrete to be 25MPa. Fair faced finish.
2. Cast Iron hardware to be supplied ex. approved Foundry. To include security lock bracket.
3. Where double pits are required, two back inlet units may be installed side by side.
4. For concrete kerbs and for bluestone kerbs use cast-iron back inlet.
5. Half syphon to be used in combined catchment areas only
6. Nominal Dimensions only – refer Manufacturers "Precast Back Entry Catchpit" specification. Minimum wall thickness 75 mm, sump depth 450 min. Minimum depth to catchpit lead invert 1.1m.
7. Increase Class of pipe for catchpit lead if cover under carriageway < 1.2m

1. For Design purposes, entry flow to catchpit = 16–18 l/s.	
2. See table below for Catchpit Efficiency Guide for gradient of channel flow.	
Channel Gradient	% of water collected
1%	82.3
2%	78.2
3%	76.5
6%	71.7
8%	64.6
12%	59.8

REVISION	BY	DATE



AUCKLAND TRANSPORT
CODE OF PRACTICE

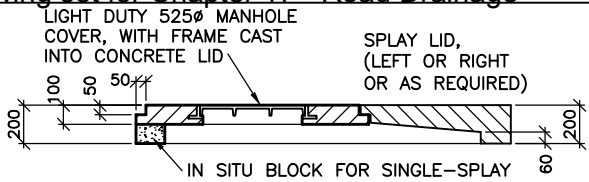
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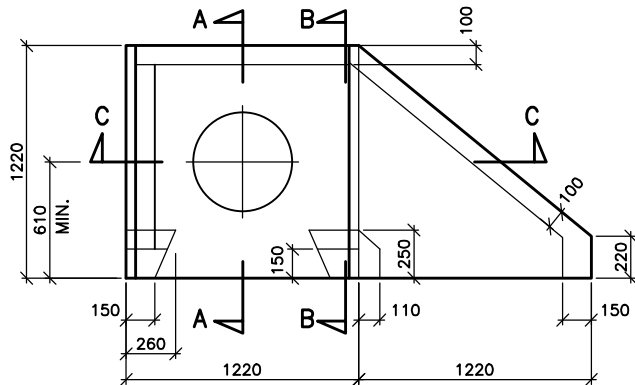
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VERSION

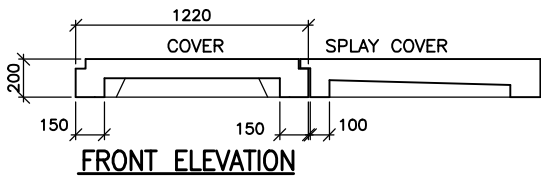
Drawing set for Chapter 17 - Road Drainage



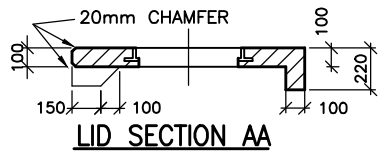
COVER & LID SECTION CC



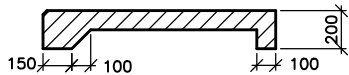
PLAN SINGLE-SPLAY CATCHPIT LID



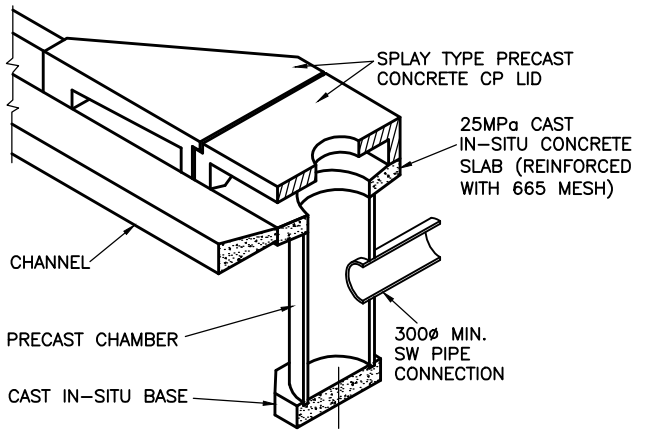
FRONT ELEVATION



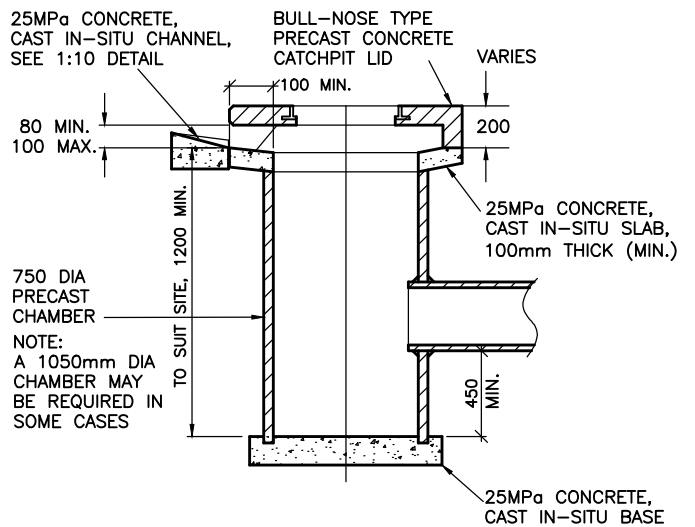
LID SECTION AA



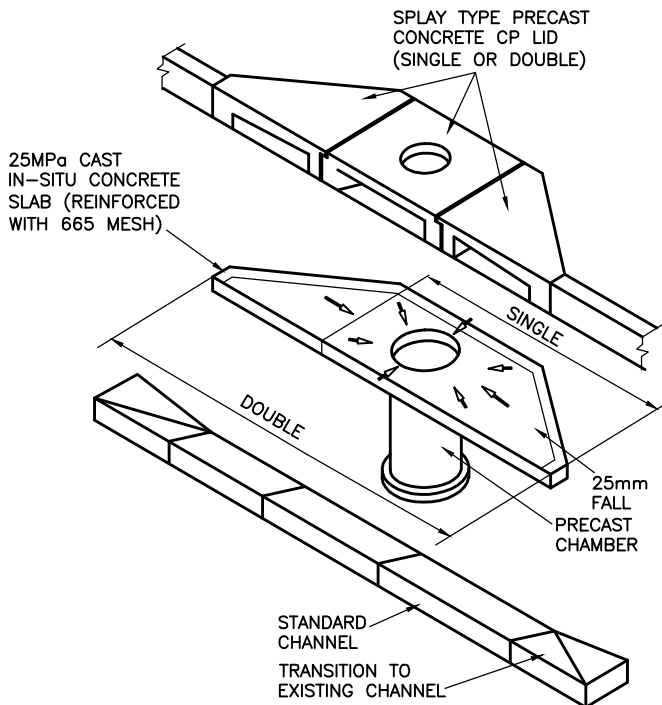
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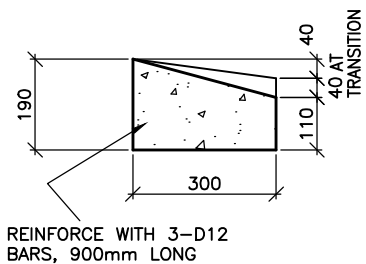
ISOMETRIC VIEW / SECTION



CATCHPIT-SECTION AA



ISOMETRIC VIEW OF CATCHPIT ASSEMBLY (DOUBLE SPLAY SHOWN)



IN-SITU CHANNEL

REVISION	BY	DATE

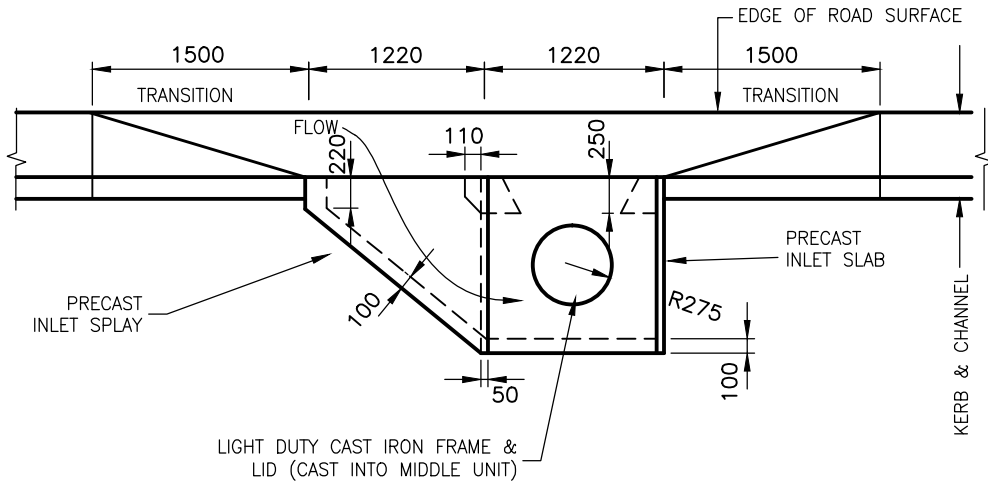


AUCKLAND TRANSPORT
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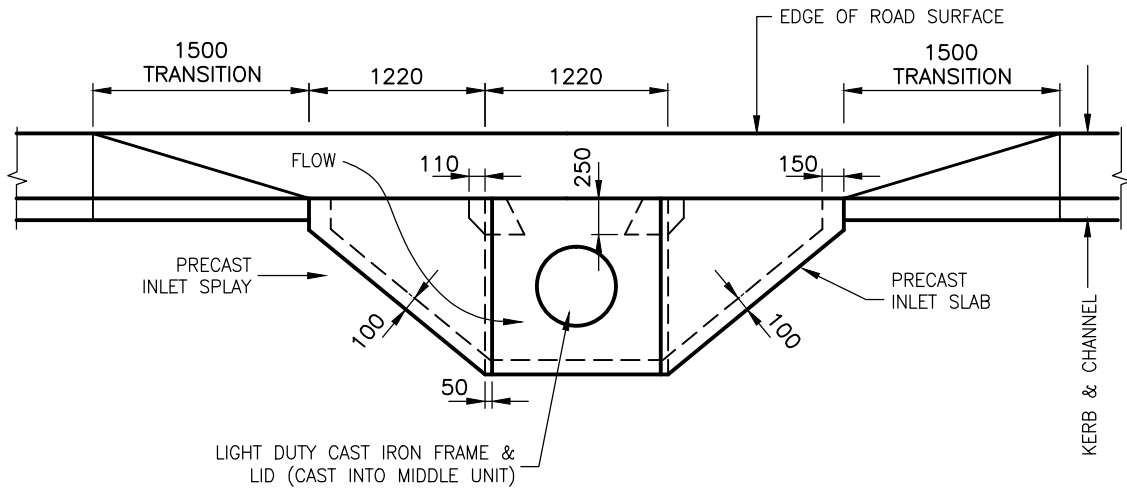
SPLAY CATCHPIT

SCALE:
N.T.S.
DRAWING No.
RD036
VERSION



PLAN-SINGLE SPLAY

(DOUBLE OPENING)



PLAN-DOUBLE SPLAY

(TRIPLE OPENING)

REVISION	BY	DATE



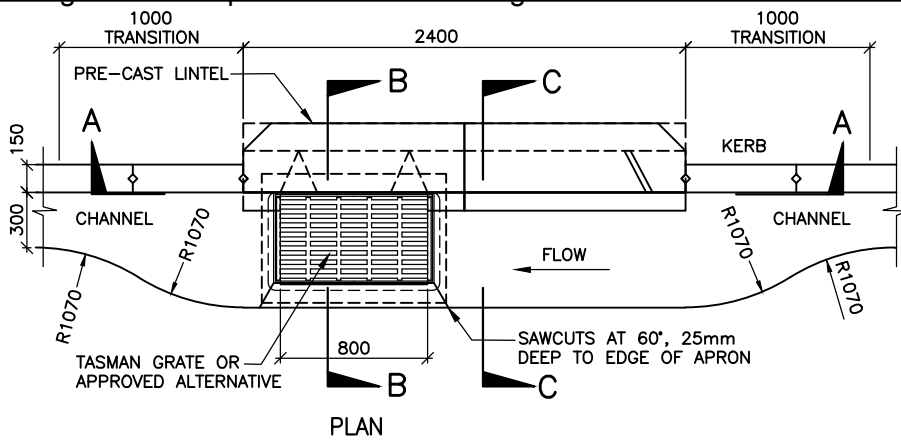
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CODE OF PRACTICE

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**SPLAY CATCHPIT
DETAILS**

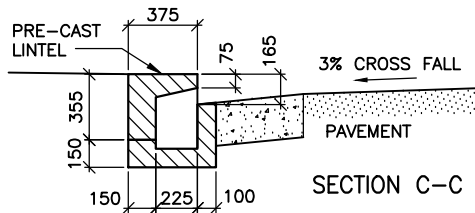
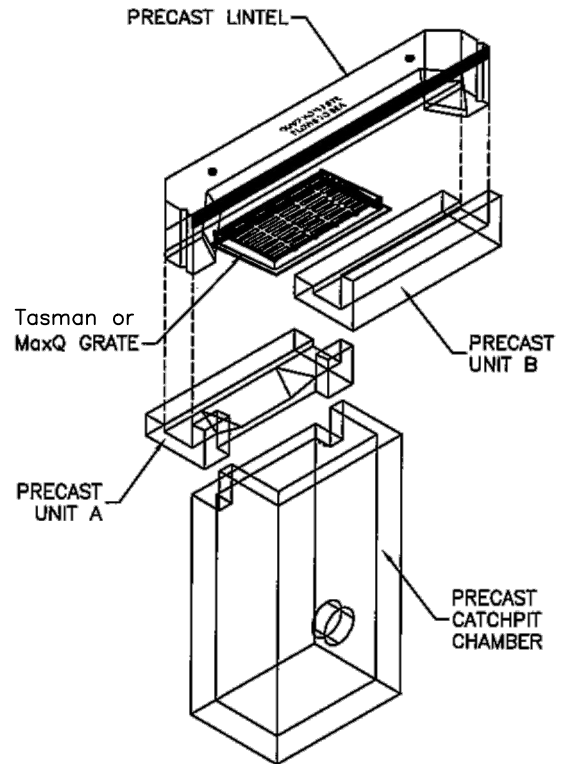
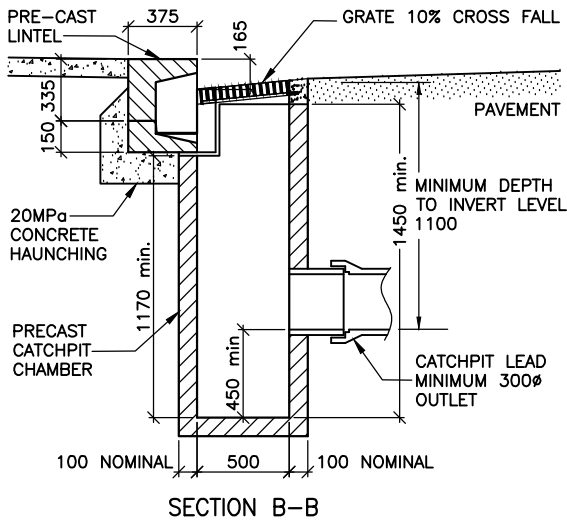
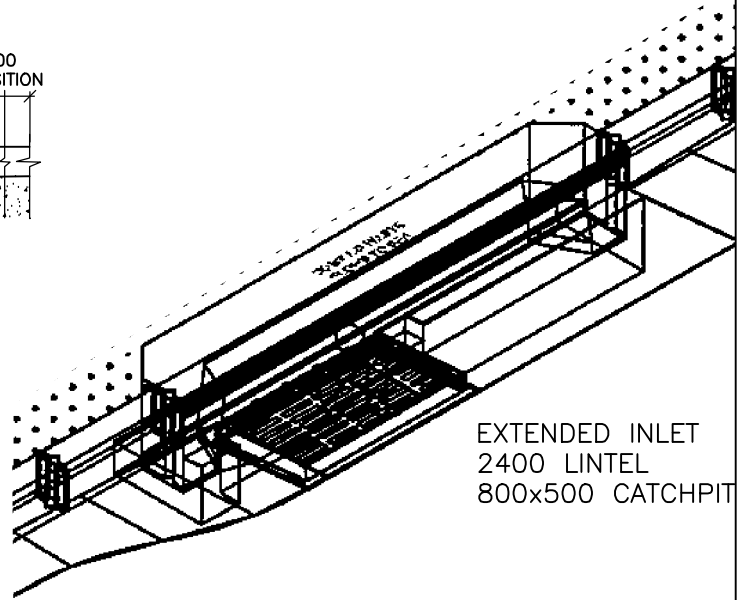
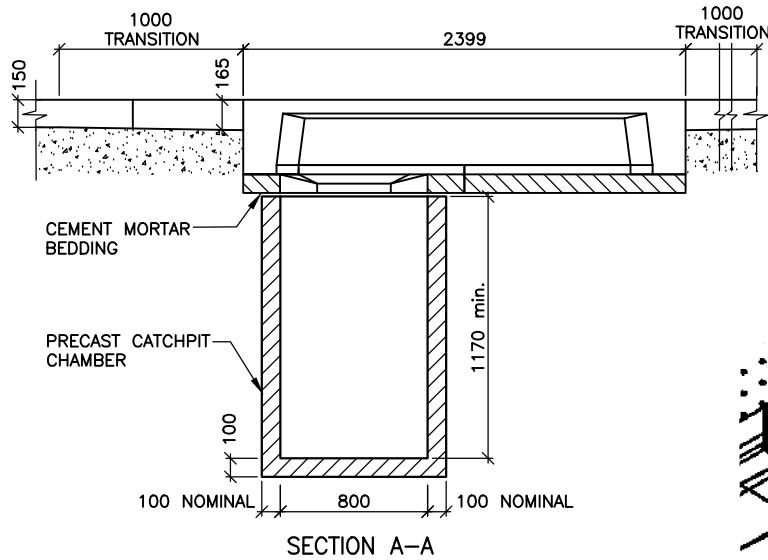
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DRAWING No.	RD037
VERSION	

Drawing set for Chapter 17 - Road Drainage



NOTES

1. Concrete to be 25 MPa.
2. Catchpits to be 1.8m deep.
3. Grates shall be max Q 800 x 500. "Tasman Grates", or approved alternative.
4. Transition-Kerb height changes, from 150 to 165.
5. Precast units A and B with lintel can be retrofitted to existing catchpit.
6. Precast tapers have not been detailed, therefore all dimensions are nominal.
7. When retrofitting unit 'A' to existing catchpit, trim back existing catchpit as shown below. Place unit 'A' centrally over back of catchpit on concrete bedding.



REVISION	BY	DATE



AUCKLAND TRANSPORT
CODE OF PRACTICE

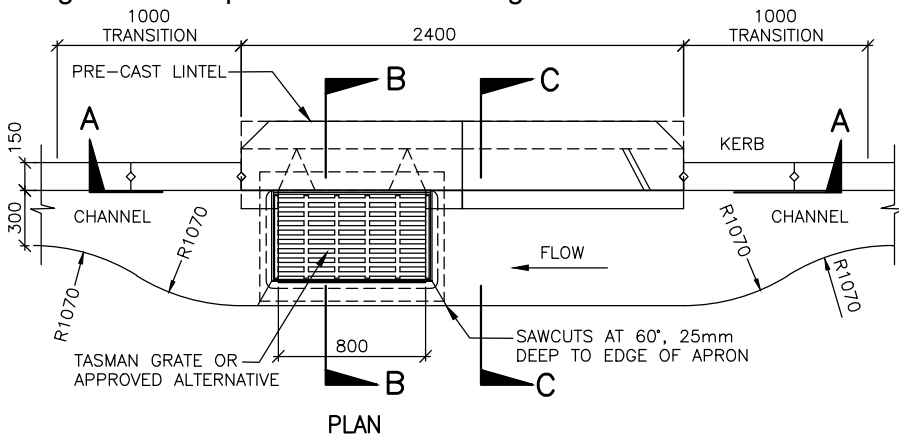
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STREET CATCHPIT
800 x 500
No Half Syphon

SCALE:
N.T.S.

DRAWING No.
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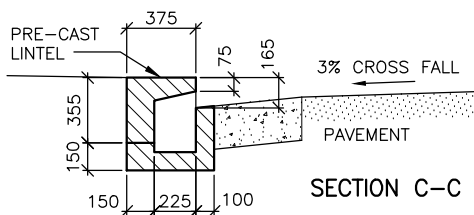
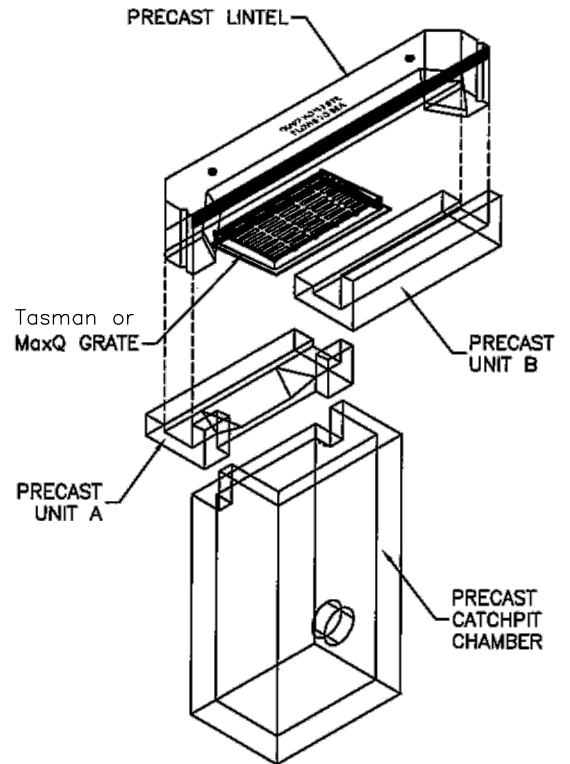
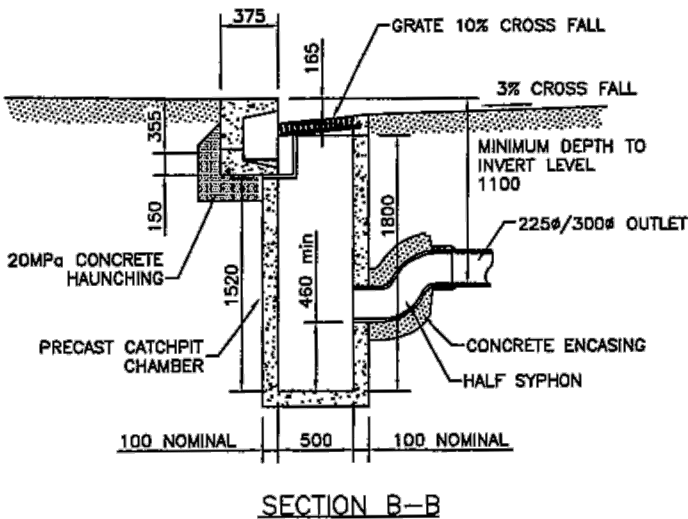
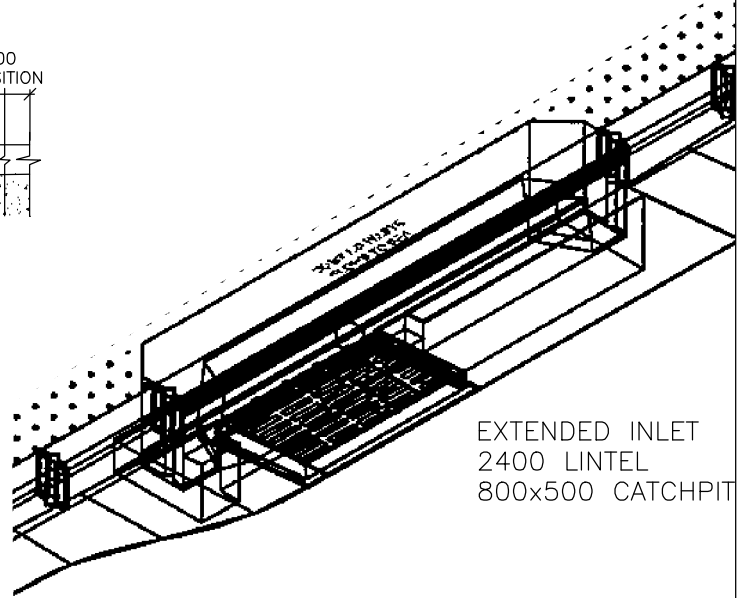
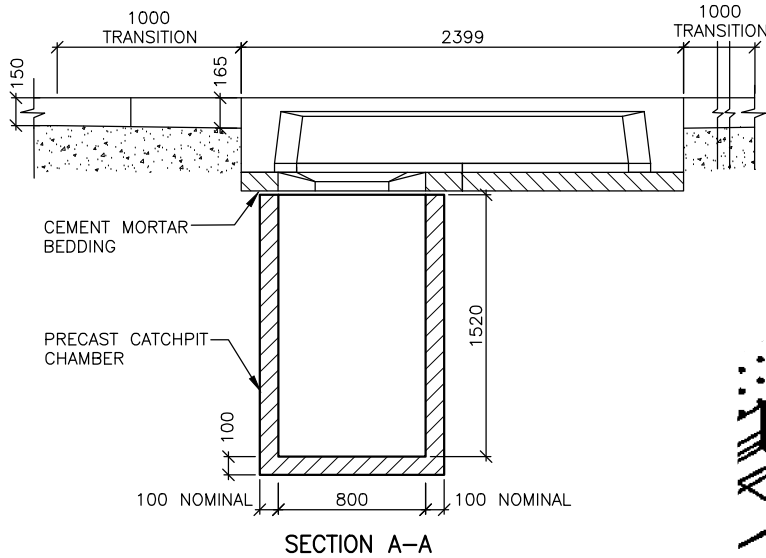
VERSION

Drawing set for Chapter 17 - Road Drainage



NOTES

1. Concrete to be 25 MPa.
2. Catchpits to be 1.8m deep.
3. Grates shall be max Q 800 x 500.
"Tasman Grates", or approved alternative.
4. Transition-Kerb height changes, from 150 to 165.
5. Precast units A and B with lintel can be retrofitted to existing catchpit.
6. Precast tapers have not been detailed, therefore all dimensions are nominal.
7. When retrofitting unit 'A' to existing catchpit, trim back existing catchpit as shown below. Place unit 'A' centrally over back of catchpit on concrete bedding.
8. Half-syphon to be used in combined catchment areas only.



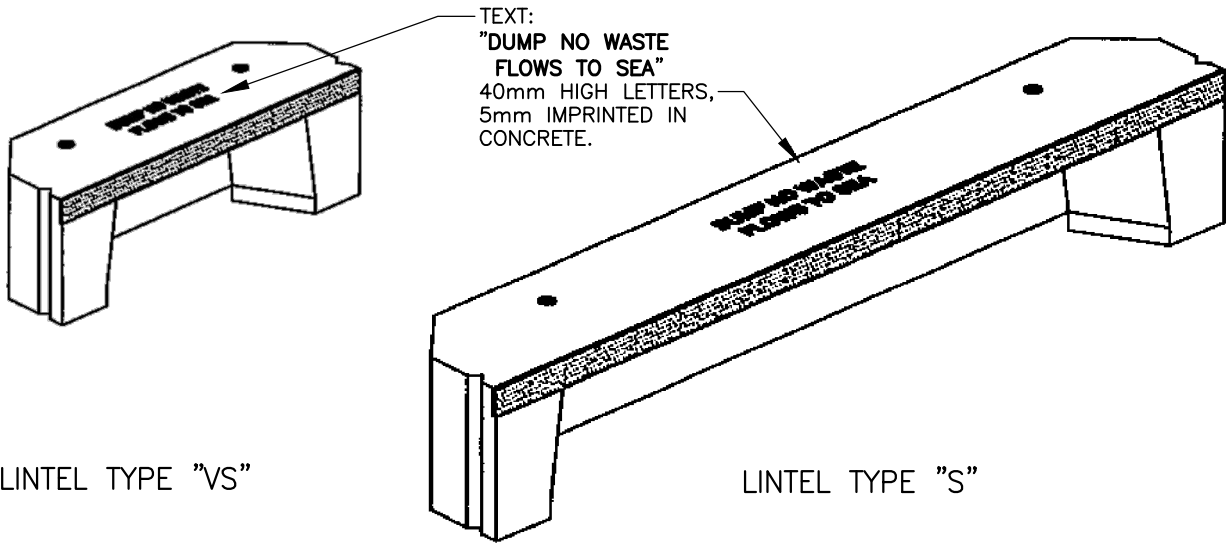
REVISION	BY	DATE



AUCKLAND TRANSPORT
CODE OF PRACTICE

TITLE
**STREET CATCHPIT
800 x 500
with Half Syphon**

SCALE:
N.T.S.
DRAWING No.
RD039
VERSION



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FLOWS TO SEA"
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5mm IMPRINTED IN
CONCRETE.

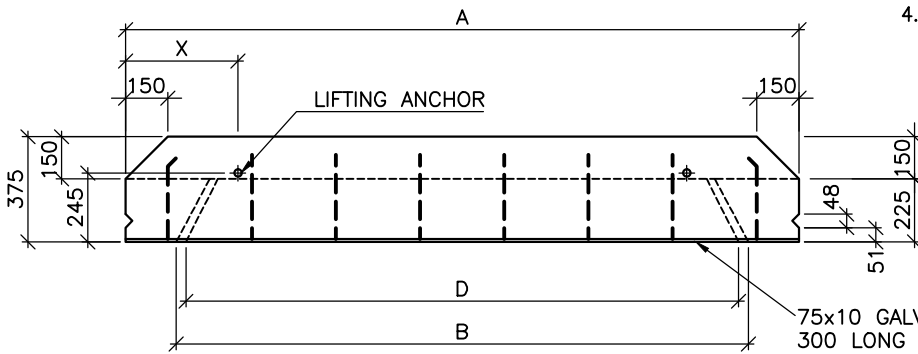
LINTEL TYPE "VS"

LINTEL TYPE "S"

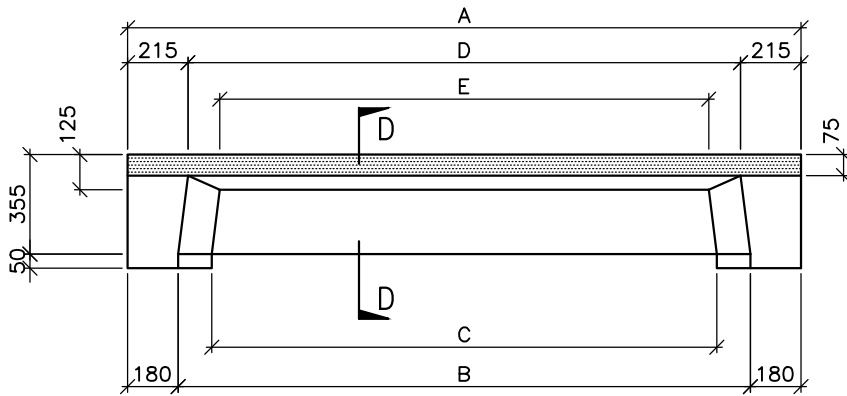
LINTEL	A	B	C	D	E	X	MASS(kg)
VS	1200	840	600	770	543	250	204
S	2400	2040	1800	1970	1743	400	499

NOTES

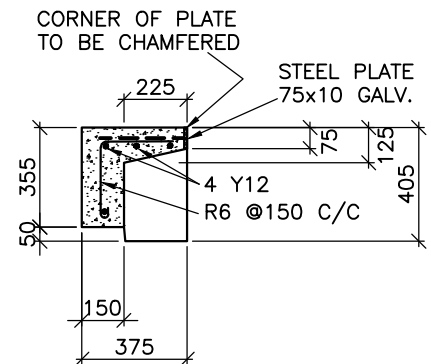
1. Precast Lintel Grade 25MPa concrete.
2. Cover to all bars to be 40mm minimum.
3. Lifting Anchor to be "Swiftlift" or equivalent 1.3 tonne galvanised.
4. Precasting tapers have not been shown. All dimensions nominal



PLAN



ELEVATION



SECTION D-D

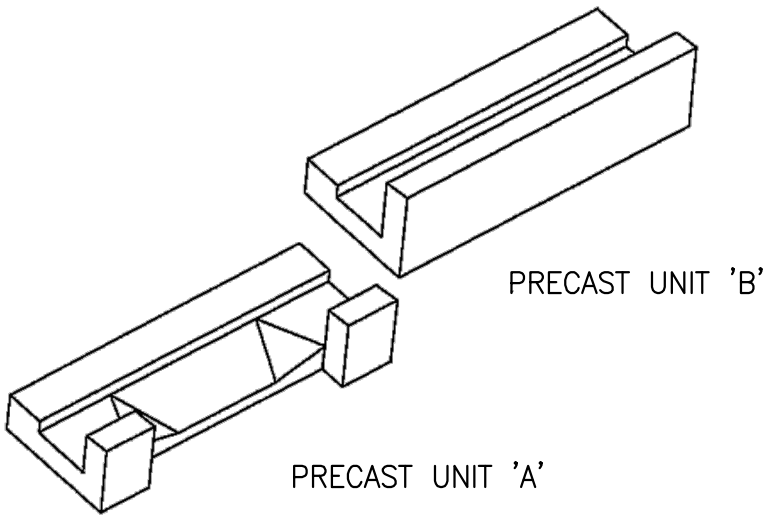
LINTEL DETAIL

REVISION	BY	DATE



AUCKLAND TRANSPORT CODE OF PRACTICE	
TITLE	STREET CATCHPIT 800 x 500 PRECAST LINTEL DETAILS

SCALE:	N.T.S.
DRAWING No.	RD040
VERSION	

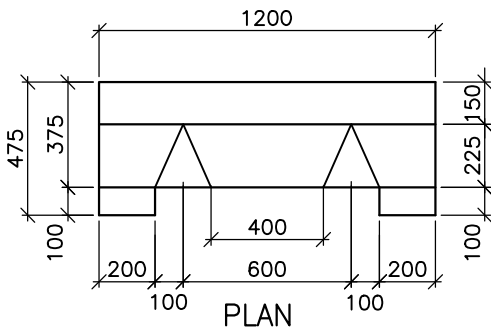


PRECAST UNIT 'A'

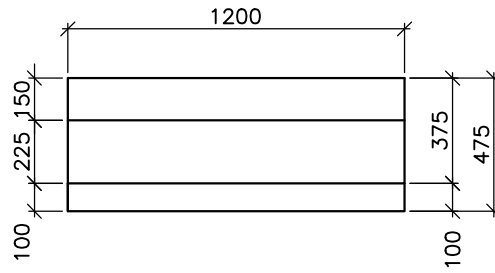
PRECAST UNIT 'B'

NOTES

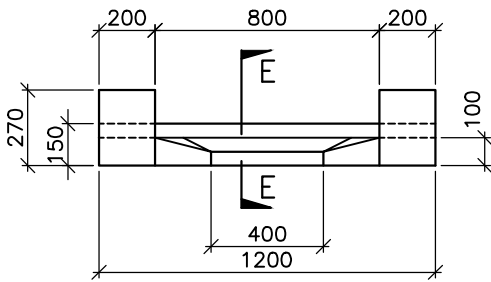
1. Precast Lintel Grade 25MPa concrete.
2. Cover to all bars to be 40mm minimum.
3. Lifting Anchor to be "Swiftlift" or equivalent 1.3 tonne galvanised.
4. Precasting tapers have not been shown.
All dimensions nominal



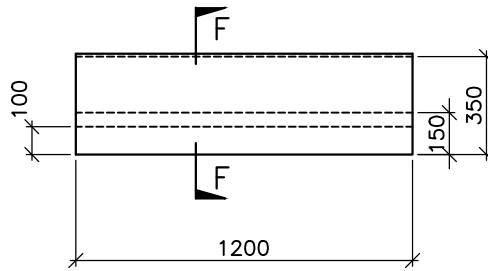
PLAN



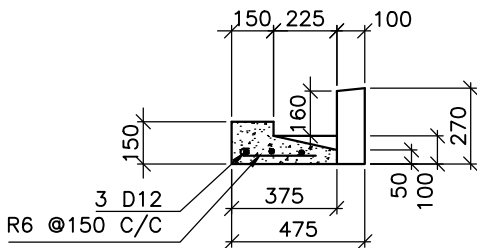
PLAN



ELEVATION

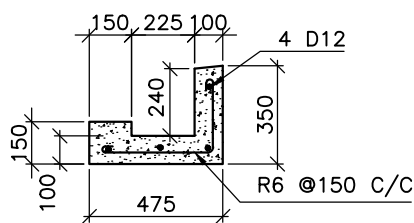


ELEVATION



SECTION E-E

PRE-CAST UNIT 'A'



SECTION F-F

PRE-CAST UNIT 'B'

REVISION	BY	DATE



AUCKLAND TRANSPORT
CODE OF PRACTICE

TITLE
**STREET CATCHPIT
800 x 500 PRECAST UNIT
DETAILS**

SCALE:
N.T.S.

DRAWING No.
RD041
VERSION

Appendix B – Terms of Reference

Confidential and Legally Privileged

Auckland Council

Catchpit Safety Review June 2017- Draft Terms of Reference

Updated July 6th 2017

This technical review is being carried out following the tragic death a young woman on June 3rd 2017 involving a road catchpit in Favona. The purpose of this review is to examine from a technical perspective the context of the incident, and compare this against best practice locally, nationally and internationally.

The AS/NZS ISO 31000:2009 Risk Management – Principal and Guidelines standard will be referenced where appropriate.

The Review will comprise the following;

1. Technical overview of the road catchpit involved in the incident.
2. Research and review of previous similar incidents both nationally and internationally
 - a. Learnings
 - b. Responses
3. Review of current best safety practice
 - a. Literature/internet review of current and best safety practice with respect to street catchpits by reviewing design standards, codes and policies from around NZ and selected international examples
4. Summary of relevant Auckland Council and Auckland Transport policies, technical standards and practices
5. Findings



Opus International Consultants Ltd
The Westhaven, 100 Beaumont St
PO Box 5848, Auckland 1141
New Zealand

t: +64 9 355 9500
f:
w: www.opus.co.nz