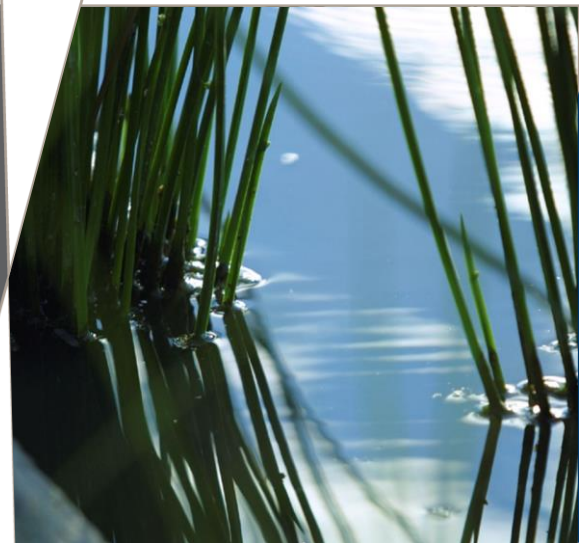


Mornington Peninsula Drainage Outlets Assessment

TBL and MCA Approach

CG150198



Prepared for
Mornington Peninsula Shire

23 November 2016

Contact Information

Cardno Victoria Pty Ltd
ABN 47 106 610 913

Level 4, 501 Swanston Street, Melbourne
Victoria 3000 Australia

Telephone: (03) 8415 7777
Facsimile: (03) 8415 7788
International: +61 3 8415 7777

victoria@cardno.com.au
www.cardno.com

Document Information

Prepared for	Morrington Peninsula Shire
Project Name	TBL and MCA Approach
File Reference	R001_v1_MCA
Job Reference	CG150198
Date	23 November 2016

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	18/05/15	Initial Release	Rob Swan	Tanja Mackenzie
2	15/07/16	Draft Report	Sophie Cant/Phebe Bicknell	Rob Swan
3	23/11/16	Final Report	Sophie Cant/Phebe Bicknell	Rob Swan

© Cardno. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

Table of Contents

1	Introduction	1
1.1	Background	1
1.2	Study Methodology	3
1.3	Review of Previous TBL Assessment	4
1.4	Review MPS Data	4
2	Community Consultation	5
3	Criteria Development	7
3.1	MCA Approach	7
3.2	Condition Assessment Criteria	7
3.3	Economic, Environmental and Social Criteria	8
3.4	MCA Calculation	9
3.4.1	Estimation of the magnitude of Impacts	9
3.4.2	Estimation of Likelihood	11
3.4.3	Potential Impact Calculation	11
4	Field Data Collection	12
4.1	GIS and Collector	12
4.2	Field Work	12
5	Multi Criteria Analysis	13
5.1	MCA Overview	13
5.2	Condition Assessment	14
5.2.1	Key Issues	14
5.2.2	Key Outlets	14
5.3	MCA Results	16
5.3.1	Key Issues	16
5.3.2	Key Outlets	16
5.3.3	Total Impact Rating	18
5.4	Community Response	20
6	Assessment of Management Options	21
6.1	Remediation and Cost	21
6.2	Cost Estimates for Key Outlets	21
7	Outcomes and Recommendations	26
7.1	Data Deliverables	26

Appendices

Appendix A – Community Consultation

Appendix B – MCA Assessment

Figures

Figure 1-1	Location of Foreshore Outlets Investigated	2
Figure 1-2	Drainage outlet assessment approach	3
Figure 5-1	Partial schematic of Figure 1-2 Drainage outlet assessment approach	13
Figure 5-2	Key Outlet Condition Issues	14
Figure 5-3	20 Highest Priority Assets based on Outlet Condition	15
Figure 5-4	Key MCA Issues	17
Figure 5-5	20 Highest Priority Assets based on Total Impact	19

Tables

Table 2-1	Community response to MCA category priority	6
Table 3-1	Outlet Condition Assessment Criteria	7
Table 3-2	MCA Assessment Criteria	8
Table 3-3	Impact Levels	10
Table 3-4	Likelihood Criteria (best estimate of % chance in a given year)	11
Table 5-1	MCA Results: Top 15 ranked outlets by category, including Melbourne Water assets (blue) and previously inspected MPS Outlets (<i>italicised</i>).	16
Table 5-2	MCA Results: Top 10 ranked MPS outlets by category	18
Table 5-3	MCA Results: Top ten ranked MPS outlets by Total Impact Rating	18
Table 5-4	MCA Results: Top 15 ranked outlets by category with community identified assets highlighted, Melbourne Water assets (blue) and previously inspected MPS Outlets (<i>italicised</i>).	20
Table 6-1	Cost Breakdown Summary	21
Table 6-2	Generic maintenance solutions and associated cost	21
Table 6-3	Costing of highest impact and threshold exceedances	22
Table 6-4	Remediation works and cost for top 30 rated condition	23

1 Introduction

The Mornington Peninsula Shire engaged Cardno to complete the Mornington Peninsula Foreshore Drainage Outlets Project. The project consists of a triple bottom line analysis of foreshore drainage outlets along the Mornington Peninsula, to enable Council to properly plan and program their future works.

The project incorporated an assessment of the base (existing) condition of the outlets along with possible remedial solutions and an estimation of costs in order to rank importance of future remedial works. Overall, the objective was to determine any safety issues, displeasing aesthetics, functional issues or environmental impacts for each outlet, and using this gathered information, assign a ranking to assist in the prioritisation of required maintenance. The project built upon work undertaken in 2011 for Melbourne Water, by URS.

Various forms of available information regarding the foreshore drainage outlets were incorporated into the project. The project obtained and utilised this information through:

- > Examining the existing MPS data sets and the previous 2011 outlet report.
- > Enquiring and consulting with stakeholders and members of the community to determine key issues with foreshore outlets.
- > Assessing each drainage outlet using agreed upon assessment criteria.
- > Providing a comparative assessment of drainage outlets.
- > Ranking the outlets in their order of priority, including the Shire's 20 outlets that were included in the Melbourne Water's 2011 report.
- > Undertaking an options study to provide the most cost effective and beneficial solution to any safety, public liability and aesthetic improvements.

In order to be consistent with the previous Melbourne Water project, this project adopted a triple bottom line assessment process based around Melbourne Water's Triple Bottom Line Guidelines (2007). To undertake the Triple Bottom Line (TBL) Assessment, a multi-criteria approach was developed to allow the importance of a specific drainage outlet to be assessed and ranked against all other outlets, taking into account economic, social and environmental concerns.

This document includes detail of the Multi-Criteria Assessment (MCA) developed for the project, noting changes from Melbourne Water's previous study to more appropriately consider the scale of Council drainage works.

Note that determination of solutions for the required future works for individual outlets was beyond the scope of this project, however some generic remediation concepts and associated costs have been presented. Further detailed design can be performed on selected high priority outlets in the future, as decided by MPS.

1.1 Background

The Mornington Shire Council manages a large number of stormwater assets along the foreshore around the Mornington Peninsula. The previous study conducted by Melbourne Water and URS in 2011, investigated 14 Melbourne Water outlets and 20 Shire outlets, where each outlet was ranked in order of priority.

To allow Council to have a complete appreciation of all their foreshore stormwater assets, Cardno has undertaken a similar investigation to include the remaining foreshore outlets. For consistency and continuity in this assessment, all foreshore drainage assets shown in the MPS database were inspected and assessed. This included the outlets included in the previous study as well as Melbourne Water assets. This analysis used an approach guided by the Melbourne Water Triple Bottom Line Guidelines, defining the needs, assessing effects and determining a solution.

In determining the base condition of the 162 outlets, issues regarding safety, aesthetics, functionality and/or environment have been identified. This information has been used in conjunction with possible remedial solutions and costs to develop a ranking to prioritise future remedial works. This study will allow strategic input to allow MPS to effectively manage their future works programmes. The study area and the location of each foreshore outlet including in the investigation are shown in Figure 1-1.

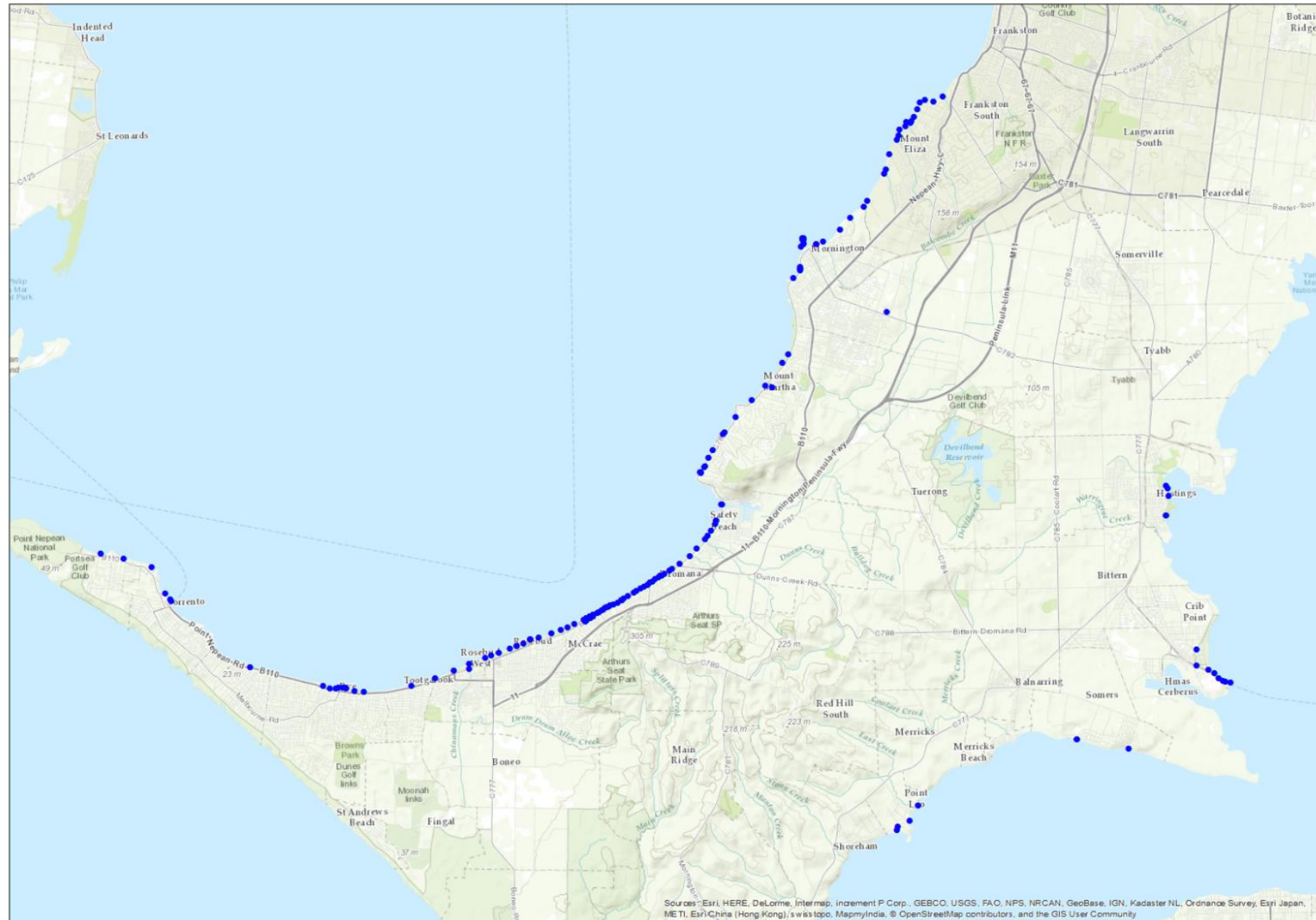


Figure 1-1 Location of Foreshore Outlets Investigated

1.2 Study Methodology

The following flow chart provides an overview of the methodology developed for the project (Figure 1-2). This method used the previous work and existing data as a framework, along with the feedback from the community, to formulate suitable criteria to be utilised in the assessment. Through using the existing information and conducting appropriate fieldwork, a condition assessment and a multi-criteria analysis were completed to prioritise outlets and cost potential remediation options.

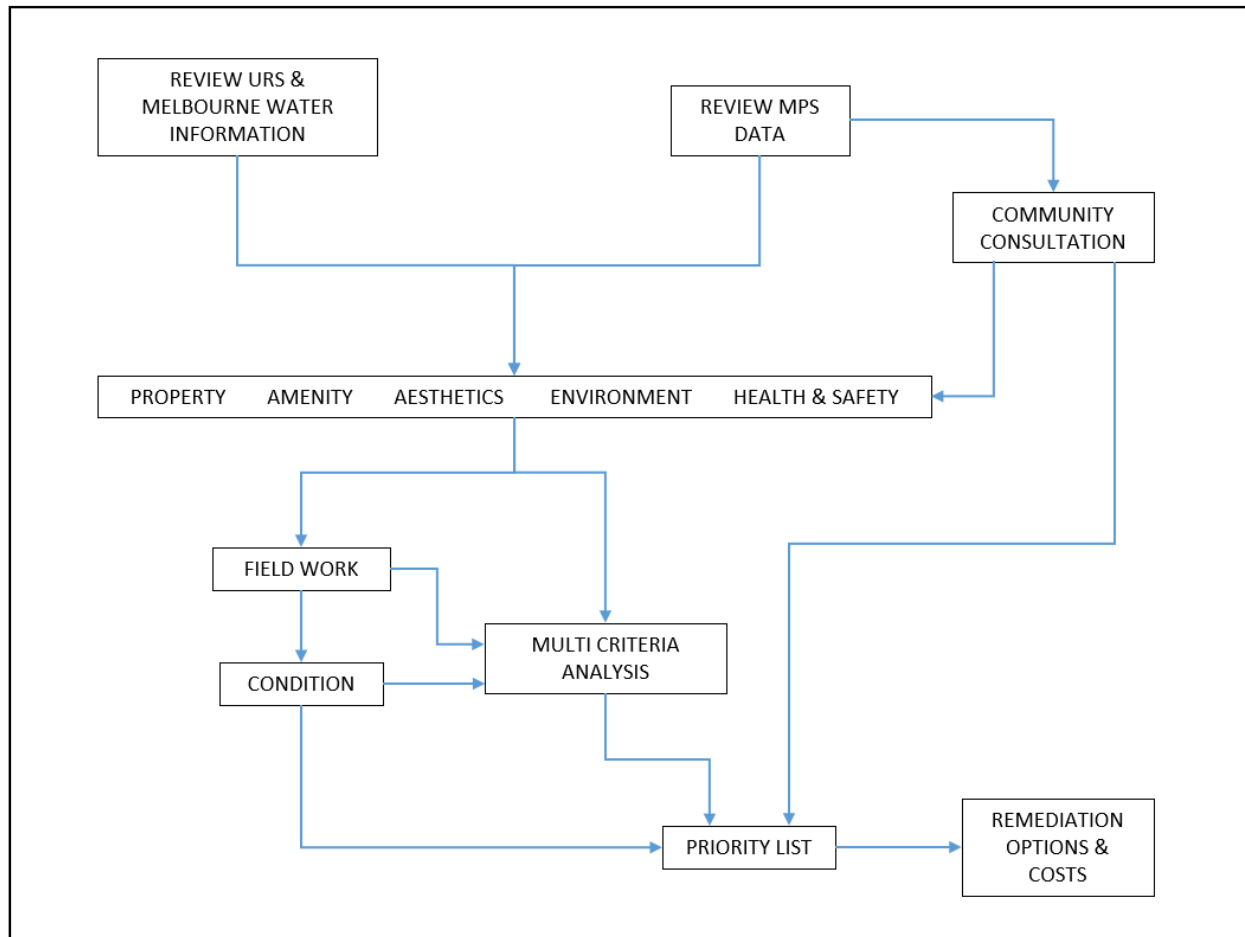


Figure 1-2 Drainage outlet assessment approach

The initial phase of the project required the review of existing background information, incorporating the MPS foreshore drainage records along with the previous URS study. In addition to this data review, a community consultation survey was developed to incorporate the views and concerns of key stakeholders and members of the community in regards to foreshore outlets.

The next phase utilised this information to develop appropriate assessment criteria that incorporated the key issues identified from existing information, previous reporting and community responses. The criteria were classified into different sections, allowing for the determination of the condition of the outlet, as well as any issues in regards to property, amenity, aesthetics, environment and health and safety. The defined criteria provides a comparative assessment between all the foreshore assets, using a consistent approach for the evaluation of each foreshore outlet.

During the site inspection, values were assigned for each criterion and integrated into the MCA. The results were examined and outlets were ranked to identify priority outlets for MPS. Potential remediation options for key issues and the associated costs were considered to provide the most cost effective and beneficial solution to any necessary safety, public liability and aesthetic improvements.

1.3 Review of Previous TBL Assessment

The previous drainage outlet study conducted for Melbourne Water by URS in 2011 was reviewed to maintain consistency with the previous approach; however, it is necessary to ensure the outcomes of the study are valuable to Council and communicated in a clear, effective way. The previous study investigated 14 Melbourne Water outlets and 20 Shire outlets, with each outlet evaluated and ranked in order of priority. The Shire's 20 outlets from the URS and Melbourne Water Report were included in this investigation.

In the previous study a triple bottom line assessment process based around Melbourne Water's Triple Bottom Line Guidelines (Melbourne Water, 2007) has been adopted. The Triple Bottom Line (TBL) Assessment for each drainage outlet has been completed using a multi-criteria approach. This approach takes into account economic, social and environmental issues.

As part of this review, Cardno have examined the table found in Figure 5.1 of the 2011 Bay Outlet report (URS, 2011). The semi-qualitative approach used in that report is appropriate for the project, however in order to rank the options, the impact levels need to be refined to better meet the needs of Council. This is due to the adoption of impact levels that are appropriate for Melbourne Water but are too coarse to provide differentiation at a local government scale. This is evidenced from the report where none of the MPS drainage outlets received a score above the negligible target impact threshold, with many drains receiving an identical score.

Findings from the study conducted by URS concluded that the two main outlet condition issues were corrosion of reinforcement in collars, headwalls, pipes and grates and the maintenance and clearing of sand blockages. In regard to total impact of outlets, URS found that the top four out of five issues related to aesthetics. Issues including beach popularity, coastal processes and tripping risk had a relatively low impact. Overall results from the URS study of 34 Melbourne Water and MPS outlets show that aesthetic impacts are the most significant issues. Impacts to public safety, amenity and natural environment were found to be relatively low.

MPS outlets previously assessed in the URS study have been reassessed by Cardno to maintain consistency between investigations and enable direct comparisons between outlets in this analysis.

1.4 Review MPS Data

The baseline drainage asset data received from MPS was used to identify the foreshore drainage outlets required to be assessed in this investigation.

MPS extracted data from their GIS system on the stormwater outlets that were within the foreshore and coastal zone. This provided the comprehensive list of outlets to be included in the assessment. It is acknowledged that some of these foreshore drains have been previously inspected in the URS study and some of these are Melbourne Water assets, however the inclusion of all assets provided a consistent and continuous appreciation of all the assets in the MPS region in this assessment. Any previous results and knowledge of the outlet was compared to final results.

Data provided included map layers for incorporation in GIS, attribute tables detailing further information about the asset including approximate address, pipe sizing, pipe material, outlet arrangement. Photos were also supplied for most outlets. Additional information and photos were not available for all assets. Where possible, photos and outlet information were consulted prior to site inspection, and were used to help guide asset location.

As the outlets are regularly positioned in locations with no clear street address, no detailed or consistent naming reference system was available to provide descriptive detail individually identifying the location of the 162 outlets. The assessment has used the Asset ID value from the data provided by MPS as the outlet ID reference (eg. **MI100056**). Cardno made some minor edits to assets that were missing the Asset ID and allocated an appropriate ID.

Further asset information was gathered on site following identification of the asset. Some discrepancies were identified for example exact location of asset, outlet material, and outlet size when compared to the information provided by MPS.

2 Community Consultation

Community and stakeholder engagement and interaction formed a critical component of this project. As part of the stakeholder engagement, a community survey was undertaken to gather information relating to how the community perceive the existing stormwater drains that are situated along this section of coastline. Respondents were asked to identify of any issues they have observed and provide potential management options or works that they would like to see considered by the Mornington Peninsula Shire.

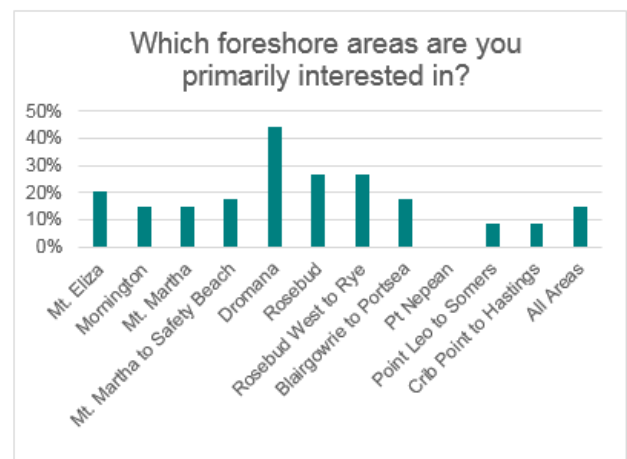
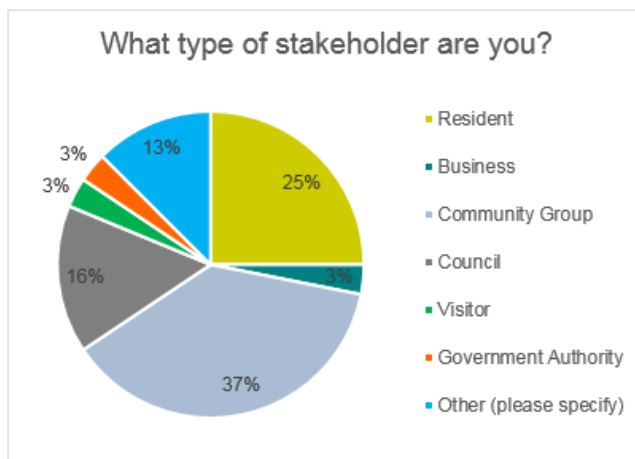
The focus of this survey was to understand how the community feel that the presence of a foreshore drainage outlet interacts with the surrounding area and the importance the community place on each of these interactions. To ensure that assessment and the developed criteria were relevant and addressed key community concerns, an online survey was created to allow the community and stakeholders to contribute comments of the foreshore outlets.

To help establish suitable criteria for the assessment, survey questions regarded feedback on:

- Individual outlets of concern
- The importance of different criteria including aesthetics, environment, amenity, property and health and safety
- The importance of different criteria at the individual outlets of concern
- Priorities for management

The survey was prepared using the online survey tool, Survey Monkey, and was provided to Council for circulation to the community and relevant stakeholders. The survey was conducted over a three week period during February and March 2016. MPS identified nine Foreshore Advisory groups and ten additional community groups that would have an interest in the project. These groups were directly invited to participate in the survey via email contact.

There were 41 respondents to the survey, with over half of these being from community groups or residents in the area. The region of most interest was Dromana followed by Rosebud, Rosebud West and Rye. This result may have potentially been influenced by the high number of foreshore drainage assets located within these sections and the location of community members who responded to the survey.



In order to establish suitable criteria for the assessment of each individual foreshore drainage outlet. The respondents were asked to consider how the presence of a foreshore drainage outlet interacts with the surrounding area and the importance they place on each of these interactions in terms of:

- **AESTHETICS:** Impact on visual aspects of the surrounding area. Possible aesthetic concerns may include interruption to views, its protrusion from the natural land, visual unattractiveness (vandalised, collects rubbish).

- **ENVIRONMENT:** Impact on the environment. Some potential environmental concerns may include odour, impacts on habitat, water quality issues, coastal processes, impairment of coastal processes and deterioration in beach condition.
- **AMENITY:** Impact on beach usage. Amenity concerns may include disruption to beach people movement, restriction on beach usage, and impact on beach popularity.
- **PROPERTY:** Impact on the functionality. Possible property concerns include structural integrity, operational capacity, exposure and the outlet alignment. This criteria includes indirect property effects of the outlet, such as damage to property caused by flooding because the outlet may be blocked, for example.
- **HEALTH & SAFETY:** Hazards arising due to the existence of the outlet. These include tripping hazards, diving hazards, confined space hazard, scour holes, contaminated water risks.

Table 2-1 Community response to MCA category priority

	Not at all important	Slightly Important	Fairly Important	Important	Very Important	No Opinion	Total
Aesthetics	0.00%	3.45%	17.24%	13.79%	65.52%	0.00%	
	0	1	5	4	19	0	29
Environment	0.00%	3.45%	0.00%	0.00%	89.66%	6.90%	
	0	1	0	0	26	2	29
Amenity	0.00%	3.45%	6.90%	20.69%	65.52%	3.45%	
	0	1	2	6	19	1	29
Property	7.14%	7.14%	28.57%	10.71%	42.86%	3.57%	
	2	2	8	3	12	1	28
Health & Safety	0.00%	3.45%	10.34%	3.45%	75.86%	6.90%	
	0	1	3	1	22	2	29

The majority of respondents saw each of these categories of ‘Very Important’ with Environment and Health and Safety rating the highest in the relation to the other categories (Table 2-1). The aesthetics and amenity seemed comparable while property rated the lowest concern for most respondents. Based on these responses, the community showed minimal bias towards a particular category, as all were considered ‘Very Important’. This balanced approach was factored in as part of the assessment methodology.

Respondents were given the opportunity to identify, rate and comment about individual assets along the foreshore. Given that the site inspection is conducted at a single point in time, this information provided insight into how the community perceives some of the individual outlets, and highlighted issues that are apparent at other times throughout the year. These comments and feedback of individual assets were incorporated into the assessment where appropriate. It was noted that in contrast to the overall results, property concerns were ranked highest at individual outlets.

A summary of these results are presented in Appendix A, while an electronic copy of the survey results was provided to Council as a record and future reference point of concerns raised by the community.

3 Criteria Development

3.1 MCA Approach

All Multi Criteria Assessments (MCAs) require an approach that is transparent and repeatable across the various options or objects for comparison, including an appropriate baseline. For the purposes of this project, the assessment only evaluated the impacts of the current condition of each outlet and the cost to mitigate these impacts back to an acceptable level of service, equivalent to the current design standards. No assessment was undertaken for additional benefits that may be gained from different approaches to mitigating issues at individual outlets.

The MCA assessment for the project included:

- > A set of condition assessment criteria to describe the stormwater outlet condition; and
- > A range of economic, environmental and social criteria that capture the cost of the works and the current level of impact the stormwater outlet is having on the environment.

MCA categories, based on economic, social and environmental factors, contained criteria that and specifically related to the performance of each structure in the local context. The criteria development for each of these categories and its application is outlined in Sections 3.2 and 3.3, while Section 3.4 outlines how the values for the MCA were calculated and results generated.

3.2 Condition Assessment Criteria

The condition assessment criteria covered both maintenance and operational aspects of each stormwater outlet. Photographs of each outlet were captured to inform the assessment, including the selection of an appropriate mitigation option (i.e. replace or repair) and to estimate the cost of any such works. Stormwater outlets have been ranked based on the sum of the scores for each of the condition assessment criteria, with higher values having a priority for remedial works. This initial step establishes the engineering basis for prioritising the stormwater outlet repairs, and feeds into the MCA. Table 3-1 shows the criteria utilised for the outlet condition assessment. The type of outlet was also recorded.

Table 3-1 Outlet Condition Assessment Criteria

Criteria	Score	Rating	Description
Alignment	1	Excellent	Pipe/Culvert is straight, not exposed, no noticeable cracks
	2	Average	Pipe/Culvert is straight, minor cracks noticeable in exposed joints or at headwall
	3	Poor	Pipe is not straight, crack in exposed joints with missing mortar
	4	Failed	Pipe is discontinuous
Structure	1	Excellent	No visible concrete spalling or corrosion
	2	Average	Minor cracks, corrosion or concrete spalling
	3	Poor	Major cracks in pipes, noticeable corrosion or major spalling
	4	Failed	Collapse of pipes, major cracking or slumping of headwall
Operation	1	Excellent	No sand or debris at outlet, free flow to receiving water
	2	Good	Outlet has minor sand or debris, outlet may be constrained under high tidal conditions
	3	Moderate	Outlet is partially blocked by sand or heavily constrained by tidal levels
	4	Poor	Outlet is fully blocked by sand/debris and is unable to function
Pipe Condition - Exposure	1	Excellent	Outlet is unlikely to be impacted by coastal processes (waves, storm tides, erosion)
	2	Good	Outlet may experience minor impacts due to coastal processes, or may be significantly impacted but is protected with mitigation measures in good condition
	3	Moderate	Outlet may be significantly impacted and protection measures are in poor condition
	4	Poor	Outlet is experiencing severe impacts and has no protection measures

3.3 Economic, Environmental and Social Criteria

For the MCA to be effective, it needed to encapsulate the impact of the presence of a foreshore drainage outlet, and how it interacts with the surrounding area, considering how these interactions fit into the economic, environmental and social context as part of the TBL approach as previously conducted. Each outlet needed to be assessed for its impacts and potential impacts on people and the environment. In order to achieve this, five MCA categories were established:

- Financial/Property
- Amenity
- Aesthetics
- Environment
- Health and Safety

In order to appropriately assess and quantify the performance of each outlet in relation to each category, a list of suitable criteria was developed by determining how the categories could potentially be rated through visual inspection. The criteria needed to incorporate the diverse array of impacts that fall within each category. Previously identified issues and concerns and the community survey results were also used as an input to this criteria development. The resulting assessment criteria for each are shown in Table 3-2. Note that the much of the criteria for the Financial/Property category falls within the condition assessment. While not identical to the URS Study, the categories utilised for this assessment and their criteria were considered to be consistent with previous inspection that was carried out on assets within the Mornington Peninsula Shire.

Table 3-2 MCA Assessment Criteria

Category	Criteria
Financial/Property	<i>Completed as part of Outlet Condition Assessment, identifying:</i> Damage to private or public infrastructure due to blockage Damage to infrastructure due to outflows
Environment	Odour; Impact on habitat / marine reserve; Impact on species inclusive of marine reserve; Impact on water quality; and Impede coastal processes causing scour and general degradation to the beach.
Aesthetics	Structure interrupts views along foreshore. Affects the landscape; Structure protrudes out of the natural lie of the land; Structure is visually unattractive (i.e. vandalised, collects rubbish); Structure out of character with surrounding environment; and Surface flows scour beach and affect "on beach" aesthetics.
Amenity	Structure/scour disrupts people movement along foreshore; Prevents or restricts the community's use of the beach for recreation based activities; and Affects the popularity of the beach during the peak and off seasons.
Health and Safety	Tripping risk - falling onto structure; Tripping risk - falling down or from structure; Injury from diving off the structure; Person entering pipe and being injured; Illness from ingestion of ponded water; and Person falling into a scour hole holding water.

3.4 MCA Calculation

3.4.1 Estimation of the magnitude of Impacts

A key element of this project was to have a methodology that was consistent with Melbourne Water's previous assessment of drainage outlets in MPS. That assessment adopted a semi-quantitative method for assessing the magnitude of each specific impact, where a value is used to provide an approximation of the magnitude of the impact. This approach allows for the application of some type of scale to the assessment for a better comparison between all the criteria.

As highlighted in Section 1.3, the impact levels needed to be refined meet the needs of Council. This was due to the adoption of impact levels that were appropriate for Melbourne Water but are too coarse to provide any differentiation at a local government scale. For this project, minor changes were made to the assessment criteria to better reflect the scale of the project and the focus on determining the relative priorities for undertaking repairs to each stormwater outlet. These minor changes related primarily to the magnitude of the values applied to financial and environmental risk categories. For example, extreme impacts were no longer categorised as impacts that were of State-wide importance.

Five impact categories were adopted, ranging from negligible to extreme, with a logarithmic scoring system adopted, consistent with the previous URS study. The impact levels for each of these categories are shown in Table 3-3, along with a definition as to what constitutes to each impact level, including a description of the magnitude of the impact in terms of affected areas, peoples, timeframes and associated costs.

Table 3-3 Impact Levels

<i>Impact Level</i>		<i>Negligible</i>	<i>Minor</i>	<i>Moderate</i>	<i>Major</i>	<i>Extreme</i>
		No or minimal impact on communities. Impacts would affect less than 10 individuals	Low level impact in some communities or moderate impact for a small number of individuals	Moderate impact for local communities or low impact for wider area	High impact in a local area or moderate impact community wide	Extreme impact in a local area or high impact community wide
<i>Category</i>	Score	0.1	1	10	100	1000
<i>Financial and Property</i>	Cost to Repair/Replace	Cost to replace or repair \$0-2,000	Cost to replace or repair \$2-15,000	Cost to replace or repair \$15-50,000	Cost to replace or repair \$50-150,000	Cost to replace or repair > \$150,000
	Property At Risk	No Private land at risk	1-10 Private Properties at Risk due to failure	10-20 Properties at Risk due to failure	20-50 Properties at Risk due to failure or Public Infrastructure (roads, footpaths etc.)	>50 Properties at Risk due to failure or Major Public Infrastructure (roads, buildings etc.)
<i>Environmental</i>	Habitat, communities and assemblages	Outlet does not affect Habitat	Outlet causes minor disturbance to habitat, in line with natural variation	Outlet causes disturbance that impacts 1-5% of habitat in local area	Outlet causes disturbance that impacts 5-20% of habitat in local area	Outlet causes disturbance that impacts >20% of habitat in local area
	Coastal Processes	No impact on coastal processes	Outlet causes minor changes to coastal process, usually within natural variation	Outlet causes minor changes to coastal process, greater than natural variation	Outlet significantly impacts local coastal process	Outlet significantly impacts coastal process on a regional scale
<i>Social</i>	Amenity - Recreation	Recreational use of the beach is not impacted	Recreation use of the beach is limited, local to the outlet, and is in a low use area	Recreation use of the beach is limited, local to the outlet, and is in a moderate use area (10-100 individuals/day)	Recreation use of the beach is limited, local to the outlet, and is in a high use area (100-500 individuals/day)	Recreation use of the beach is highly restricted due to the outlet
	Aesthetics - Visual, Noise, Odour	Impacts alter the perception of the area as pleasant and attractive to live or visit for less than 10 individuals	Impacts alter the perception of the area as pleasant and attractive to live or visit for 10-100 individuals	Impacts alter the perception of the area as pleasant and attractive to live or visit for 100-1000 individuals	Community Perception that the area is significantly damaged. Area losses appeal as recreation or residential area	Community Perception that the area has experienced major damage as a recreational and residential area and should be avoided.
<i>Public Health and Safety</i>	Minor Injury/Illness	Minor injury or illness (<10 people)	Minor injury or illness (10-100 people)	Minor injury or illness (>100 people)	n/a	n/a
	Major Injury / Illness	n/a	Major injury or illness (1 person)	Major injury or illness (<10 people)	Major injury or illness (10-100 people)	Major injury or illness (100-1000 people)
	Fatality, Serious injury, Disability	n/a	n/a	1 fatality or serious injury	Between 1 and 10 fatalities/serious injuries	Greater than 10 fatalities /serious injuries

3.4.2 Estimation of Likelihood

Scores generated from the impact table are an indication only of the magnitude of the effect of the impact. The likelihood of that impact occurring in any given year effectively provides a modifier for the total impact score. For the purposes of the assessment, amenity, aesthetic and environmental impacts were considered to be a certainty, and will therefore have a likelihood of 100%. For the other criterion, Table 3-4 was used when assessing the likelihood of an impact occurring.

Table 3-4 Likelihood Criteria (best estimate of % chance in a given year)

Score	Estimate of % chance in a given year
10	Occurrence almost certain in the next year
7.5	75% chance of occurrence in the next year
5	50% chance of occurrence in the next year
2.5	25% chance of occurrence in the next year
1	10% chance of occurrence in the next year
0.1	1% chance of occurrence in the next year
0.01	Very unlikely to occur (less than 1% chance in any year)

The score for each element from the magnitude and likelihood tables were multiplied and added together to form a raw score for that consideration (Financial/Property, Environmental, Social and Health and Safety). It is noted that as some areas have a higher number of individual elements.

3.4.3 Potential Impact Calculation

In order to determine the impact of each of the MCA assessment criteria, the product of the level of impact and the likelihood of the impact occurring was calculated. The total impact of each MCA category (Property, Environment, Aesthetics, Amenity and Health and Safety) on an outlet was calculated by adding the impact of each criterion within that category. For example, the sum of the impact of all criteria within the category of aesthetics.

To allow the five categories to be directly comparable in the overall total impact calculation, the results normalised in order to prevent the dominance of the categories that had a higher number of criterion by which to judge the category performance.

Note that there was the option to apply weighting factors to an MCA, to better reflect key concerns and priorities of Council. This option was considered following the generation of the MCA results and is discussed further in Section 5.

4 Field Data Collection

4.1 GIS and Collector

The location and asset information provided by MPS on each drainage outlet was incorporated into the GIS system. To facilitate the field work data collection an online interactive GIS database, ESRI ArcGIS Online, within a field work tablet, was used to record and analyse each outlet against the categories and their respective criteria. GPS positioning within the ArcGIS online tool enabled each outlet to be located whilst in the field.

The Collector application, powered by ESRI ArcGIS Online, was set up with the MCA proforma designed specifically for this project. The approach allowed for the inspection team to input the MCA assessment directly to the database and include linkages to relevant site photos and information. The GIS system also allowed for online editing of the database via the tablet used on site.

4.2 Field Work

The field data collection involved locating each of the 162 outlets identified by MPS as being a coastal foreshore stormwater asset. The field data collection occurred over six days during September and October 2015. Two Cardno engineering staff carried out the inspection of each outlet, examining the condition structural, operational and safety. It was noted that some outlets were recorded multiple times in the asset database. Where appropriate, these were consolidated to a single outlet location.

At the location of the asset, GPS coordinates were recorded and the outlet condition assessment was completed. The outlet condition assessment involved rating the asset using the outlet condition assessment criteria and MCA assessment criteria. This assessment included completing the MCA proforma within the tablet upon visual inspection. Photographs of the asset were taken to confirm the asset identity and to enable further analysis following the site visit.

The criteria utilised for this assessment was consistent with previous inspection carried out on assets within the Morningside Peninsula Shire. As the assessment was to consider how a drainage outlet interacts with the beach and coastline, each outlet was inspected in its entirety, incorporating multiple coastal based drainage structures such as pipes, pits and spillways, as a part of one single assessment.

By conducting all inspections within a short timeframe of several weeks, this ensured all outlets had all been exposed to the same events and seasonality and their response to similar conditions could be estimated. The same two staff members undertook all inspections, maintaining an additional degree of consistency for the assessment.

5 Multi Criteria Analysis

5.1 MCA Overview

The MCA assessment was successfully conducted using the methodology outlined within Sections 3 and 4. The resulting impact calculations of the MCA assessment for each individual outlet were tabulated and then further analysed to identify key issues evident within each category, as well as individual assets of concern.

As part of the field work, the condition assessment was conducted as a standalone assessment that fed into the MCA under the “Property” category (Figure 5-1). The aim of the MCA was to create a list of prioritised outlet for maintenance works.

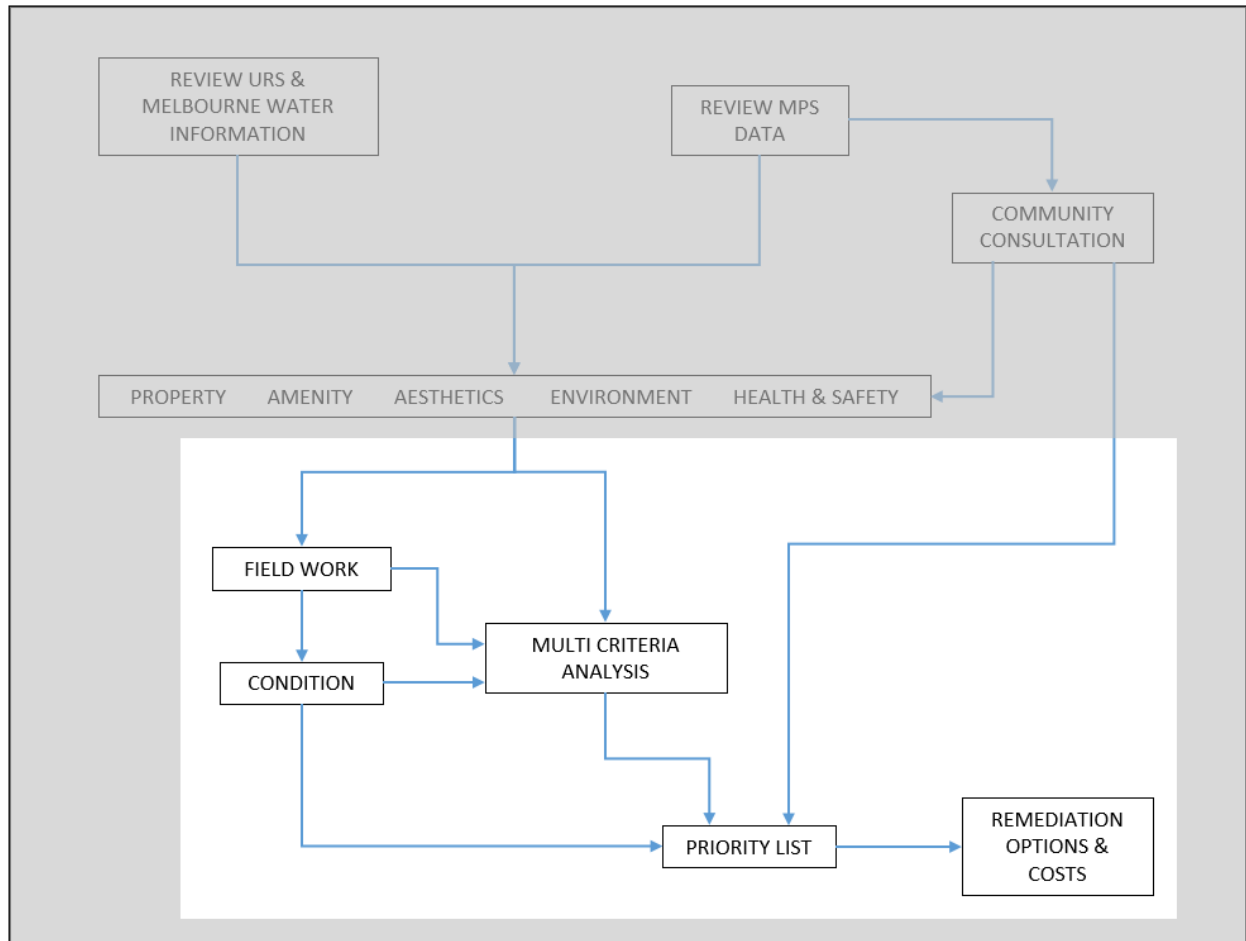


Figure 5-1 Partial schematic of Figure 1-2 Drainage outlet assessment approach

Following the generation of the MCA results, the possibility of applying weighting factors to better reflect key concerns and priorities of Council was considered. Comparing the higher ranking outlets for the different categories, it was felt that the results reasonably identified the key outlets without applying weighting factors and the method was deemed suitable in highlighting outlets that require maintenance in the near future. The previous report and the community responses from the survey also indicated this balanced approach was appropriate.

5.2 Condition Assessment

5.2.1 Key Issues

In order to highlight key outlet condition issues apparent among assets investigated, all assets given a score of 3 or 4 for MCA criteria including Alignment, Structure, Operation and Exposure in Table 3-1 were identified. Pipe condition issues evident in each of these assets were then identified. As shown in

K, the most prevalent issue identified among outlets was significant scour and ponding, affecting outlet operation. Structural issues including major cracking, corrosion and spalling were also identified in a number of outlets.

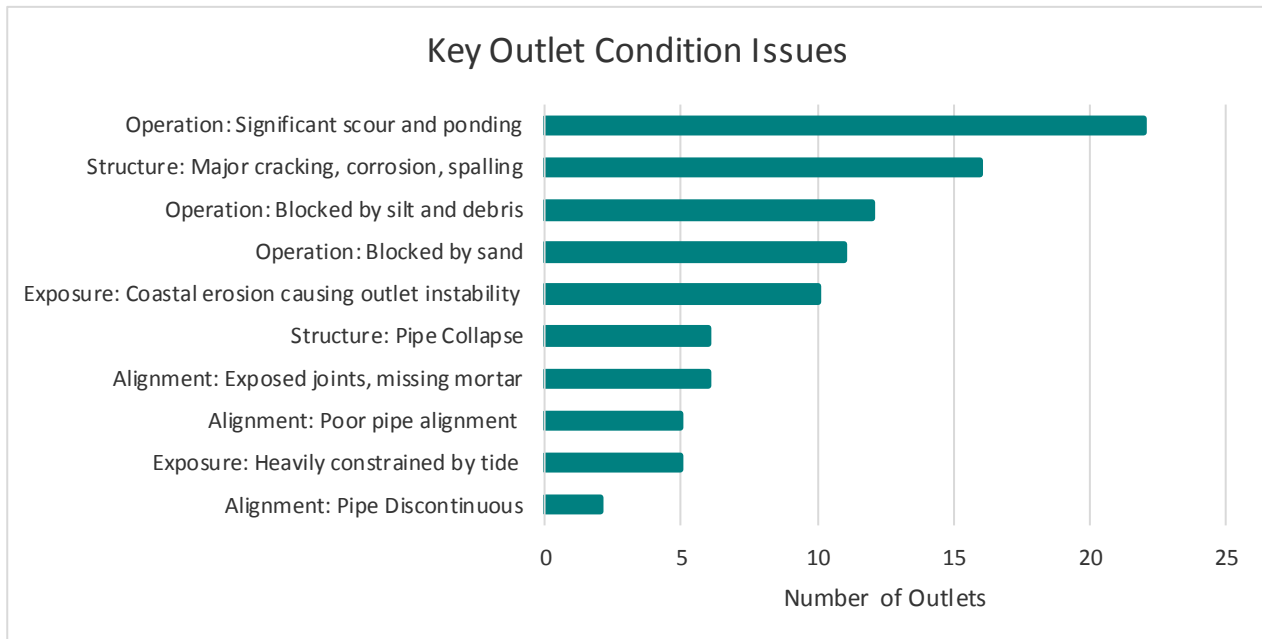


Figure 5-2 Key Outlet Condition Issues

5.2.2 Key Outlets

In order to identify assets that should be prioritised for repair or replacement due to outlet condition issues relating to alignment, structure, operation and exposure, assets with the twenty highest impact ratings have been identified.

As MPS are particularly interested in operational and functional condition of the outlets, mitigation options and their costings for the property category have been considered for the thirty highest property ratings.

5.3 MCA Results

5.3.1 Key Issues

The key outlet issues considering property, environment, aesthetics, amenity and health and safety have been identified in Figure 5-4. Impact scores outlined in Table 3-3 were assigned to each asset for each of the developed assessment criteria. The key issues present among foreshore assets were then identified by adding the impact of each MCA criteria assessed. The most significant issue identified was the visual unattractiveness of outlet structures. It is evident from Figure 5-4 that issues within the categories of Aesthetics and Pipe Condition are considered to have the greatest impact. Issues within the category of Health and Safety have a relatively low impact compared to other categories because the likelihood of occurrence is relatively low, however, in some cases the consequence of Health and Safety issues is high.

The full outcome of the MCA is found in Appendix B, including the approximate street address of each outlet.

5.3.2 Key Outlets

All assets were ranked for each category to identify the outlets were experiencing significant issues. These initial rankings (shown in Table 5-1), included all assets of MPS and Melbourne Water. Melbourne Water assets are shown in blue and the previously inspected MPS drains are *italicised* in Table 5-1.

Table 5-1 MCA Results: Top 15 ranked outlets by category, including Melbourne Water assets (blue) and previously inspected MPS Outlets (*italicised*).

Property (Pipe Condition)		Environment		Aesthetics		Amenity		HSE		
ID	Rating	ID	Rating	ID	Rating	ID	Rating	ID	Rating	
1	MI100115	55.00	MI100064	42.22	<i>MI100109</i>	82.00	<i>MI100109</i>	40.00	MI100118	22.52
2	MI100061	52.75	<i>MI100109</i>	24.40	<i>MI100013</i>	80.20	MI100104	40.00	<i>MI100120</i>	18.75
3	MI100063	52.75	MI100061	24.04	MI100015	80.20	MI100118	37.00	<i>MI100109</i>	11.25
4	<i>MI100170</i>	50.28	<i>MI100013</i>	20.80	<i>MI100011</i>	62.20	MI100117	33.70	<i>MI100051a</i>	4.44
5	MI100121	30.25	MI100015	20.62	MI100121	24.40	<i>MI100011</i>	10.00	MI100040	4.26
6	MI100062	30.03	<i>MI100111</i>	20.06	MI100111	10.00	<i>MI100182</i>	10.00	MI100168	3.00
7	<i>MI100160</i>	30.00	<i>MI100047</i>	8.02	MI100163	10.00	MI100168	7.00	MI100061	2.67
8	MI100127	28.00	MI100060	8.00	MI100004	8.20	MI100034	7.00	MI100121	1.85
9	MI100089	28.00	MI100063	6.22	<i>MI100175</i>	8.20	<i>MI100055</i>	6.67	MI100106	1.84
10	<i>MI100109</i>	27.55	MI100062	6.22	<i>MI100052</i>	8.20	<i>MI100013</i>	4.00	MI100169	1.75
11	MI100053	27.55	<i>MI100182</i>	4.42	MI100169	8.02	MI100163	4.00	<i>MI100170</i>	1.75
12	MI100053	27.55	MI100152	4.40	<i>MI100014</i>	6.40	<i>MI100175</i>	4.00	MI100094	1.68
13	MI100150	27.53	MI100042	4.04	MI100040	6.40	<i>MI100170</i>	4.00	MI100115	1.19
14	MI100071	25.75	<i>MI100113</i>	4.04	<i>MI100051</i>	6.40	<i>MI100077</i>	4.00	MI100071	1.09
15	MI100064	25.28	<i>MI100011</i>	2.80	<i>MI100029</i>	6.40	MI100078	4.00	MI100062	1.09

Given the larger size of the Melbourne Water assets within the study area, it is unsurprising that a high proportion of their assets have ranked quite highly within the MCA for each category. This is because their larger size lends itself to higher flow volumes and more formal structures, which are likely to have a more significant impact when compared to smaller council drains.

Table 5-2 presents the top ten ranked outlets owned by MPS, identified by the assessment for each of the five categories. This provides Council with an understanding of the relative importance of each asset and their associate risk against each criteria. The rating scores are comparable across categories.

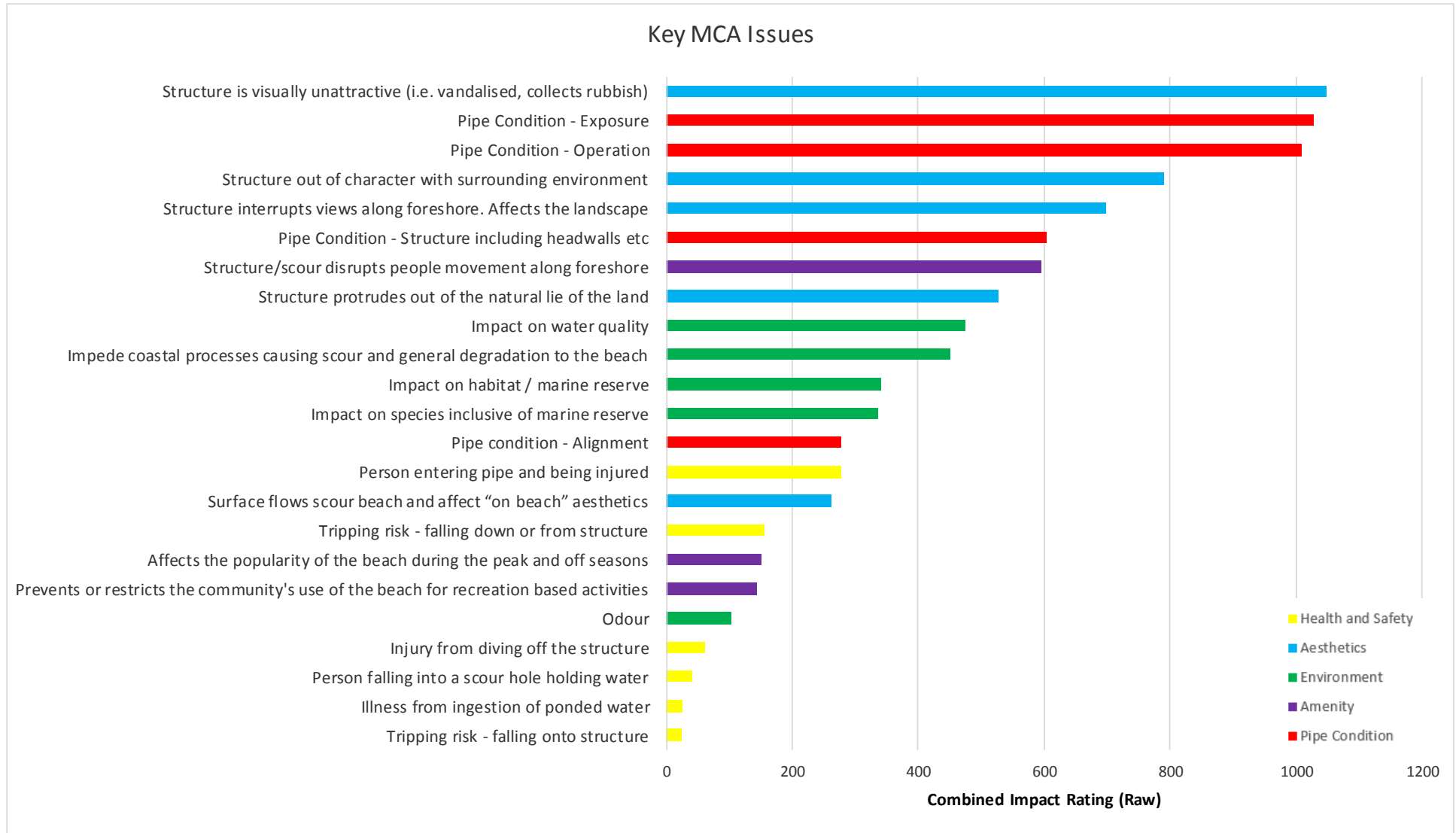


Figure 5-4 Key MCA Issues

Table 5-2 MCA Results: Top 10 ranked MPS outlets by category

	Property (Pipe Condition)		Environment		Aesthetics		Amenity		HSE	
	ID	Rating	ID	Rating	ID	Rating	ID	Rating	ID	Rating
1	MI100115	55.00	MI100064	42.22	MI100013	80.20	MI100104	40.00	MI100118	22.52
2	MI100061	52.75	MI100061	24.04	MI100015	80.20	MI100118	37.00	MI100120	18.75
3	MI100063	52.75	MI100013	20.80	MI100121	24.40	MI100117	33.70	MI100051a	4.44
4	MI100121	30.25	MI100015	20.62	MI100111	10.00	MI100168	7.00	MI100040	4.26
5	MI100062	30.03	MI100047	8.02	MI100163	10.00	MI100034	7.00	MI100168	3.00
6	MI100160	30.00	MI100060	8.00	MI100004	8.20	MI100055	6.67	MI100061	2.67
7	MI100127	28.00	MI100063	6.22	MI100169	8.02	MI100013	4.00	MI100121	1.85
8	MI100089	28.00	MI100062	6.22	MI100040	6.40	MI100163	4.00	MI100106	1.84
9	MI100053	27.55	MI100152	4.40	MI100115	4.60	MI100078	4.00	MI100169	1.75
10	MI100150	27.53	MI100042	4.04	MI100077	4.60	MI100120	4.00	MI100094	1.68

The rating values in Table 5-1 and Table 5-2 also demonstrate that while there are a small number of outlets within each category that have very high ratings, the rating values drop off quite quickly, with most of the categories only having 3 to 4 standout outlets of concern.

Upon assigning ratings, the previous study incorporated threshold values to provide perspective as to the rating values below which an outlet is considered to be in an acceptable state. As MPS are particularly interested in operational and functional condition of the outlets, mitigation options arising for the property category has been considered separately and will therefore investigate mitigation options and costings for the thirty highest property ratings. However, for the remaining categories, a rating of ten is thought an appropriate threshold for works to be considered to mitigate the identified risks. As Table 5-2 indicates, there are eleven outlets that exceed this criteria for the environment, aesthetics, amenity or HSE criteria. Mitigation options are presented in Section 6.

5.3.3 Total Impact Rating

The overall impact rating, combining the ratings for the five MCA categories, was also calculated. In order to identify key outlets to be further investigated, the foreshore drainage outlets with the twenty highest impact ratings were selected. Figure 5-5 shows the 20 highest priority assets based on total impact with the size of the dots being representative of the level of impact, and thus a priority, from highest to smallest. 0 provides a summary of the top ten Council owned assets for Total Impact.

Table 5-3 MCA Results: Top ten ranked MPS outlets by Total Impact Rating

	ID	Address	Total Impact Rating
1	MI100013	013 : 775 Point Nepean Road McCrae 3938	113.38
2	MI100015	015 : 690 Point Nepean Road McCrae 3938	105.85
3	MI100061	061 : Fred Smith Reserve Hastings 3915	83.73
4	MI100064	064 :25 Skinner Street Hastings 3915	68.34
5	MI100118	118 : 2-4 Kunyung Road Mount Eliza 3930	64.14
6	MI100063	063 : Hastings Foreshore Reserve (Tennis Club) Hastings 3915	63.35
7	MI100121	121 : 47 Rosserdale Crescent Mount Eliza 3930	56.88
8	MI100104	104 : 745A Esplanade Mornington 3932	43.54
9	MI100117	117 : 14 Albatross Avenue Mount Eliza 3930	38.57
10	MI100062	062 : Hastings Foreshore Reserve (Bowls Club) Hastings 3915	38.01

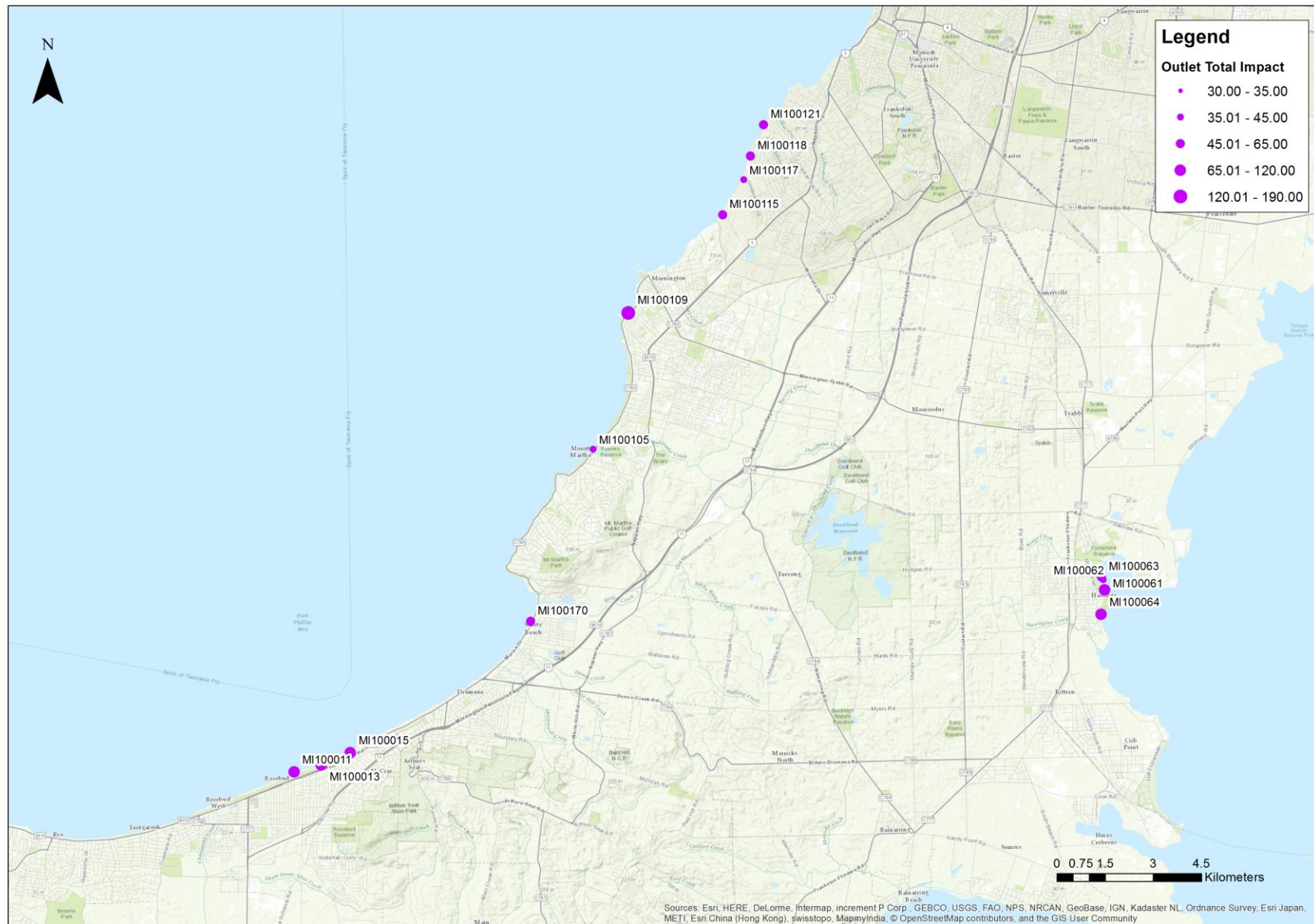


Figure 5-5 20 Highest Priority Assets based on Total Impact

5.4 Community Response

Following the analysis of the MCA results, individual assets, along with the overall concerns raised by the community and stakeholders were compared with the final high rating assets. Several of the assets identified by the community aligned with assets appearing within the high rating shortlists.

Of the 18 individual assets identified in the survey, six were in the top list by category and are highlighted in the table below (Table 5-4). An additional two outlets were identified in the thirty highest condition rating. (MI100044 and MI100125).

Table 5-4 MCA Results: Top 15 ranked outlets by category with community identified assets highlighted, Melbourne Water assets (blue) and previously inspected MPS Outlets (italicised).

	Property (Pipe Condition)		Environment		Aesthetics		Amenity		HSE	
	ID	Rating	ID	Rating	ID	Rating	ID	Rating	ID	Rating
1	MI100115	55	MI100064	42.22	MI100109	82	MI100109	40	MI100118	22.52
2	MI100061	52.75	MI100109	24.40	MI100013	80.20	MI100105	40.00	MI100120	18.75
3	MI100061	52.75	MI100109	24.4	MI100013	80.2	MI100118	37	MI100120	18.75
4	MI100063	52.75	MI100061	24.04	MI100015	80.2	MI100117	33.7	MI100109	11.25
5	MI100170	50.28	MI100013	20.8	MI100011	62.2	MI100011	10	MI100051a	4.44
6	MI100121	30.25	MI100015	20.62	MI100121	24.4	MI100182	10	MI100040	4.26
7	MI100062	30.03	MI100111	20.06	MI100111	10	MI100168	7	MI100168	3
8	MI100160	30	MI100047	8.02	MI100163	10	MI100034	7	MI100061	2.67
9	MI100127	28	MI100060	8	MI100004	8.2	MI100055	6.67	MI100121	1.85
10	MI100089	28	MI100063	6.22	MI100175	8.2	MI100013	4	MI100106	1.84
11	MI100109	27.55	MI100062	6.22	MI100052	8.2	MI100163	4	MI100169	1.75
12	MI100053	27.55	MI100182	4.42	MI100169	8.02	MI100175	4	MI100170	1.75
13	MI100053	27.55	MI100152	4.4	MI100014	6.4	MI100170	4	MI100094	1.68
14	MI100150	27.53	MI100042	4.04	MI100040	6.4	MI100077	4	MI100115	1.19
15	MI100071	25.75	MI100113	4.04	MI100051	6.4	MI100078	4	MI100071	1.09

The MCA results of each of the other identified assets were considered and while the study appreciated some of the concerns raised regarding individual outlets, the MCA results suggested the magnitude of these issues was not as significant in relation to the greater group of outlets. As each outlet underwent the same the same inspection and analysis, the MCA results are deemed the most suitable way to assign the prioritisation of maintenance works. The discrepancy between the community concerns and the MCA analysis may be related to the location of the responders to the survey.

6 Assessment of Management Options

6.1 Remediation and Cost

To aid MPS with prioritisation and scheduling works, some potential remediation solutions and associated costs were developed. The costs were classified into five separate bands, from *Negligible* cost of \$0-\$5000 through to *Extreme* cost of greater than \$150,000. Table 6-1 shows an overview of this cost breakdown.

Table 6-1 Cost Breakdown Summary

Cost Breakdown	Cost to repair/replace	Rating
Negligible	\$0 - \$5,000	0.1
Minor	\$2,000 - 15,000	1
Moderate	\$15,000 - \$50,000	10
Major	\$50,000 - \$150,000	100
Extreme	> \$150,000	1000

Based on the key issues identified as part of the MCA, there are some general maintenance measures that can be undertaken to remediate the impact of the outlet on the surrounding area (Table 6-2).

Table 6-2 Generic maintenance solutions and associated cost

Required Maintenance	Key Improvements	Required Works	Cost rating
Clearance of sand in and around the outlet.	Operation, less ponding,	Excavation, Jetting	Minor
Scour protection to protect the outlet from erosion	Operation, environment, amenity, aesthetics	Placement of rocks to reduce flow velocities, bubble-up pits	Minor to Moderate
Safety improvements	Health and Safety	Installation of signage, markers, rails	Minor
Scour protection to protect the dunes/beach from eroding	Operation, water quality, environment, health and safety, amenity, aesthetics	Placement of rocks to reduce flow velocities	Minor to Moderate
Repairs to cracked, damaged or deteriorated pipes	Structure, operation, alignment, health and safety	General repairs, patching, banding	Minor to Major
Redesign of some outlets	All categories	Detailed design and construction	Moderate to Extreme

Note that more detailed network modelling would be required to confirm the feasibility of making significant adjustments to the network, such as changes to configuration or merging of multiple outlets, to ensure they are of appropriate capacity to handle the stormwater outflows from the network.

6.2 Cost Estimates for Key Outlets

Cardno undertook a costing exercise based on an engineering assessment of each identified outlet. Following the condition assessment and the MCA analysis, costs were estimated for the remediation of individual drainage structures. These costs considered the required maintenance and repairs necessary to improve the outlet's structural condition and operation, as well improvements needed to reduce the impact of the outlet in regards to aesthetics, amenity, environmental, and health and safety.

The highest ten impact ratings were costed, along with any outlets that exceeded the threshold of ten for a particular category (Table 6-3)

Table 6-3 Costing of highest impact and threshold exceedances

ID	THRESHOLD EXCEEDED					RATING		\$ COST	DESCRIPTION OF REMEDIATION WORKS
	P R O P	E N V I	A E S T	A M E N	H S E	TOTAL IMPACT	COST		
MI100013	✓	✓	✓			113.38	100	150,000	Complete design required
MI100015	✓	✓	✓			105.85	100	100,000	Replace Pipe and rebuild cradles
MI100061	✓	✓				83.73	100	117,000	Outlet reconstruction inc pipe replacement and one way valve
MI100064	✓	✓				68.34	10	8,000	Further investigation required due to site sensitivity - Possibly a weir to prevent sediment accumulating against valve
MI100118	✓			✓	✓	64.14	10	28,000	Fill in existing pond. Placement rocks to extend spillway area to limit scour and resulting deep pond on beach. Revegetation.
MI100063	✓					63.35	1	5,000*	Repair and replacement of broken end section of pipe. Reposition rocks around outlet. Formalise headwall.
MI100121	✓		✓			56.88	100	150,000	Complete redesign
MI100105	✓			✓		43.54	10	50,000	Resolve amenity issue by constructing a walkway over creek outlet
MI100117	✓			✓		38.57	1	5,000*	Natural watercourse with no formalised structures. Needs clearing of organic debris, silt and rubbish
MI100062	✓					38.01	10	10,000	Remove Headwall, replace final pipe segment. Replace rocks
MI100120					✓	18.75	1	15,000	Place rocks in spillway area to limit scour. Regrade and clear out organic debris and silt in flowpath

In addition to costing up outlets with high impact ratings, remediation options for the thirty highest condition ratings were indicatively costed, as shown in Table 6-4.

Table 6-4 Remediation works and cost for top 30 rated condition

	ASSET ID	OWNER	ADDRESS	RATING			\$ COST	DESCRIPTION OF REMEDIATION WORKS
				CONDITION	TOTAL IMPACT	COST		
1	MI100115	MPS	115 : 2 Sunnyside Road Mount Eliza 3930	55.00	63.91	100	100, 000	Complete reinstatement
2	MI100061	MPS	061 : Fred Smith Reserve Hastings 3915	52.75	83.73	100	117, 000	Outlet reconstruction including pipe replacement and one way valve
3	MI100063	MPS	063 : Hastings Foreshore Reserve (Tennis Club) Hastings 3915	52.75	63.35	1	5,000*	Repair and replacement of broken end section of pipe.
4	MI100170	MW	170 : 145 Marine Drive Safety Beach 3936	50.28	64.29	100	106, 000	Complete redesign required - Clear out and put tide flex valve on the end
5	MI100121	MPS	121 : 47 Rosserdale Crescent Mount Eliza 3930	30.25	56.88	100	38, 000	Complete redesign and replacement
6	MI100062	MPS	062 : Hastings Foreshore Reserve (Bowls Club) Hastings 3915	30.03	38.01	10	10, 000	Remove Headwall, replace final pipe segment. Replace rocks
7	MI100160	MPS	160 : 741 Point Nepean Road McCrae 3938	30.00	33.63	1000	100, 000	Complete redesign required
8	MI100089	MPS	089 : 4 Hotham Road Sorrento 3943	28.00	28.97	0.1	5,000*	Maintenance – Clean out outlet
9	MI100127	MPS	127 : 71 Glen Shian Lane Mount Eliza 3930	28.00	34.84	10	31, 000	Repair and replacement of broken off section of pipe
10	MI100053	MPS	053 : 8 St Aubins Way Sorrento 3943	27.55	28.17	0.1	5,000*	Monitor to see if exposure results in flooding upstream in network
11	MI100109	MW	109 : 719 Esplanade Mornington 3931	27.55	185.20	1000	200, 000	Complete redesign required
12	MI100150	MPS	150 : 1 Stony Point Road Crib Point 3919	27.53	28.46	0.1	5,000*	Due to beach height, presence in base of sea wall is not adequate - Monitor to see if becomes fully blocked
13	MI100071	MPS	071 : 340 Esplanade Mount Martha 3931	25.75	29.90	100	64, 000	Replace outlet pit
14	MI100064	MPS	064 :25 Skinner Street Hastings 3915	25.28	68.34	10	5,000*	Further investigation required due to site sensitivity - Possibly a weir to prevent sediment accumulating against valve

	ASSET ID	OWNER	ADDRESS	RATING			\$ COST	DESCRIPTION OF REMEDIATION WORKS
				CONDITION	TOTAL IMPACT	COST		
15	MI100042	MPS	042 : 2535 Point Nepean Road Rye 3941	25.08	30.05	1	5,000 - 10,000	Allow flushout to occur during storm event
16	MI100044	MPS	044 : 2473 Point Nepean Road Rye 3941	25.00	25.00	10	19,000	Locate and dig out pipe. Determine if redesign required for present coastline state. Cost will increase if redesign required.
17	MI100056	MPS	056 : 2389 Point Nepean Road Rye 3941	10.00	14.55	10	10,000 – 26,000	Replace lost pipe, replace concrete cradles, install bulkhead,
18	MI100013	MPS	013 : 775 Point Nepean Road McCrae 3938	7.75	113.38	100	150,000	Complete design required
19	MI100133	MW	133 : 23 Gulls Way Mount Eliza 3930	7.75	11.64	10	33,000	Improve spillway and surrounding erosion and scour
20	MI100229	MPS	229 : 369-561 Point Nepean Road Dromana 3936	5.50	6.73	100	12,000	Redesign required - Could put rock around and allow weep through rock
21	MI100011	MPS	011 : End of Durham Place Rosebud 3939	5.50	81.03	1000	100,000 – 320,000	Consolidate three pipes into a single 1200mm pipe outfall
22	MI100122	MPS	122 : 2 Canadian Bay Road Mount Eliza 3930	5.50	10.14	1	19,000	Clean out pit, rock around to limit scour immediately around
23	MI100130	MPS	130 : 44 Jacksons Road Mount Eliza 3930	5.28	6.23	3	30,000	Fixed pipe alignment and pipe join upstream of outlet. Improve spillway and surrounding erosion and scour with some rock
24	MI100125	MW	125 : Ballar Creek, Mount Eliza 3930	5.28	11.69	10	24,000	Remove concrete basin - Energy dissipation works
25	MI100049	MPS	049 : 199-201 Point Nepean Road Dromana 3936	5.05	8.17	1	14,000	Pipe replacement, and construction of bulkhead with footings
26	MI100005	MPS	005 : 1219 Point Nepean Road Rosebud 3938	5.05	11.51	10	5,000*	Maintenance – Clean out sand channel
27	MI100169	MPS	169 : 145 Marine Drive Safety Beach 3936	3.25	16.10	100	106,000	Redesign required. Minor immediate maintenance would include patching cracks in pipe joins, repairing cradles at a cost rating of 10 (moderate)
28	MI100015	MPS	015 : 690 Point Nepean Road McCrae 3938	3.25	105.85	100	100,000	Replace Pipe and rebuild cradles
29	MI100012	MPS	012 : 856 Point Nepean Road Rosebud 3938	3.25	8.96	0.1	5,000*	Allow flush out to occur during storm event

ASSET ID	OWNER	ADDRESS	RATING			\$ COST	DESCRIPTION OF REMEDIATION WORKS	
			CONDITION	TOTAL IMPACT	COST			
30	MI100106	MPS	106 : 8 Helena Street Mount Martha 3934	3.25	5.35	0.1	46,000	Due to beach height, presence in base of sea wall is not adequate - Monitor to see if becomes fully blocked with silt or if exposure causes flooding

*Due to the cost of site establishment minor works have been estimated to cost \$5,000

7 Outcomes and Recommendations

The outcomes of the project include:

- > A comprehensive analysis of 162 drainage outlets that are within the Mornington Peninsula Shire. The assessment included:
 - The structural condition of the outlet
 - The impact of the outlet on property, amenity, aesthetic, environmental and health and safety criteria
- > The completion of an Multi-criteria assessment to identify the key issues at each outlet and rank the outlets of concern throughout the municipality;
- > An index of photos and information on each of the 162 outlets;
- > A ranked list of outlets for each criteria, indicating the outlets that are considered to have the highest impacts, enabling consideration of mitigation options;
- > Community concerns regarding individual drainage outlets; and
- > A list of potential mitigation options to mitigate the drainage outlets with structural issues, including an indicative costing for the highest ranked outlets.

The report will enable Council to prioritise spending and actions to target those outlets that were identified as the highest risk. Many of the outlets ranked the highest in the assessment are owned by Melbourne Water and results of the analysis should be passed through to that organisation.

7.1 Data Deliverables

The following digital data is provided as part of this report:

- A Digital Photo Library of all outlets assessed
- A GIS table of the MCA information at each drainage outlet
- A spreadsheet containing the MCA results
- A document with including all survey responses

Mornington Peninsula Drainage
Outlets Assessment

APPENDIX A
COMMUNITY SURVEY

ID	Please select a region to identify a drainage outlet of concern Response	Which drainage outlet is of highest concern in this region? Response	Ranked Importance					Is there anything else you would like to tell us about this drainage outlet? Open-Ended Response
			Aesthetics	Environment	Amenity	Property	Health and Safety	
MI100088	Blairgowrie to Portsea	088 : 1 Hotham Road Sorrento 3943	1	2	4	5	3	
MI100089	Blairgowrie to Portsea	089 : 4 Hotham Road Sorrento 3943	1	2	3	5	4	
	Crib Point to Hastings	I don't want to select an individual drainage outlet	3	1	5	4	2	the drainage outlets which concern me are not on your list they are at salmon st., Warrenqite cres James Hird drive. the last two flow into warrenqite creek but they are in the estuarine zone which goes all the way to just below the rail crossing at reid pde.
MI100032	Dromana	032 : Dromana Foreshore Off Point Nepean Road Dromana 3936	2	4	3	5	1	It is the ugliest and most unsafe outlet of all the MPS outlets to Dromana beaches and is probably the most visited and viewed.
	Dromana	032 : Dromana Foreshore Off Point Nepean Road Dromana 3936	2	4	3	5	1	This outlet is located at one of the most popular beaches of Dromana Bay and is visited by many beach users and is highly visible. The usually elongated scour channel removes much beach space and the stagnant pond of water is a safety hazard, as well as a magnet for children. Large timber pieces from old beach groynes present tripping risks and the vegetation at the outlet traps wind borne rubbish. There is little doubt that this drain contributes much of the pollution that triggers the EPA swimming alerts for Dromana after rain events.
	Dromana	032 : Dromana Foreshore Off Point Nepean Road Dromana 3936	2	3	4	5	1	This drain is located at a popular beach and adjacent a parking bay. The ugly long scour channel frequently exposes old timber structures. The surrounding vegetation catches wind borne debris in the stagnant waters. Highest priority for improvement
	Dromana							Can't see map. One of EPA's 5 poorest locations for beach report water quality Outlet under pier - end of pier st
	Dromana	032 : Dromana Foreshore Off Point Nepean Road Dromana 3936	2	4	3	5	1	This outlet is not that of the highest concern in the Dromana region. Outlets of higher or equal concern were identified in a previous survey and are not included in this survey. Just how the results of both surveys are to be combined is not clear to me given they are five years apart and use different criteria. This outlet is of concern as it is located at a very popular beach and adjacent a well used car park. The scour channel destroys a large section of beach and presents unhealthy ponds of stagnant water which accumulate debris. The foliage at the outlet is unsightly and the exposed old timbers are a safety hazard.
	Dromana	I don't want to select an individual drainage outlet					5	Health and safety are a major concern. Increased number of visitors to our area increases the level of responsibility. Who is responsible for providing a suitable environment for our visitors, local residents and their children, protecting their health and safety around drain outlets along the beaches? Aesthetics are an important consideration also. No-one should swim/play near a smelly neglected drain, especially as we have such beautiful beaches, with proper maintenance this should never happen. The impact on the environment and the local residents- should be a prime consideration.
	Dromana	032 : Dromana Foreshore Off Point Nepean Road Dromana 3936	4	5	2	3	1	
MI100165	Dromana	165 : 107 Point Nepean Road Dromana 3936	2	3	4	5	1	This outlet is often overgrown with weeds which harbour vermin and trap rubbish and stagnant water. The scour channel robs this popular beach of much beach space.
MI100050	Dromana	165 : 107 Point Nepean Road Dromana 3936	2	4	3	5	1	Vermin have been reported as being in the ugly scour channel which is usually choked with weeds. It is visually unattractive and is located at a well used beach, reducing the amenity and prevents full use of the beach.
	Dromana	050 : 181 Point Nepean Road Dromana 3936			3	2	5	
	Dromana	165 : 107 Point Nepean Road Dromana 3936	2	4	3	5	1	See notes to the previous outlet. This outlet is of equal or greater concern as some of those not included in this survey. This outlet is one of two located near a petrol station and in the past vapour fumes and vermin have been reported in both. The outlet is located at the back of the beach causing a long scour channel to form which is usually filled with weeds and polluted water, reducing the amount of useable beach and presenting an unsightly health risk. I intend selecting other outlets in another submission.
MI100030	Dromana	030 : 357 Point Nepean Road Dromana 3936	2	4	3	5	1	
MI100129	Mt Eliza	129 : 69 Williams Road Mount Eliza 3930	2	1	3	5	4	This drainage outlet is above a major car park which means that the area is utilized, year round, by the public. Algae pools at the base of the outlet & water quality - as assessed by the EPA - is frequently poor. The outlet, & surrounding areas, is unsightly - large lumps of rock, concrete & an unconnected pipe are visual impediments. The outlet is set well above the level of the surrounding landscape. Given that the Shire has given strong support for the restoration of indigenous habitats at this site, it would be wonderful to see drainage works further the amenity, aesthetics & water quality of this area.
MI100125	Mt Eliza	125 : Ballar Creek, Mount Eliza 3930	2	1	3	5	4	E. coli readings in Canadian Bay frequently exceed those required for safe swimming, particularly after rainfall. This drain is a direct contributor to those readings, and should be studied for fecal contamination. The poor state of the footbridge over the creek, and the disconnect of stairways also need revision and upgrading.
	Mt Eliza							In EPA's top 5 for poor water quality in beach report
	Mt Eliza	125 : Ballar Creek, Mount Eliza 3930	1	3	2		4	This very large & unsightly outlet is well above the waterline. While it may be beyond the scope of this survey, the relationship between this outlet & the surrounding steps & bridge is an aesthetic nightmare. Given that this area is near the Canadian Bay car park, it seems important that the aesthetics of the area be improved.
	Mt Eliza	129 : 69 Williams Road Mount Eliza 3930	1	4	3	5	2	This drain outlet is neglected and needs reconstructing in a more aesthetically pleasing manner.
								The primary concern re the Balcombe Creek/Estuary is the sediment that enters the creek and estuary via a number of storm water outlets drains. At the present time BERG Mt Martha and Shire have a monitoring and measurement program underway. Details of this may be obtained from Jessica Wingad, MPS officer - Ph 5950 1278 or email jessica.wingad@mornpen.vic.gov.au
MI100105	Mt. Martha	105 : Balcombe Creek Mount Martha 3934	4	1	3	5	2	
MI100182	Mt. Martha	182 : 463-465 Esplanade Mount Martha 3931						
MI100083	Mt. Martha to Safety Beach	083 : 115 Marine Drive Safety Beach 3936						
MI100179	Pt Leo to Somers	179 : 66 Western Parade Point Leo 3916	3		2	1		When this was put in it changed the hydrology of the area. The pipe is now causing erosion of the surrounding area and is an eye sore. The water should have been diverted into the wetlands where it would have followed a now disused water course
	Pt Leo to Somers	179 : 66 Western Parade Point Leo 3916	3	1	4	5	2	
MI100146	Rosebud	146 : 380 Esplanade Mount Martha 3931						
	Rosebud							

	Rosebud		3	5				
MI100040	Rosebud West to Rye	040 : 2495 Point Nepean Road Rye 3941	3	2		4	1	It is quite deep and dangerous and often has stagnant water lying there. All the drainage outlets need work on then eg barriers for rubbish.
MI100047	Rosebud West to Rye	047 : 2145 Point Nepean Road Rye 3941	3	2	4	5	1	It doesn't run straight out to sea it goes along the beach and washes away a lot of sand
	Rosebud West to Rye	Rosebud West to Rye	3	1	4	5	2	I am not sure I have the right drainage outlet, so have not selected from the above - all outlets on Rye Beach foreshore are of concern. The largest drain is the one almost opposite Elgin St. Rye (perhaps no. 42?)
								your references are wrong. 034 is mouth of chinamans creek which is in rosebud west 3940 beach washing away threatening swamp skink population / board walk disappearing at bridge. illegal covering of swamp skink habitat by melbourne water. fencing washed away. we spent years trying to protect this area. seems personnel making decisions are not qualified to do so. discussed area with matt srahmers and ceo carol cowie. nothing beind done expect a few plants to be put in. needs serious plans to reduce erosion and drifting sand blowing up on vegetation and around car park area to east immediate restoration needs to be done. no one prepared to take control of area plans of restoration need to be done and implemented quickly our friends group are considering legal action against melbourne water under the flora and fauna for destroying swamp skink habitat without taking proper action to protect the species during works the question is should the outlet be cleaned out. my answer to that is no. the recent works carried out by melbourne water had a devastating effect on the area. photos and observations available.
MI100034	Rosebud West to Rye	034 : 1571 Point Nepean Road Rosebud 3938	2	1	3	4	5	As before with all outlets
MI100044	Rosebud West to Rye	044 : 2473 Point Nepean Road Rye 3941	3	2	4	5	1	It doesn't drain away properly and floods the bike track.
	Rosebud West to Rye	044 : 2473 Point Nepean Road Rye 3941	3	1	4	5	2	See previous answer - all outlets on the Rye foreshore are an issue
								pt nepean road rosebud west this indicates the silt trap on chinamans creek the north side of pt nepean road the silt trap was part of the drainage design carried out by pat condina and neil craige access to cran this silt trap out is in place .the cleaning out is the duty of melbourne water. my understanding is that the silt trap forms a venturi effect during high flows. when i was looking after the creek the trap was cleaned out around every 3 years. indeed an access gate was put in for this purpose. melbourne water seem to think that this silt trap does not need to be serviced, i beg to differ.
MI100034	Rosebud West to Rye	035 : 1571 Point Nepean Road Rosebud 3938	3	1	4	2	5	
	I don't want to select any more outlets	I don't want to select an individual drainage outlet	4	1	5	3	2	

Mornington Peninsula Drainage
Outlets Assessment

APPENDIX B
MCA ASSESSMENT

Raw Impact

Scaled Impact: 0.2 for each at this stage

AssetID_MPS		TOTAL (Pipe Condi- tion)	TOTAL (Enviro- ment)	TOTAL (Aesth- etics)	TOTAL (Ameni- ty)	TOTAL (HSE)	Total: Raw Data Impact	TOTAL (Pipe Condi- tion)	TOTAL (Enviro- ment)	TOTAL (Aesth- etics)	TOTAL (Ameni- ty)	TOTAL (HSE)	Total: Scale d Impac- t
MI100116	116 : 8 Osprey Avenue Mount Eliza 3930	0.55	0.28	4.42	0.10	0.18	5.53	0.11	0.06	0.88	0.02	0.04	1.11
MI100117	117 : 14 Albatross Avenue Mount Eliza 3930	0.00	2.42	2.44	33.70	0.01	38.57	0.00	0.48	0.49	6.74	0.00	7.71
MI100035	035 : 1571 Point Nepean Road Rosebud 3938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100034	034 : 1571 Point Nepean Road Rosebud 3938	0.28	0.82	0.82	7.00	0.04	8.95	0.06	0.16	0.16	1.40	0.01	1.79
MI100036	036 : 1695 Point Nepean Road Rosebud 3938	0.78	0.46	1.00	4.00	0.45	6.68	0.16	0.09	0.20	0.80	0.09	1.34
MI100037	037 : 1781 Point Nepean Road Rosebud 3938	3.03	0.28	1.00	1.00	0.45	5.75	0.61	0.06	0.20	0.20	0.09	1.15
MI100048	048 : 1931 Point Nepean Road Tootgarook 3941	0.78	0.64	0.46	1.00	0.02	2.90	0.16	0.13	0.09	0.20	0.00	0.58
MI100047	047 : 2145 Point Nepean Road Rye 3941	2.80	8.02	4.06	0.40	0.02	15.30	0.56	1.60	0.81	0.08	0.00	3.06
MI100038	038 : 2285 Point Nepean Road Rye 3941	3.03	0.64	0.82	0.40	0.06	4.95	0.61	0.13	0.16	0.08	0.01	0.99
MI100056	056 : 2389 Point Nepean Road Rye 3941	10.00	0.06	0.62	3.70	0.17	14.55	2.00	0.01	0.12	0.74	0.03	2.91
MI100039	039 : 2389 Point Nepean Road Rye 3941	1.00	0.28	1.00	3.70	0.07	6.05	0.20	0.06	0.20	0.74	0.01	1.21
MI100045	045 : 2413 Point Nepean Road Rye 3941	2.80	0.10	0.28	0.70	0.01	3.89	0.56	0.02	0.06	0.14	0.00	0.78
MI100043	043 : 2463 Point Nepean Road Rye 3941	0.33	0.28	0.46	1.00	0.06	2.13	0.07	0.06	0.09	0.20	0.01	0.43
MI100044	044 : 2473 Point Nepean Road Rye 3941	25.00	0.00	0.00	0.00	0.00	25.00	5.00	0.00	0.00	0.00	0.00	5.00
MI100040	040 : 2495 Point Nepean Road Rye 3941	0.55	2.62	6.40	1.00	4.26	14.83	0.11	0.52	1.28	0.20	0.85	2.97
MI100042	042 : 2535 Point Nepean Road Rye 3941	25.08	4.04	0.82	0.10	0.02	30.05	5.02	0.81	0.16	0.02	0.00	6.01
MI100041	041 : 2831 Point Nepean Road Rye 3941	0.55	0.10	1.00	0.70	0.01	2.36	0.11	0.02	0.20	0.14	0.00	0.47
MI100089	089 : 4 Hotham Road Sorrento 3943	28.00	0.06	0.80	0.10	0.01	28.97	5.60	0.01	0.16	0.02	0.00	5.79
MI100053	053 : 8 St Aubins Way Sorrento 3943	27.55	0.44	0.08	0.00	0.10	28.17	5.51	0.09	0.02	0.00	0.02	5.63
MI100088	088 : 1 Hotham Road Sorrento 3943	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100054	054 : 8 Merrylands Avenue Portsea 3944	3.00	0.80	0.82	0.00	0.00	4.62	0.60	0.16	0.16	0.00	0.00	0.92
MI100220	220 : 3658 Point Nepean Road Portsea 3944	0.55	2.44	2.62	1.00	0.84	7.45	0.11	0.49	0.52	0.20	0.17	1.49
MI100055	055 : 3782 Point Nepean Road Portsea 3944	0.33	0.42	2.26	6.67	0.18	9.85	0.07	0.08	0.45	1.33	0.04	1.97
MI100066	066 : 30 Western Parade 3916	3.03	0.46	0.82	0.10	0.18	4.58	0.61	0.09	0.16	0.02	0.04	0.92
MI100179	179 : 66 Western Parade Point Leo 3916	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100179	179 : 66 Western Parade Point Leo 3916	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100178	178 : 22 The Promenade Somers 3927	0.33	0.64	0.44	1.00	4.44	6.84	0.07	0.13	0.09	0.20	0.89	1.37
MI100178a	178b : 22 The Promenade Somers 3927	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100157	157 : 17 Western Park Road Somers 3927	0.00	0.20	0.00	0.70	0.01	0.91	0.00	0.04	0.00	0.14	0.00	0.18
MI100155	155 : 17 Stony Point Road HMAS Crib Point 3919	0.08	0.44	0.00	0.00	0.00	0.52	0.02	0.09	0.00	0.00	0.00	0.10
MI100154	154 : 11-17 Stony Point road Crib Point 3919	2.78	0.44	0.00	0.00	0.00	3.22	0.56	0.09	0.00	0.00	0.00	0.64
MI100153	153 : 17 Stony Point Road HMAS Cerberus 3920	0.00	0.42	0.00	0.00	0.00	0.42	0.00	0.08	0.00	0.00	0.00	0.08

MI100152	152 : 17 Stony Point Road HMAS Cerberus 3920	2.78	4.40	0.00	0.00	0.01	7.18	0.56	0.88	0.00	0.00	0.00	1.44
MI100151	151 : 9 Stony Point Road Crib Point 3919	3.00	0.44	0.00	0.00	0.00	3.44	0.60	0.09	0.00	0.00	0.00	0.69
MI100150	150 : 1 Stony Point Road Crib Point 3919	27.53	0.10	0.64	0.10	0.09	28.46	5.51	0.02	0.13	0.02	0.02	5.69
MI100156	156 : 142 Stony Point Road Crib Point 3919	2.55	2.60	0.00	0.00	0.00	5.15	0.51	0.52	0.00	0.00	0.00	1.03
MI100060	060 : 17 Colin Parade Crib Point 3919	0.28	8.00	0.60	0.00	0.20	9.08	0.06	1.60	0.12	0.00	0.04	1.82
MI100064	064 :25 Skinner Street Hastings 3915	3.25	42.22	0.80	0.00	0.04	46.31	0.65	8.44	0.16	0.00	0.01	9.26
MI100064	064 :25 Skinner Street Hastings 3915	25.28	42.22	0.80	0.00	0.04	68.34	5.06	8.44	0.16	0.00	0.01	13.67
MI100061	061 : Fred Smith Reserve Hastings 3915	52.75	24.04	4.24	0.03	2.67	83.73	10.55	4.81	0.85	0.01	0.53	16.75
MI100062	062 : Hastings Foreshore Reserve (Bowls Club) Hastings 3915	30.03	6.22	0.64	0.03	1.09	38.01	6.01	1.24	0.13	0.01	0.22	7.60
MI100062	063 : Hastings Foreshore Reserve (Tennis Club) Hastings 3915	52.75	6.22	4.24	0.03	0.11	63.35	10.55	1.24	0.85	0.01	0.02	12.67
MI100104	104 : 745A Esplanade Mornington 3932	0.78	0.26	0.06	0.00	0.00	1.10	0.16	0.05	0.01	0.00	0.00	0.22
MI100148	148 : 745A Esplanade Mornington 3932	0.55	0.06	0.06	0.10	0.00	0.77	0.11	0.01	0.01	0.02	0.00	0.15
MI100103	103 : 745A Esplanade Mornington 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100102	102 : 751 Esplanade Mornington 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100109	109 : 719 Esplanade Mornington 3931	27.55	24.40	82.00	40.00	11.25	185.20	5.51	4.88	16.40	8.00	2.25	37.04
MI100170	170 : 145 Marine Drive Safety Beach 3936	50.28	2.06	6.20	4.00	1.75	64.29	10.06	0.41	1.24	0.80	0.35	12.86
MI100169	169 : 145 Marine Drive Safety Beach 3936	3.25	2.08	8.02	1.00	1.75	16.10	0.65	0.42	1.60	0.20	0.35	3.22
MI100084	084 : 134 Marine Drive Safety Beach 3936	0.78	2.26	0.82	0.10	0.07	4.02	0.16	0.45	0.16	0.02	0.01	0.80
MI100083	083 : 115 Marine Drive Safety Beach 3936	2.75	0.26	0.28	0.10	0.00	3.39	0.55	0.05	0.06	0.02	0.00	0.68
MI100082	082 : 100 Marine Drive Safety Beach 3936	0.50	0.28	0.64	0.10	0.02	1.54	0.10	0.06	0.13	0.02	0.00	0.31
MI100168	168 : 92 Marine Drive Safety Beach 3936	3.03	1.00	4.60	7.00	3.00	18.63	0.61	0.20	0.92	1.40	0.60	3.73
MI100080	080 : 55 Marine Drive Safety Beach 3936	0.78	0.46	2.80	0.40	0.94	5.37	0.16	0.09	0.56	0.08	0.19	1.07
MI100078	078 : 32-33 Marine Drive Safety Beach 3936	0.28	0.28	4.60	4.00	0.27	9.43	0.06	0.06	0.92	0.80	0.05	1.89
MI100077	077 : 2 Marine Drive Safety Beach 3936	0.55	0.46	4.60	4.00	0.29	9.90	0.11	0.09	0.92	0.80	0.06	1.98
MI100051a	051a : 97 Point Nepean Road Dromana 3936	0.55	0.64	1.00	0.40	0.22	2.81	0.11	0.13	0.20	0.08	0.04	0.56
MI100165	165 : 107 Point Nepean Road Dromana 3936	0.33	0.64	1.00	1.00	0.21	3.18	0.07	0.13	0.20	0.20	0.04	0.64
MI100051	051 : 141 Point Nepean Road Dromana 3936	0.55	2.26	6.40	0.70	0.22	10.13	0.11	0.45	1.28	0.14	0.04	2.03
MI100050	050 : 181 Point Nepean Road Dromana 3936	0.78	0.28	1.00	0.40	0.11	2.57	0.16	0.06	0.20	0.08	0.02	0.51
MI100049	049 : 199-201 Point Nepean Road Dromana 3936	5.05	2.06	0.64	0.40	0.02	8.17	1.01	0.41	0.13	0.08	0.00	1.63
MI100201	201 : 291 Point Nepean Road Dromana 3936	2.78	0.28	0.64	0.40	0.09	4.19	0.56	0.06	0.13	0.08	0.02	0.84
MI100228	228 : 369-561 Point Nepean Road Dromana 3936	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100026	026 : 369-561 Point Nepean Road Dromana 3936	0.53	0.08	1.00	1.00	0.12	2.72	0.11	0.02	0.20	0.20	0.02	0.54
MI100225	225 : 369-561 Point Nepean Road Dromana 3936	0.33	0.04	0.00	0.00	0.03	0.39	0.07	0.01	0.00	0.00	0.01	0.08

MI100224	224 : 369-561 Point Nepean Road Dromana 3936	0.55	0.08	0.08	0.03	0.01	0.75	0.11	0.02	0.02	0.01	0.00	0.15
MI100022	022 : 567 Point Nepean Road McCrae 3938	0.00	0.04	0.04	0.00	0.00	0.08	0.00	0.01	0.01	0.00	0.00	0.02
MI100024	024 : 567 Point Nepean Road McCrae 3938	0.05	0.06	0.28	0.10	0.00	0.49	0.01	0.01	0.06	0.02	0.00	0.10
MI100020	020 : 587 Point Nepean Road McCrae 3938	0.28	0.10	0.28	0.10	0.00	0.76	0.06	0.02	0.06	0.02	0.00	0.15
MI100059	059 : 609 Point Nepean Road McCrae 3938	0.53	0.44	0.08	0.00	0.00	1.05	0.11	0.09	0.02	0.00	0.00	0.21
MI100143	143 : 609 Point Nepean Road McCrae 3938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100018	018 : 625 Point Nepean Road McCrae 3938	0.78	0.46	0.46	0.10	0.02	1.82	0.16	0.09	0.09	0.02	0.00	0.36
MI100019	019 : 587 Point Nepean Road McCrae 3938	3.03	0.64	0.46	0.10	0.00	4.23	0.61	0.13	0.09	0.02	0.00	0.85
MI100058	058 : 625 Point Nepean Road McCrae 3938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100058b	058b: 625 Point Nepean Road McCrae 3938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100057	057 : 625 Point Nepean Road McCrae 3938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100016	016 : 637 Point Nepean Road McCrae 3938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100016	016 : 637 Point Nepean Road McCrae 3938	2.55	0.00	0.00	0.00	0.00	2.55	0.51	0.00	0.00	0.00	0.00	0.51
MI100014	014 : 719 Point Nepean Road McCrae 3938	2.78	2.80	6.40	1.00	0.27	13.25	0.56	0.56	1.28	0.20	0.05	2.65
MI100160	160 : 741 Point Nepean Road McCrae 3938	30.00	2.00	0.62	1.00	0.01	33.63	6.00	0.40	0.12	0.20	0.00	6.73
MI100008	008 : 930 Point Nepean Road Rosebud 3938	2.80	0.42	0.64	0.10	0.00	3.96	0.56	0.08	0.13	0.02	0.00	0.79
MI100171	171 : 994 Point Nepean Road Rosebud 3938	0.30	0.64	0.62	0.10	0.00	1.66	0.06	0.13	0.12	0.02	0.00	0.33
MI100006	006 : 994 Point Nepean Road Rosebud 3938	0.55	2.62	2.80	0.70	0.04	6.71	0.11	0.52	0.56	0.14	0.01	1.34
MI100005	005 : 1219 Point Nepean Road Rosebud 3938	5.05	2.62	2.80	1.00	0.04	11.51	1.01	0.52	0.56	0.20	0.01	2.30
MI100052	052 : 3B Pier Street Dromana 3936	0.33	2.44	8.20	0.70	0.19	11.86	0.07	0.49	1.64	0.14	0.04	2.37
MI100032	032 : Dromana Foreshore Off Point Nepean Road Dromana 3936	0.55	0.64	2.80	1.00	0.04	5.03	0.11	0.13	0.56	0.20	0.01	1.01
MI100163	163 : 335-339 Point Nepean Road Dromana 3936	0.78	0.64	10.00	4.00	0.27	15.68	0.16	0.13	2.00	0.80	0.05	3.14
MI100030	030 : 357 Point Nepean Road Dromana 3936	0.78	0.82	2.80	0.70	0.02	5.11	0.16	0.16	0.56	0.14	0.00	1.02
MI100029	029 : 359 Point Nepean Road Dromana 3936	3.03	0.28	6.40	0.10	0.13	9.93	0.61	0.06	1.28	0.02	0.03	1.99
MI100028	028 : End Permien Street Dromana 3936	0.33	0.08	0.46	0.10	0.03	0.99	0.07	0.02	0.09	0.02	0.01	0.20
MI100027	027 : 369 Point Nepean Road Dromana 3936	0.78	0.64	1.00	0.40	0.23	3.04	0.16	0.13	0.20	0.08	0.05	0.61
MI100230	230 : 369-561 Point Nepean Road Dromana 3936	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100229	229 : 369-561 Point Nepean Road Dromana 3936	5.50	0.28	0.82	0.10	0.03	6.73	1.10	0.06	0.16	0.02	0.01	1.35
MI100227	227 : 369-561 Point Nepean Road Dromana 3936	0.78	0.28	0.10	0.10	0.10	1.36	0.16	0.06	0.02	0.02	0.02	0.27
MI100226	226 : 369-561 Point Nepean Road Dromana 3936	2.58	0.28	0.28	0.10	0.94	4.17	0.52	0.06	0.06	0.02	0.19	0.83
MI100223	223 : 369-561 Point Nepean Road Dromana 3936	3.03	0.28	0.10	0.10	0.03	3.54	0.61	0.06	0.02	0.02	0.01	0.71
MI100222	222 : 369-561 Point Nepean Road Dromana 3936	3.03	0.10	0.10	0.10	0.03	3.36	0.61	0.02	0.02	0.02	0.01	0.67

MI100221	221 : 369-561 Point Nepean Road Dromana 3936	3.03	0.10	0.10	0.10	0.03	3.36	0.61	0.02	0.02	0.02	0.01	0.67
MI100221a	221a : 369-561 Point Nepean Road Dromana 3936	2.58	0.10	0.10	0.10	0.03	2.91	0.52	0.02	0.02	0.02	0.01	0.58
MI100162	162 : 369-561 Point Nepean Road Dromana 3936	3.03	0.28	0.10	0.10	0.10	3.61	0.61	0.06	0.02	0.02	0.02	0.72
MI100017	017 : 637 Point Nepean Road McCrae 3938	0.00	0.64	0.28	0.10	0.00	1.02	0.00	0.13	0.06	0.02	0.00	0.20
MI100015	015 : 690 Point Nepean Road McCrae 3938	3.25	20.62	80.20	1.00	0.78	105.85	0.65	4.12	16.04	0.20	0.16	21.17
MI100013	013 : 775 Point Nepean Road McCrae 3938	7.75	20.80	80.20	4.00	0.63	113.38	1.55	4.16	16.04	0.80	0.13	22.68
MI100012	012 : 856 Point Nepean Road Rosebud 3938	3.25	2.62	2.80	0.10	0.19	8.96	0.65	0.52	0.56	0.02	0.04	1.79
MI100011	011 : End of Durham Place Rosebud 3939	5.50	2.80	62.20	10.00	0.53	81.03	1.10	0.56	12.44	2.00	0.11	16.21
MI100011	011 : End of Durham Place Rosebud 3939	3.25	2.80	62.20	10.00	0.61	78.86	0.65	0.56	12.44	2.00	0.12	15.77
MI100011	011 : End of Durham Place Rosebud 3939	5.50	2.80	62.20	10.00	0.61	81.11	1.10	0.56	12.44	2.00	0.12	16.22
MI100004	004 : Sunnyside Beach Off Sunnyside Road Mount Eliza 3930	3.03	2.80	8.20	0.70	0.08	14.80	0.61	0.56	1.64	0.14	0.02	2.96
MI100175	175 : End of Boneo Road (West) Rosebud 3939	2.80	2.80	8.20	4.00	0.54	18.34	0.56	0.56	1.64	0.80	0.11	3.67
MI100033	033 : 315-317 Point Nepean Road Dromana 3936	2.80	2.62	2.44	1.00	0.08	8.94	0.56	0.52	0.49	0.20	0.02	1.79
MI100131	131 : Daveys Bay Beach Mount Eliza 3930	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100133	133 : 23 Gulls Way Mount Eliza 3930	7.75	0.08	2.80	0.10	0.91	11.64	1.55	0.02	0.56	0.02	0.18	2.33
MI100132	132 : 5 Elm Court Mount Eliza 3930	3.00	0.26	0.46	0.10	0.00	3.82	0.60	0.05	0.09	0.02	0.00	0.76
MI100181	181 : 1 Tintagel Court Mount Eliza 3930	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100130	130 : 44 Jacksons Road Mount Eliza 3930	5.28	0.42	0.10	0.40	0.03	6.23	1.06	0.08	0.02	0.08	0.01	1.25
MI100129	129 : 69 Williams Road Mount Eliza 3930	0.55	0.46	1.00	3.70	0.20	5.91	0.11	0.09	0.20	0.74	0.04	1.18
MI100127	127 : 71 Glen Shian Lane Mount Eliza 3930	28.00	0.64	2.62	3.40	0.18	34.84	5.60	0.13	0.52	0.68	0.04	6.97
MI100125	125 : Ballar Creek, Mount Eliza 3930	5.28	0.08	2.62	3.70	0.01	11.69	1.06	0.02	0.52	0.74	0.00	2.34
MI100123	123 : 1a Canadian Bay Road Mount Eliza 3930	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100122	122 : 2 Canadian Bay Road Mount Eliza 3930	5.50	0.28	4.24	0.10	0.02	10.14	1.10	0.06	0.85	0.02	0.00	2.03
MI100121	121 : 47 Rosserdale Crescent Mount Eliza 3930	30.25	0.28	24.40	0.10	1.85	56.88	6.05	0.06	4.88	0.02	0.37	11.38
MI100120	120 : 3 Rosserdale Crescent Mount Eliza 3930	0.78	0.64	2.62	4.00	18.75	26.79	0.16	0.13	0.52	0.80	3.75	5.36
MI100119	119 : 27 Rendlesham Avenue Mount Eliza 3930	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100118	118 : 2-4 Kunyung Road Mount Eliza 3930	1.00	2.62	1.00	37.00	22.52	64.14	0.20	0.52	0.20	7.40	4.50	12.83
MI100115	115 : 2 Sunnyside Road Mount Eliza 3930	55.00	2.42	4.60	0.70	1.19	63.91	11.00	0.48	0.92	0.14	0.24	12.78
MI100114	114 : Manmangur Creek - 2 Sunnyside Road Mount Eliza 3930	0.00	2.60	2.08	4.00	0.02	8.70	0.00	0.52	0.42	0.80	0.00	1.74
MI100113	113: Carrar Creek	0.00	4.04	0.42	0.00	0.00	4.46	0.00	0.81	0.08	0.00	0.00	0.89
MI100112	13-15 Kalmina Drive, Mornington PrivateDischargePt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100112	112 : 811 Esplanade Mornington 3931	0.10	0.62	0.46	0.70	0.17	2.05	0.02	0.12	0.09	0.14	0.03	0.41
MI100110	110 : 802-803 Esplanade Mornington 3931	0.33	0.28	2.80	0.40	0.19	3.99	0.07	0.06	0.56	0.08	0.04	0.80
MI100111	111 : 802-803 Esplanade Mornington 3931	3.03	20.06	10.00	1.00	0.27	34.36	0.61	4.01	2.00	0.20	0.05	6.87

MI100096	096 : 1 Schnapper Point Drive Mornington 3931	0.78	0.44	0.06	0.10	0.17	1.54	0.16	0.09	0.01	0.02	0.03	0.31
MI100135	135 : 1 Schnapper Point Drive Mornington 3931	0.78	0.44	0.06	0.10	0.17	1.54	0.16	0.09	0.01	0.02	0.03	0.31
MI100097	097 : 1 Schnapper Point Drive Mornington 3931	0.78	0.44	0.06	0.10	0.17	1.54	0.16	0.09	0.01	0.02	0.03	0.31
MI100136	136 : 1 Schnapper Point Drive Mornington 3931	3.03	2.24	0.06	0.10	0.17	5.59	0.61	0.45	0.01	0.02	0.03	1.12
MI100138	138 : 1 Schnapper Point Drive Mornington 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100095	095 : 1 Schnapper Point Drive Mornington 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100137	137 : 1 Schnapper Point Drive Mornington 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100094	094 : 1 Schnapper Point Drive Mornington 3931	0.33	0.26	0.08	0.00	1.68	2.35	0.07	0.05	0.02	0.00	0.34	0.47
MI100094	094 : 1 Schnapper Point Drive Mornington 3931	0.55	0.44	0.20	0.03	0.18	1.41	0.11	0.09	0.04	0.01	0.04	0.28
MI100093	093 : 1 Schnapper Point Drive Mornington 3931	0.55	0.44	0.04	0.33	0.18	1.55	0.11	0.09	0.01	0.07	0.04	0.31
MI100092	092 : 1 Schnapper Point Drive Mornington 3931	0.25	0.44	0.04	0.00	0.08	0.81	0.05	0.09	0.01	0.00	0.02	0.16
MI100099	099 : 1 Schnapper Point Drive Mornington 3931	2.58	0.28	0.08	0.00	0.00	2.94	0.52	0.06	0.02	0.00	0.00	0.59
MI100098	098 : 1 Schnapper Point Drive Mornington 3931	0.25	0.46	0.08	0.00	0.00	0.79	0.05	0.09	0.02	0.00	0.00	0.16
MI100100	100 : Flinders Drive Mornington 3931	2.80	2.60	0.64	0.10	0.19	6.33	0.56	0.52	0.13	0.02	0.04	1.27
MI100108	108 : 564 Esplanade Mount Martha 3934	3.03	0.06	0.44	0.10	0.03	3.66	0.61	0.01	0.09	0.02	0.01	0.73
MI100106	106 : 8 Helena Street Mount Martha 3934	3.25	0.10	0.06	0.10	1.84	5.35	0.65	0.02	0.01	0.02	0.37	1.07
MI100104	104 : 745A Esplanade Mornington 3932	0.00	2.80	0.64	40.00	0.10	43.54	0.00	0.56	0.13	8.00	0.02	8.71
MI100182	182 : 463-465 Esplanade Mount Martha 3931	0.78	4.42	4.60	10.00	0.44	20.24	0.16	0.88	0.92	2.00	0.09	4.05
MI100091	091 : 413 Esplanade Mount Martha 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100146	146 : 380 Esplanade Mount Martha 3931	0.55	0.62	0.44	0.00	0.19	1.80	0.11	0.12	0.09	0.00	0.04	0.36
MI100072	072 : 373 Esplanade Mount Martha 3931	0.00	0.62	0.04	0.00	0.01	0.67	0.00	0.12	0.01	0.00	0.00	0.13
MI100067	067 : 292-293 Esplanade Mount Martha 3931	0.55	0.82	2.60	0.03	0.53	4.53	0.11	0.16	0.52	0.01	0.11	0.91
MI100067b	067 : 292-293 Esplanade Mount Martha 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100067a	067 : 292-293 Esplanade Mount Martha 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100068	068 : 2-4 Fairbairn Avenue Mount Martha 3931	0.53	0.00	0.00	0.00	0.00	0.53	0.11	0.00	0.00	0.00	0.00	0.11
MI100069	069 : 10 Stanley Crescent Mount Martha 3931	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MI100070	070 : 325 Esplanade Mount Martha 3931	0.10	0.82	0.08	0.00	0.27	1.27	0.02	0.16	0.02	0.00	0.05	0.25
MI100071	071 : 340 Esplanade Mount Martha 3931	25.75	0.64	2.42	0.00	1.09	29.90	5.15	0.13	0.48	0.00	0.22	5.98
MI100087	087 : 185 Marine Drive Safety Beach 3936	0.53	0.28	0.08	0.03	0.85	1.77	0.11	0.06	0.02	0.01	0.17	0.35
MI100086	086 : 184 Marine Drive Safety Beach 3936	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

