Executive Summary

Lysterfield Lake situated within Lysterfield Park has been identified by Parks Victoria (PV) and the City of Casey (CoC) as an area of high importance specific to aquatic recreation drowning and injury events. Lysterfield Lake is viewed as a popular aquatic recreation destination for seasonal swimmers, local residents and visitors. Not all visitors to Lysterfield Park will be aware of the characterised waterway hazards specific to this site.

By commissioning Life Saving Victoria (LSV) to undertake a risk assessment, PV and CoC are taking a proactive approach in determining appropriate risk mitigation actions to help prevent any foreseeable loss of life and injury to visitors (residents and tourists). A systematic risk management approach was used for this project in order to structure selection of the most appropriate risk treatment options that mitigate any foreseeable adverse aquatic recreation outcomes.

The risk management process adopted for this project is AS/NZS ISO 31000:2009 Risk Management - Principles and guidelines (Standards Australia International, 2009). This report contains all pertinent summary risk assessment documentation specific to the application of this Standard and its processes. Furthermore, the findings and recommendations are specific to current standards, guidelines and best practice regarding risk management pertinent to the characteristics and designed applicative use of Lysterfield Lake.

The documented procedures associated with the project’s risk assessment process contain a number of key elements. These elements are all based on the project objective of ensuring that Lysterfield Lake is managed in a manner that minimises the probability of an overrepresentation of any unintentional\(^1\) fatal drowning\(^2\) events.

A major component of the project was to identify all pertinent hazards specific to Lysterfield Lake. This was undertaken as part of a multifaceted hazard identification process (refer to 2.1 Risk Identification/Risk Identification. This multifaceted hazard identification approach included:

a. An overview of general characteristics hazards associated with lake waterways,
b. Notation on hazards and residual hazards taking into account existing controls via a physical site assessment process, and;
c. The tabling of results from a stakeholder engagement process (online survey) that aimed to understand perceived hazards from a waterway user perspective.

\(^1\) The process of experiencing respiratory impairment from submersion/immersion in liquid.

\(^2\) Defined as accidental drowning and submersion, accident to watercraft causing drowning and submersion, and water-transport-related drowning and submersion without accident to watercraft. Does not include intentional self-harm by drowning and submersion, assault by drowning and submersion and undetermined intent of drowning and submersion.
The hazards identified as a result of the multifaceted identification provided the following site specific waterway hazards and/or hazards immediately adjacent recreational reserves and car parks:

- Topological Hazards (e.g. reservoir wall, beach access areas, sloping shoreline and jetty infrastructure)
- Variable Water Depth (Shallow shoreline, Drop off, Deep water)
- Currents
- Uncontrolled/ Undefined Access to water
- Submerged Objects
- Sun, Heat and Cold Water Exposure
- Lack of Zoning and/or Enforcement of Zoning (e.g. no swimming and boating prohibition zones)
- Existing Risk Controls (lack of clarity of path access areas and poorly positioned safety signage)
- Water Quality (i.e. turbidity – lack of water quality)

With the identification of hazards process complete analysis of the risks specific to the project objective was required. In order to satisfactorily complete this task a review of historical cases was required. According to the National Coronial Information System (NCIS) two fatal drowning events have occurred at Lysterfield Lake from June 2000 to July 2014 (closed cases as at July 2014). A summary of these two events outlines that:

- Both events was occurred during the summer months (January and February).
- Both events occurred on a weekend (Saturday and Sunday).
- Both events occurred during a 3-5 pm timeframe.
- Both events involved males in the 15-34 year age bracket.
- One event involved a rescuer becoming the drowning fatality.

There is one further open case (at the time of distribution of this report). It has not been included in the summary above because the contributing cause of death has not been finalised by the case assigned Coroner. Preliminary details suggest this event was also in summer and a male in the 15-34 age bracket. The event also occurred on a weekend during the 3-5pm timeframe.

These event figures, directly facilitated a number of other risk analysis process in which an overview of probability estimates and examination of the relative risk of drowning events at Lysterfield Lake from a local and global state-wide perspective was undertaken (refer to 0 A review of responses from expected hazards and dangers from generic inland waterways as opposed to Lysterfield Lake provided a simple cross-validation process of earlier listed lake characteristics and site observations. Issues such as boating and zoning, debris and rubbish, alcohol and drugs in addition to being unprepared and/or unknowledgeable about changing weather conditions were elicited as part of the stakeholder hazard identification process.

Further data required to determine the probability of a drowning event, are counts of past events at Lysterfield Lake. While knowledge of these are critical part of the identification phase they will be
introduced during the next phase of analysis (Risk Analysis) as it directly aids with the quantification of probability estimates required for other analysis functions. These probability estimates will be used in conjunction with the relevant identified hazards and with other components of the risk assessment process being risk analysis and risk evaluation.

Risk Analysis). A summary this analysis outlined;

- That lake based drownings events across the state account for 7% of all drowning events.
- That the probability of one or more lake based drowning events within a given year is 88.23%.
- That based on historical events (2 NCIS closed cases), the probability of no drowning events occurring at Lysterfield Lake with a given year is 86.69%. Based on historical figures, if the trend was to continue a drowning event at Lysterfield Lake could be expected to occur 1 in every 7.6 years.
- In terms of geographical relative risk of all drowning events in proximity to Lysterfield and Lake and within the Casey LGA, the risk level is generally below the threshold value of one (1) for both incident location and place of residence. This ratio is based on the underlying population distribution of all Victorian LGA’s.
- In terms of lake specific drowning events with Victorian LGA’s, 58% (46) Victorian LGA’s did not experience a lake based drowning event from June 2000 to July 2014. During that timeframe City of Casey has had two recorded lake drowning events (both at Lysterfield Lake).
- Using a relative risk ratio based on total lake surface area and lake specific events (2000 – 2014) per LGA, City of Casey had an excess risk ration of 20.5 (5th highest ratio).
- City of Casey on a ratio bases has a considerably high lake/dam surface area ratio (1.35%) compared to its overall LGA area compared to all other Victorian LGA’s (ranked 27th of 80 LGA’S).
- In terms of Lysterfield Lake area, it is in the top 0.22% of lake surface area size in the State (based on VicMAP Spatial Hydro Water Area Polygon layer). The portion of Lysterfield Lake that intersects the City of Casey LGA is 5.22% of the total lake/dam surface value for the LGA.

The outputs from analysis assisted with the task of evaluating hazards based the project objective and risk criteria. All these assessment components and criteria were collectively and systematically applied and documented using a risk register (Error! Reference source not found.). The project risk register includes a number of additional formal risk management process and requirements such as the setting of risk tolerance levels. A summary of the highest ranking identified hazards prior to any applying the effectiveness of any existing controls is tabled (Table 1).

**Table 1 - Summary of Hazard and Initial Risk Factor Score**

<table>
<thead>
<tr>
<th>Identified Beach Hazards</th>
<th>Qualitative Risk Factor Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topological Hazards(e.g. reservoir wall, beach access areas, sloping shoreline and jetty infrastructure)</td>
<td>High</td>
</tr>
<tr>
<td>Variable Water Depth (Shallow shoreline, Drop off, Deep water)</td>
<td>High</td>
</tr>
<tr>
<td>Currents</td>
<td>High</td>
</tr>
<tr>
<td>Uncontrolled/ Undefined Access to water</td>
<td>High</td>
</tr>
<tr>
<td>Submerged Objects</td>
<td>High</td>
</tr>
<tr>
<td>Sun, Heat and Cold Water Exposure</td>
<td>High</td>
</tr>
</tbody>
</table>
With the completion of the risk register a set of proposed risk treatment options was elucidated. The comprehensive table *(Error! Reference source not found.)* identified a number of site applicable (and non-applicable) risk treatment options was reviewed by the applicable land managers and/or vested stakeholders as a consultative process. A summary of treatment options considered suitable for Lysterfield Lake were tabled.

Table 2 – Summary of suitable Risk Treatment Options

<table>
<thead>
<tr>
<th>Treatment Options</th>
<th>Suitability of Treatment Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival information</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>On-site Education</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Barriers</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Signage</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Regulations</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Activity Management</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Safe access to shoreline and beach areas</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Trained Observers</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Parental/Carer Supervision</td>
<td>Highly Suitable</td>
</tr>
<tr>
<td>Activity Restrictions</td>
<td>Highly Suitable</td>
</tr>
</tbody>
</table>

This report as an abridged final version of consultative drafts previously submitted to Parks Victoria, City of Casey and other parties listed as vested parties by these agencies. Risk treatment recommendations were set by LSV as preliminary recommendations. The land managers considered their own organisational risk philosophies and resources capacities when reviewing and assessing the suitability of the nominated risk treatments.
Table of Contents

Executive Summary ........................................................................................................................................ 1

Table of Figures .......................................................................................................................................... 6
Table of Graphs ........................................................................................................................................ 6
Table of Tables ........................................................................................................................................ 6

1 Introduction ............................................................................................................................................. 7
  1.1 Project Initiation ................................................................................................................................. 8
  1.2 Establish Context ............................................................................................................................... 8
    1.2.1 Objective ...................................................................................................................................... 8
    1.2.2 Stakeholders ............................................................................................................................... 9
  1.3 Criteria ................................................................................................................................................ 10

2 Risk Assessment ..................................................................................................................................... 13
  2.1 Risk Identification ............................................................................................................................. 13
    2.1.1 Hazard Identification – Lake Characteristics ........................................................................... 14
    2.1.3 Stakeholder Survey ................................................................................................................... 16
  2.2 Risk Analysis ...................................................................................................................................... 17
    2.2.1 Fatal Drowning Events ............................................................................................................. 17
    2.2.2 Discourse on Probabilities and Overrepresentation .................................................................. 19
    2.2.3 Summary of Risk Analysis ....................................................................................................... 19
  2.3 Risk evaluation ................................................................................................................................... 20
  2.4 Risk Register ...................................................................................................................................... 20

3 Risk Treatment Options .......................................................................................................................... 21
  3.1 Treating the Risk - Summary Discussion of Treatment Options ....................................................... 21
    3.1.1 Education and information ......................................................................................................... 22
    3.1.2 Denial of access and/or provision of warnings ........................................................................ 22
    3.1.3 Provision of supervision ............................................................................................................ 23
    3.1.4 Acquisition of survival skills .................................................................................................... 25
    3.1.5 Monitor and Review .................................................................................................................. 27
  3.2 Conclusion .......................................................................................................................................... 28
  3.3 References ......................................................................................................................................... 28
Table of Figures
Figure 1 : AS/NZS ISO 31000:2009 Risk Management Process ......................................................... 10

Table of Graphs
Graph 1 – Poisson Probabilities of fatal drowning events at Lysterfield Lake based on 2000 – 2014 events - P(X = K)........................................................................................................................................ 18

Table of Tables
Table 1 - Summary of Hazard and Initial Risk Factor Score ............................................................... 3
Table 2 – Summary of suitable Risk Treatment Options ........................................................................ 4
Table 3 – Project Funding Stakeholders ............................................................................................... 9
Table 4 - Project Stakeholders as part of Lysterfield Lake Water Safety Committee ......................... 9
Table 5 – When you think of people recreating in and around inland waterways, what immediate dangers or hazards come to mind? .................................................................................................................. 16
Table 6 – What is this danger or hazard of people recreating in and around Lysterfield Lake? ......... 17
1 Introduction

Recreational waterways such as Lysterfield Lake provide users the opportunity to experience an array of benefits (i.e. social and physical). Maximising derived benefits for Lysterfield Lake users in a safe manner is a high priority for the lakes’ land managers and interested stakeholders. As a result of this importance and interest, Life Saving Victoria (LSV) was commissioned to undertake a risk assessment at the site. The assessment seeks to maximise user safety at the lake by focusing on reducing the probability of aquatic recreation injury or any unintentional fatal drowning events at the site. This report contains the workings of an applied risk assessment, as part of a wider systematic risk management process, geared at maximising the safety of lake users at Lysterfield Park.

The park currently offers a range of active and passive recreational opportunities for visitors. These activities include land-based picnicking, jogging, cycling, sightseeing and water based such as swimming, canoeing, sailing and paddle boating. It is primarily the water based activities that are the focus of this assessment. Furthermore, this report focuses only on a small south-east section of the lake identified by the project land managers. This small accessible section of the lake is approximately 750 metres in length and incorporates a number of shoreline bays (4) of varying lengths, entry surfaces (i.e. sand and rock) and permissible zoned activities (refer to Image 1 – Lysterfield Lake Assessment Area Overview).

The first two most southerly bays are zoned as swimming only areas. These small curved bays are generally protected swimming bays with sandy beach entries. The entries are initially gradual but the turbid water increases significantly in depth at approximately 20 meters from the shoreline. In terms of other water based activities on the lake, most areas permit non-powered boating. The exceptions are the northern, eastern and south-eastern boundaries. These areas are zoned in order to protect swimmers (zone outlined above) and waterbird habitats. Powerboats are not permitted on the lake. Monohull sailing boats up to 5 metres long and multi-hull boats up to 4.3 metres in length are permitted on the lake. There is a local sailing club at the lake. Canoeing, rowing and sailboarding are also permitted on the lake.

This risk assessment seeks to quantify the likelihood of any adverse drowning and/or injury event occurring at Lysterfield Lake. Drowning events may be as a result of partaking in the active water pursuits outlined above or by engaging in passive recreational pursuits in close proximity to the lake shoreline. The assessment additionally seeks to guide active site land managers with treatment selection options that will aid in reducing the probability and/or severe consequence of a drowning and/or injury event at this site in the future.

This document summarises the assessment outcomes associated with the coordinated and systematic activities reflective of good risk management practice. The overarching risk management principles used are reflective of AS/NZS ISO 31000 Risk Management (Standards Australia International, 2009). Key requirements of this process are:
1. Communicate and consult with relevant stakeholders
2. Establish the context and objectives
3. Risk Assessment - incorporating identification, analysis and evaluation of hazards and how they impact on the overall project risk objective,
4. Treatment of the hazards that lead to the risk being realised, and;
5. Monitor and review requirements.

The remainder of this report is structured to reflect the summarised process requirements outlined above. Utilising this approach is seen to best facilitate the task of addressing the project objective which is to ensure that Lysterfield Lake is managed in a way to minimise the probability of any unintentional fatal drowning event/s. The key components surrounding the formation of the project objective and project requirements as per the adopted risk management process is provided in the next section of the report.

1.1 Project Initiation
The project was jointly funded initiated by the PV and CoC. In addition to the provision of funding, the City of Casey have convened a stakeholder group specific to the water safety at Lysterfield Park (refer to Stakeholders). Life Saving Victoria (LSV) as the peak Victorian water safety agency, is taking the project lead role, in addition to providing in-kind professional services. The Primary project officer from LSV will be Robert Andronaco – Risk and GIS Development Manager.

1.2 Establish Context
A vital process requirement is the establishment of the project context. This aids in providing the background elements on which the rest of the risk management processes will be based. This includes the listing of the project objective and stating criteria against which risks will be assessed. The project objective is provided below.

1.2.1 Objective
As previously stated, the core project objective is:

To ensure that the Lysterfield Lake is managed in a way to minimise the probability of any unintentional fatal drowning event/s.

This objective will be used to guide and structure the following risk assessment components and tasks;

1. Undertake a provisional analysis of the probability of a drowning or injury event occurring within the identified aquatic recreational waterway – refer to 2.2 Risk Analysis;
2. Undertake a physical site assessment and collect observational hazard data specific to the project criteria – refer to 2.1.3 Physical Hazard Identification
3. Overlay collected data with other relevant datasets in order to fully quantify the likelihood and consequence of observed hazards from the site assessment that could impact on the expressed project risk objective;
4. Provide an initial risk assessment summary (refer to 2.4 Risk Registers) and treatment plan summary (refer to 3.2 Risk Treatment Options Table) that aim to help facilitate
4. achievement of the project objective once appropriate treatments have been implemented by the project initiators;
5. Consult with Land Managers and other interested identified stakeholders, once an initial draft report has been provided and gain feedback into the practicality and feasibility of the proposed risk treatments actions;
6. Issue a final report that reflects the design and operational requirements, project feedback phases (i.e. understanding land manager resource capacity) and the inherent environmental conditions of the waterway under assessment.

1.2.2 Stakeholders
The project has two major stakeholder groups. The primary stakeholders are the funding land manager authorities PV and the CoC. Parks Victoria directly manage the waterway and adjacent park reserves and service amenities. In terms of COC the southern section of the park is within their gazetted local government area. The primary project representatives from these agencies are:

Table 3 – Project Funding Stakeholders

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Role</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Stakeholder – Project funding liaison.</td>
<td>Parks Victoria - District Manager South East Melbourne</td>
<td>Libby Jude</td>
</tr>
<tr>
<td>Primary Stakeholder – Project funding liaison.</td>
<td>City of Casey - Team Leader Leisure Facilities Sport &amp; Leisure</td>
<td>Terry Jenvey</td>
</tr>
</tbody>
</table>

The other key stakeholder group is a collection of public safety conscious authorities that have taken a direct interest in the provision of a safe waterway for community aquatic recreation pursuits. This committee is comprised of the following agencies and representatives:

Table 4 - Project Stakeholders as part of Lysterfield Lake Water Safety Committee

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria Police</td>
<td>Inspector Paul Breen</td>
</tr>
<tr>
<td>Parks Victoria - Area Chief Ranger Cardinia/ Sandbelt</td>
<td>Darren Mitchell</td>
</tr>
<tr>
<td>Parks Victoria - Ranger in Charge Park Services</td>
<td>John Goodman</td>
</tr>
<tr>
<td>Parks Victoria - Regional Marketing and Communications Officer</td>
<td>Jarred Parsons</td>
</tr>
<tr>
<td>City of Casey</td>
<td>Deputy Mayor Louise Berkelmans</td>
</tr>
<tr>
<td>City of Casey</td>
<td>Cathy Rees</td>
</tr>
<tr>
<td>City of Casey</td>
<td>Councillor Rafal Kaplon</td>
</tr>
<tr>
<td>Life Saving Victoria – General Manager (Lifesaving Club Development)</td>
<td>Andrew Foran</td>
</tr>
</tbody>
</table>

Communication with the identified stakeholders will be undertaken during a number of different project stages. There were a series of preliminary communication phases prior to the tabling of this report. This consultation was aimed at gaining valuable background information of the requirements of the project and obtaining site specific information. Additionally, it provided a series of opportunities to discuss any concerns specific to the aquatic recreational use of Lysterfield Lake. Background statistical data, spatial data, and operational reports and documentation reports were provided by PV.
The second major consultative phase will occur after the issuing of a consultative draft report (this report). Draft reports were provided to the primary funding stakeholder groups. These parties could elect to circulate the report to meet their direct consultative needs. It was the responsibility of these parties to evaluate and summarise feedback from any wider consultation and then provide such material back to LSV in an electronic form.

1.3 Criteria

1.3.1.1 Process Development and Application

The assessment process used for the duration of the project is as per the AS/NZS ISO 31000:2009 Risk Management process (Figure 1: AS/NZS ISO 31000:2009 Risk Management Process).

Figure 1: AS/NZS ISO 31000:2009 Risk Management Process

The risk management process and associated risk assessment activities are reflective of the processes outlined above in addition to and assessment techniques outlined within the following Standards:

1.3.1.2 Outlining the Assessment Area

The area under assessment is only a small south-easterly section of the lake. The assessment areas comprises three distinctive embayment zones. The total length of the assessment area is approximately 750 metres taking into account the curve of the bays. The two most southern bays are designated swimming zones with the two northern zones demarcated as craft/boating zones. An illustrative overview of the assessment site is provided in Error! Reference source not found.
Representation 1 - Lysterfield Lake Assessment Area Overview

** Lysterfield Lake is situated within the north of the City of Casey LGA boundary. The lake intersects this boundary and crosses into Yarra Ranges Council with City of Know also within close proximity on the north-west section of the lake.
1.3.1.3 Risk Criteria

Risk criteria are used as reference terms in which to evaluate any quantified risks against. They aid in determining whether a specified level of risk is acceptable or tolerable. The project risk objective is to ensure that no unintentional drowning related fatalities occur at the site in the future.

The risk objective is conditioned on the assumption that all practicable and cost-effective hazard controls are operational at this particular site. Hazards (as potential sources of harm) are the origin trigger points that will lead to an intolerable risk being realised. In other words, there are hazards at the site that if left untreated will increase the probability of a drowning event to occur.

Analysed hazards identified as intolerable shall be assigned a number of proposed new treatments and/or modification of existing controls. Adoption, modification and implementation of the assigned treatment options (as outlined by LSV in the report) are the responsibility of the land manager. The land managers are best placed to apply treatment options based on known resource capacities and the risk priorities of their organisation. The application of the risk criteria tolerance levels is outlined in the risk registers section of the report.

1.3.1.4 Risk Scales and Matrices

Risk scales and matrices have been developed to reflect the project risk criteria and provide a clear indication of what identified and analysed hazards will trigger a scenario that could make the achievement of the project objective fail.

1.3.1.5 Timeframes

For the purposes of this project, the risk objective specific to the realisation of a fatal drowning event, is being viewed as a perpetual requirement. This essentially means that any fatal drowning event, at any time, is viewed as a failure to realise the project objective.

2 Risk Assessment

2.1 Risk Identification

According to AS/NZS ISO 31000: Risk Management (Standards Australia International, 2009) risk identification is defined as any process involve in finding, recognizing, and describing the risks that could affect the achievement of objectives (in this case the project objective). It (identification) is used to find possible sources of risk in addition to the events and circumstances (drowning) that could affect the achievement of objectives (nil unintentional drowning events). It also includes the identification of possible causes and potential consequences (i.e. ascertaining various severity levels of injury should an injury event occur).

Risk identification can incorporate use of historical data, theoretical analysis, informed opinions, expert advice, and stakeholder input to identify your organization’s risks. This project utilises a number of these identification methods. This multifaceted hazard identification process is to be achieved by:
• Shortlisting expected environmental hazards associated with the waterway type (lakes).
• Taking into account hazards identified during initial consultation phases.
• The undertaking of a stakeholder engagement survey and provide a summary of results.
• Ascertaining the historical number of drowning fatality cases at the site.

With the potential to identifying an inordinate amount of hazards as a result of a utilizing the multifaceted identification process outlined above, like hazards will be grouped, reported and treated as a collective. It was not in the project scope to demarcate the siting of each physical hazard and/or list every possible hazard event. Grouping and generalisation is required in order to provide a synthesized list of hazards.

Additionally, hazards identified during this process must be viewed as directly influencing the failure to achieve the risk objective (i.e. reputational risks to the land manager, whilst a key consideration for them, does not directly impact the expressed project objective and will not be identified for this project).

A preliminary step of the hazard identification process is to highlight expected hazards at Lysterfield Lake. Knowledge of waterway types and associated characteristics are beneficial in aiding with identification of physical hazards. Known hazards that arise as a natural by-product of the behaviour of the waterway can be used in formal risk assessment documentation processes.

2.1.1 Hazard Identification – Lake Characteristics

Lakes are characterised as standing or slow-moving bodies of water. Lakes can vary from each other due to three key dimensions being: length, width, and depth. The shape and volume of a lake (lake morphology), often relates to factors such as age, origins, and the organisms that live within it. The shape of the lake is influenced by the surrounding landscape, controlling much of what goes on physically and biologically underwater.

Lysterfield Lake was historically built as a reservoir in 1936. It has been decommissioned since and is being used for a number of recreational purposes, (swimming and boating). Reservoirs being man-made lakes, can be thought of as a combination of lakes and rivers; as a result of building a dam and flooding a river valley in order to store water. This artificial damming and flooding in order to create the lake enables the sharing of similar river qualities and hazards (such as currents).

Upstream sections of a reservoir (Lysterfield Lake has two inflow areas) can share prominent river-like qualities such as currents and organisms intersecting the lake and river inlet/mouth. As the water moves closer to the dam, the currents generally slow, and the reservoir becomes more lake-like. At this point, many of the sediments and materials (organisms) carried in by the river settle to the bottom of the reservoir (creating turbidity).

The shape of the lake can provide an indication of the type of hazard. Lake length is measured as the longest straight-line shoreline-to-shoreline distance across a lake. In the case of Lysterfield Lake this
would be a north to south orientated measure. Lake length can play an important role specific to production and intensity of hazards. For example, winds often pick up greater speed over open water areas than in enclosed bays and surrounding protected landscape areas. Interaction between currents (as a result of winds) and varying water temperatures can produce varying results in regards to the behaviour of water movement throughout different sections of lakes.

The effects of these complex interactions between wind (creating currents) and water temperature will be inconsistent hazards and hazard vulnerability throughout the lake. Different sections of the lake will be affected by these interactions in different ways depending on the localised shoreline shape, size and inshore zones (depth). Shoreline characteristics; whether they are jagged or smooth, curved or angular, affect what happens underwater. The more jagged and indented the shoreline, the more the lake is affected by inputs from the surrounding land and connecting waterway run-offs. Falling tree and branch debris into the water also provide a source of harm (hazard) to the unsuspecting visitor.

The generalised characteristics of lakes, as outlined above, are only but a simple snapshot of the overall complex nature and evolving composition of lakes. From this brief summary of generic characteristics of lakes, hazards that become apparent are:

- Currents
- Variable water depths (shallow and deep)
- Water Temperature
- Turbidity (lack of water clarity)
- Submerged objects and debris
- Isolation (depending on size of waterway)

In order to localise generic waterway hazards reflective of the water type under assessment, a site inspection of Lysterfield Lake was carried out. This site assessment was done in order to see if the general waterway characteristics outlined above were applicable to the assessable site and to what extent. Furthermore, the site assessment provided an opportunity to observe additional localised hazards not characterised by the generic waterway description above.
2.1.3 Stakeholder Survey

An online survey tool (Cvent) was used in order to engage with project stakeholders about what they perceived as hazards applicable to inland waterways in general, and more specifically Lysterfield Lake. A summary of the survey methodology is provided below:

- Forty one stakeholders or stakeholder group representatives were identified by PV and CoC. These stakeholders were identified as each having some immediate affinity/connection (to varying extents) with the lake.
- A survey was developed by LSV that aimed at eliciting stakeholder perception of hazards likely to impact on recreational pursuits at lakes in general, and at Lysterfield Lake in particular.
- The survey response rate was low with only eight surveys completed (19.5%). Respondents had a minimum timeframe of 21 days to respond to the survey participation invitation. Four respondents opened the survey but did not complete it, while 29 (70.73%) of respondents didn’t open the invitation at all. The low number of results should be viewed with caution.
- When prompted for multiple responses about dangers and hazards relating to inland waterways, variable water depth and drowning were most often mentioned perceived dangers/hazards.

<table>
<thead>
<tr>
<th>Re-classed Responses – Question 2</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable water depths/ drop off</td>
<td>6</td>
<td>26%</td>
</tr>
<tr>
<td>Drowning</td>
<td>3</td>
<td>13%</td>
</tr>
<tr>
<td>Alcohol/ drugs</td>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>Changing weather and/or unprepared for it</td>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>Lack of adequate floatation devices</td>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>Zoning</td>
<td>2</td>
<td>9%</td>
</tr>
<tr>
<td>Boating related incidents</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Cold</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Insufficient ability to cope in the water</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Lack of rescue assistance</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Lacking knowledge / ability to swim</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td>Poor signage</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Total Responses (Multiples permitted):</strong></td>
<td><strong>23</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

In terms of specific dangers and hazards at Lysterfield Lake, the following coded responses variable water depth was again most frequently noted followed by boating related incidents and falling debris/rubbish (refer to Table 6).
Table 6 – What is this danger or hazard of people recreating in and around Lysterfield Lake?

<table>
<thead>
<tr>
<th>Re-classed Responses – Question 3</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable to project scope</td>
<td>5</td>
<td>26%</td>
</tr>
<tr>
<td>Variable water depths/ drop off</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>Boating related incidents</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Falling trees/debris and rubbish</td>
<td>2</td>
<td>11%</td>
</tr>
<tr>
<td>Alcohol/ drugs</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Changing weather and/or unprepared for it</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Drowning</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Lack of rescue assistance</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Lacking knowledge / ability to swim</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Trips and Falls</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td>Water Quality</td>
<td>1</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total Responses (Multiples permitted):</strong></td>
<td><strong>19</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

A review of responses from expected hazards and dangers from generic inland waterways as opposed to Lysterfield Lake provided a simple cross-validation process of earlier listed lake characteristics and site observations. Issues such as boating and zoning, debris and rubbish, alcohol and drugs in addition to being unprepared and/or unknowledgeable about changing weather conditions were elicited as part of the stakeholder hazard identification process.

Further data required to determine the probability of a drowning event, are counts of past events at Lysterfield Lake. While knowledge of these are critical part of the identification phase they will be introduced during the next phase of analysis (Risk Analysis) as it directly aids with the quantification of probability estimates required for other analysis functions. These probability estimates will be used in conjunction with the relevant identified hazards and with other components of the risk assessment process being risk analysis and risk evaluation.

2.2 Risk Analysis

As part of the risk analysis phase some understanding of the likelihood and consequence of events specific to Lysterfield Lake is required. Knowledge of the likelihood (probability) of an adverse fatal event is a critical element of the overall risk assessment phase.

2.2.1 Fatal Drowning Events

Records indicate that **two (2)** fatal drowning events occurred in the immediate Lysterfield Lake assessment area. These two cases cover a fourteen year period from 2000 – 2014 (based on financial years). These cases were verified as closed cases within the National Coronial Information System (NCIS). NCIS is an internet based data storage and retrieval system for Australia and New Zealand coronial cases.

A summary of these two (2) drowning specific cases at Lysterfield Lake is provided:

- Both events occurred during the summer months (January and February).
- Both events occurred on a weekend (Saturday and Sunday).
- Both events occurred during a 3-5 pm timeframe.
- Both events involved males in the 15-34 year age bracket.
- One event involved a rescuer becoming the drowning fatality.

There is one further open case (at the time of distribution of this report). It has not been included in the summary above because the contributing cause of death has not been finalised by the case assigned Corner. Preliminary details suggest this event was also in summer and a male in the 15-34 age bracket. The event also occurred on a weekend during the 3-5pm timeframe.

With knowledge of the number of cases across a specific timeframe (in this case two confirmed cases over 14 years), probability estimates can be calculated. Poisson distribution calculations are used as a fit-for-purpose probability estimator due to its ability to calculate the number of likely low case events (i.e. drowning) occurring within a specified period of time (i.e. on a yearly basis).

An illustration of this probability estimator is provided below. Given the two closed case drowning events over a fourteen year timeframe (2000 – 2014) the annual average rate for Lysterfield Lake is 0.14 events per year ($\lambda = 0.14$). When applying this rate ($\lambda = 0.14$) to the Poisson probability estimator based on a twelve month exposure timeframe (i.e. what is the probability of drowning within a given twelve months) the following probabilities are devised (Graph 1).

Graph 1 – Poisson Probabilities of fatal drowning events at Lysterfield Lake based on 2000 – 2014 events - $P(X = K)$

The above graph suggests that for any given year (i.e. a randomly selected year and not year-on-year) the probability that no drowning event will occur based on historical events (2 closed cases) is 86.69%. This in strict probability terms indicates a low probability of an event occurring. However, in public health and epidemiology domains the prospect of a residual 13.31% of any number of events (i.e. one or more events) occurring over a twelve month period would be viewed as an intolerable risk.

Inclusion of open cases with the overall event count does not drastically change the probability estimates. Graph 1 also include the Poisson probability estimates based on three events all falling within the years spanning 2000-2014. Three fatal events provides a probability estimate of 80.71%
chance of no drowning fatality over a given twelve month period. The residual probability that any number of fatalities (one or more) is experienced at Lysterfield Lake in the future is 19.29%.

2.2.2 Discourse on Probabilities and Overrepresentation

Using three fatal events instead of 2 provides an intuitive ratio of approximately a 1 in 5 year probability of at least one drowning event at Lysterfield Lake. A comparison of the two fatalities over the fourteen year timespan provides a 1 in 7.6 year probability. To reiterate, either figure from a public health and epidemiology perspective is unacceptable. Additionally, given the risk objective of this project, an expected fatal drowning event once every 5 or 7.6 years is not tolerable.

The probabilities above provide a localised snapshot of the events specific to Lysterfield Lake. Although isolated year-to-year probabilities of a drowning death are low, accumulatively and in reference to examination of one isolated waterway they indicate that a level of risk that is unacceptable.

2.2.3 Summary of Risk Analysis

The analysis above provided an overview of the probability and the relative exposure of drowning events at Lysterfield Lake from a local and global state-wide perspective. In summary:

- That lake based drownings events across the state account for 7% of all drowning events.
- That the probability of one or more lake based drowning events within a given year is 88.23%.
- That based on historical events (2 NCIS closed cases), the probability of no drowning events occurring at Lysterfield Lake with a given year is 86.69%. Based on historical figures, if the trend was to continue a drowning event at Lysterfield Lake could be expected to occur 1 in every 7.6 years.
- In terms of geographical relative risk of all drowning events in proximity to Lysterfield and Lake and within the Casey LGA, the risk level is generally below the threshold value of one (1) for both incident location and place of residence. This ratio is based on the underlying population distribution of all Victorian LGA’s.
- In terms of lake specific drowning events with Victorian LGA’s, 58% (46) Victorian LGA’s did not experience a lake based drowning event from June 2000 to July 2014. During that timeframe City of Casey has had two recorded lake drowning events (both at Lysterfield Lake).
- Using a relative risk ratio based on total lake surface area and lake specific events (2000 – 2014) per LGA, City of Casey had an excess risk ratio of 20.5 (6th highest ratio).
- City of Casey on a ratio bases has a considerably high lake surface area ratio (1.35%) compared to its overall LGA area compared to all other Victorian LGA’s (ranked 27th of 80 LGA’S).
- In terms of Lysterfield Lake area, it is in the top 0.22% of lake surface area size in the State (based on VicMAP Spatial Hydro Water Area Polygon layer). The portion of Lysterfield Lake that intersects the CoC LGA is 5.22% of the total lake surface value for the LGA.
With a better understanding of the probabilities and relative exposure of drowning events at Lysterfield Lake (based on historical events), the risk assessment process can move onto the task of evaluating the drowning risk at the assessed site.

### 2.3 Risk evaluation

The risk evaluation process is used as a means to compare risk analysis (refer to 2.2 Risk Analysis) results with risk criteria (refer 1.3 Risk Criteria) in order to determine whether or not a specified level of risk is acceptable or tolerable. The risk objective was to minimise the probability of any unintentional fatal drowning events at Lysterfield Lake.

Evaluation of hazards impacting the risk objective involves:

- Ranking hazards in order of decreasing level of impact to the risk objective.
- Identifying Extreme or High hazards for detailed action planning (via treatment plans). These would be viewed as exceeding the risk tolerance limit.
- Identify Medium hazards for ongoing management and monitoring.
- Identify Low hazards for routine monitoring and/or management.
- Listing treatment actions (or options in this case) in the context that the land manager (being the ‘risk owner’) is ultimately responsible for ensuring hazards are treated appropriately.

A quick review of risk analysis section above would suggest that in the strictest probability terms the likelihood of drowning at Lysterfield Lake in a given year is relatively low. On a cumulative probability sense the likelihood is higher (drowning ratio on one (1) event every 7.6 years). The risk analysis also outlined that from a risk exposure perspective the sheer size of the lake maybe be contributing to a higher level of exposure as compared to other comparable waterbodies. What hasn’t been taken into the consideration in the analysis so far in the level and adequacy of controls at the site. The evaluation phase assist with this task. These workings and calculations are documented in the report using a risk register).

### 2.4 Risk Register

A risk register has been developed in order to document and synthesise identification, analysis and evaluation processes associated with the risk assessment. A risk register is fundamentally a tool used to record the consequence and likelihood ratings of the risk or hazard and to provide the risk priorities (Cooper, Grey, Raymond and Walker, 2005).

Risk registers aid in tabling applicable identified risks that are deemed to have potential impact on the project objective. The register also includes the probability of particular hazards triggering an adverse drowning and/or injury event and the estimated severity or possible impact of the event. The priority list is then used to determine where the greatest effort should be focused in treating the identified risks with the most preferred treatment option in line with organisational objectives, resources and capabilities (refer to Risk Treatment Options Table).
3 Risk Treatment Options

Risk treatment includes the identification of feasible responses based on expert domain knowledge (i.e. within aquatic safety and lifesaving agencies). Nominated treatment options generally focus on reducing the likelihood of an event occurring first and foremost. Secondary, but not any less important, is attempting to minimise the consequence of hazard events that may occur.

Although focused on minimising likelihood and consequences as a key strategy, it would be remiss to not take into account normative risk treatment strategies such as:

- Risk reduction and risk avoidance
- Impact mitigation
- Risk sharing
- Risk retention

Land managers of the assessed waterways, may or may not already be employing some of these risk control strategies such as risk sharing and risk transfer via insurance mechanisms. In terms of providing expert domain knowledge in order to reduce the likelihood and consequences of an adverse aquatic recreation event, a number of feasible treatment responses are provided (see below).

3.1 Treating the Risk - Summary Discussion of Treatment Options

The International Life Saving Federation(2008)(ILS) has identified four factors that commonly lead to drowning events. These are:

1. Lack of knowledge, disregard or misjudgement of the hazard
2. Uninformed, unprotected or unrestricted access to the hazard
3. Lack of supervision or surveillance
4. An inability to cope once in difficulty.

Any of the above factors by themselves or in combination could lead to a fatal drowning and/or an aquatic related injury event. In an attempt to reduce recreational drowning and injury an understanding of which factors are prime contributors is useful when selecting risk treatment options. For many risks and hazards, a multiple factor treatment approach is often needed and highly recommended. In some cases a sole factor treatment response may be the best option due to the limited availability of land manager resources.

Not all nominated treatment options will be appropriate for all the highlighted hazards. This report has set out a range of applications that have been successfully applied throughout the world in various organisations and localities. It provides a list of options that enable the land manager/s to select the most appropriate initiatives for the aquatic waterway under their management.

There are a range of risk treatment options that can be considered in the context of aquatic risk management. The selection of the most appropriate option involves balancing the financial, social and environmental impacts of implementing each against the benefits derived from each application.
The options provided aim to give as much detail as possible specific to the assessed waterway location. However, due to the diverse nature of location characteristics, recommendations may be generic in nature. Land managers should endeavour to adopt the most appropriate risk treatments specific to the organisational capabilities and in consultation with relevant stakeholders. The principal risk treatments addressing each of the four aspects of the drowning prevention chain are as follows:

3.1.1 Education and information

- **Community Education** - This education is targeted toward changing people’s perceptions and increasing awareness of aquatic recreation dangers in and around open water. Community Education can be achieved using a variety of applications (i.e. school education, media, information brochures and other general awareness programs). Involving the local community and encouraging them to think of the assessed site as an important recreational asset is an important outcome.

- Education programs should aim to promote water safety across all life stages and should be tailored accordingly. For example, adult education could emphasise the inherent dangers of drinking alcohol and taking drugs prior to swimming or recreating near water. Education campaigns that address use of public rescue equipment are also important. An understanding of how to use the equipment would be beneficial when responding during an emergency.

- **Arrival Information** – This can be viewed as an opportunity to provide community education at a localised level at the time of arrival at particular waterway locations. Arrival information can aim to either reinforce existing knowledge or provide new site specific education. This information should be kept specific and succinct as the attention of any arriving individual or group is not likely to be extensive. Arrival information is generally signposted on access and car park signs.

- **On-site Education** – Similar to arrival information, on-site education is a localised education measure. It can be executed via measures such as public address systems and/or face-to-face communication methods (i.e. undertaken by lifeguards or other trained supervisors or service providers).

3.1.2 Denial of access and/or provision of warnings

- **Barriers** - Methods of protection will vary from place to place and require site-specific risk assessment. There is a reasonable requirement to protect people from falling from heights, whether this is into water or not. Falls may be a result of loss of balance or slipping into water. Protection from falling can be achieved by providing rails appropriate to the location and visitor risk profile.

The position of balustrades is important. They should be installed not too far from the edge. A greater distance creates an edge platform and haven, which may attract intrusion. Care should be taken not to balustrade an area, which could deny easy access from the water to land. Balustrading should be accompanied by hazard warning signs. When the aim is one of exclusion, the provision of rescue equipment, other than in exceptional circumstances, is not advised.

‘Denial fencing’ on long stretches of cliff top or exposes edging should be utilised as practicably as possible. Where the risk
increases at viewing spots and other features attracting people, it should be viewed as mandatory. Where a cliff or raised edge is subject to frequent erosion changing the route of a path, signage should be used to indicate the variable nature of this ground. Access pathways should have warning signs indicating hazards in proximity.

In relation to promenades and piers/jetty and pontoons, many problems arise when water periodically inundates the shoreline during stormy weather and surging/flooding water events. Promenades that are regularly prone to flooding should be clearly identified. These areas may be earmarked for temporary closure during stormy weather or flooding events.

- **Signage** – A coordinated approach to signage, with strategically placed signs and content clearly visible, is a very important part of aquatic risk management. As part of a safety signage program, attention should be given to the adoption of an emergency location marker system. The provision of specific location information along shoreline areas can be vital in times of emergency; ensuring emergency services can respond to a call for help and go directly to the location without hesitation.

- **Regulations** – This includes the application of formal regulatory arrangements that are the requirement of the managing land authority, and where applicable in collaboration with other land manager authorities with common regulatory requirement/s. Regulation requirements are commonly communicated via signposting and encouraged via the installation and upkeep of waterway infrastructure (i.e. barriers permitting access onto venerable sand dunes).

- **Activity Management** – Applications of activity management include formal regulatory arrangements with user/interest groups, self-regulation programs and/or the requirement of permits to undertake specific activities in designated zones (i.e. requiring a boating licence in a boating only zone).

### 3.1.3 Provision of supervision

- **Trained Observers** – This includes the provision of trained activity supervisors and/or coaches and instructors. Many land managers do not directly facilitate structured programs and activities on their managed areas. These types of activities are generally provided by third parties. Where this is the case, land managers should stipulate (i.e. by hire agreements and stipulated in contracts) that the provision of programs and structured activities should only be conducted with supervisors with current and applicable supervision awards suitable for the environment and conditions.

- **Parental/Carer Supervision** - Children need to be actively supervised by a parent or guardian when in and around water. Children under five should always be in arms reach, and children under 10 should always be in sight. This message should be reinforced on localised signage in and around aquatic areas and in proximity to playground and BBQ areas abutting waterways.

- **First Aid Facilities** – Where first aid and lifeguard stations are provided (i.e. patrolled locations) first aid facilities and lifeguard stations should be clearly signposted and accessible. Additionally, lifeguards should maintain fully stocked portable first aid kits in addition to permanent/fixed first aid facilities. Portable first aid kits should also be provided by third party agencies facilitating aquatic program and structured activities under supervision.
• **Supervision Services** – The supervision of beaches (coastal or Inland beaches) is often required to manage the risk of the location whether due to prevailing water conditions, the proximity to large populations of people or the attendance to the beach due to its proximity or attractiveness. The following factors, often termed the hierarchy of supervision, are collectively vital components of effective aquatic supervision.

**Attention of supervision**

**Visual supervision** is vital in any effective supervision.

i. Lifeguards (on beaches/shorelines, on towers, in-water and combination) are the most effective method of supervision as they can provide supervision that is able to prevent incidents, they can be mobile to compensate for changing conditions such as beach usage, weather and water conditions.

ii. Cameras through closed circuit television (CCTV) can aid supervision through remote monitoring of television screens; however their effectiveness is only as good as the person watching the screen and the appropriateness of the response practices and procedures in place to respond. CCTV can be effective for accident investigation.

**Auditory supervision** can aid visual supervision, however in many aquatic instances the environmental sounds such as that created by wind and those recreating can mask or even modify the sounds.

i. **Proximity of supervision** in the aquatic safety context can be defined as the location (on-beach, in a lifeguard tower, mobile, in-water, on vessel or vehicle etc.) of persons providing supervision (lifeguard) to persons on the beach/waterway and in the water such that they can affect an intervention to minimize the risk of injury or death.

ii. **Continuity of supervision** is measured in terms of uninterrupted, intermittent, or absent and can impact aquatic safety.

iii. **Timeliness of supervision** is the provision of supervision at appropriate or opportune times where there is a reasonable likelihood, determined by historical and real time data analysis, of people being present at the beach/in the water and requiring intervention to ensure their safety from risk of injury or death.

The management of protective and rescue services at open-water recreational beaches should distinguish between those areas that will receive a lifesaving service and those areas that will not. The primary decision to be made by management before establishing a lifesaving service is which areas or whole waterways will be denoted as “guarded” and which will be “unguarded.”

A **lifeguards beach** or **designated safer bathing (swimming)** area is one at which a trained lifesaver and/or lifeguard is stationed during prescribed times and designated by the flying of red and yellow flags. A lifesaver/lifeguard or lifeguard vehicle that periodically visits or checks a beach area should not be considered as providing a guarded beach by either the management or the population served. The beach users should be made aware of the location of the guarded and unguarded sites so that they may make an informed choice as to where to swim. This can be achieved through appropriate signage, advertising in local media, and public awareness through residential and accommodation promotion.
As is often the case, the provision of supervision is difficult to establish or not provided for some or all of the following.

- The provision of a service may encourage attendance at a non-suitable location
- Difficulty locating suitable volunteers
- Deemed too cost prohibitive and therefore not provided by the responsible management agency.

There are a range of beach supervisory services that should be considered as it is not “one size fits all”. They include:

- Full time comprehensive Lifesaving Service with appropriate levels of trained personnel, fixed and portable facilities, equipment, craft, vehicles and links to central command and emergency services.
- Seasonal Lifesaving Service with appropriate levels of trained personnel, portable facilities, equipment, craft, vehicles and links to central command and emergency services.
- Seasonal Lifesaving Service with trained personnel, portable facilities, some equipment and craft, and links to a command centre.
- Camera surveillance, however the limitations as outlined above must be noted
- No Service, but the provision of Safety Signs.

- **Activity Restrictions** - Clearly defined areas for swimming and boating will greatly reduce the likelihood of a collision occurring between a swimmer and a boat and/or other small craft (e.g. in the Lake). These areas should be reinforced with appropriate visible signage, viewable and legible from both in and out of the water.

In addition, the separation of swimming and boating may necessitate the need for prohibition and/or warning signage advising that swimming is not advised. A distinction between the two types of signage (prohibition and warning) needs to be made as considerations arise with each alternative.

Fundamentally, a prohibition ‘No Swimming Sign’ can be interpreted as requiring a systemic approach of reinforcement/ policing (e.g. enforceable within local laws regulations). If it cannot be feasibly enforced, consideration should be given to erecting an advisory warning sign of ‘Swimming Not Advised’. Consultation should be made with the local laws or relevant regulatory enforcement body.

### 3.1.4 Acquisition of survival skills

- **Community Education** - Education and awareness programs for residents and visitors (tourists) alike have been shown to be effective in controlling risks at aquatic recreation waterways. Public education and safety awareness programs outlining known and likely occurring hazards should be developed. Additionally, local community groups should also be made aware of any potential hazards associated with their local waterway environment i.e. primary school children.

Community groups may benefit from the delivery of a range of structured and/or informal education programs. These programs would ideally revolve around the acquisition of survival skills, self-rescue skills and skills which enable individuals to rescue others in the safest manner.
possible while minimising any personal risk.

- **Emergency Communications** – Emergencies can vary between land and water, and can be the result of natural processes or human action. A well planned and rehearsed Emergency Action Plan (EAP) can greatly minimize the extent of injury and damage if an incident does occur. Local stakeholders and users will need to know how to raise the alarm and this will involve educating them in the EAP.

The Emergency Action Plan (EAP) is an important part of waterway operations. A locality specific waterway based EAP should consider many emergency situations including medical, missing persons, fire, vehicle accident, pollution event, severe weather, structure collapse, structure climbing/descending emergencies, and natural disasters such as flooding.

The EAP should be developed through broad consultation with all relevant stakeholders. This may include relevant personnel from the local government authorities and regional agencies for the State government, emergency services representatives and local safety organizations. The EAP should consider a broad range of issues including the following.

- The specific needs, conditions and environment of each location
- Details of the location such as map, street names, GPS coordinates
- The date when the plan was developed and approved for implementation
- Emergency Personnel Names and Phone Numbers
- Designated Responsible Official (Highest Ranking Manager for Shire); name and contact details, plus role and responsibilities
- Emergency Coordinator for the location; roles and responsibilities
- Emergency notification flow chart
- Emergency assembly locations, access and evacuation routes; if gated the names and contact details for all relevant personnel who have access
- Emergency related equipment such as communications (telephones, alarms etc.), rescue equipment, firefighting etc.
- Emergency service contact details, which may include Fire, Police, Ambulance, Lifesavers, Security, Ranger/land manager, utilities such as water, communications, gas and electricity
- Emergency procedures in particular procedures that establish timely and reliable recognition of emergency events, and procedures for emergency notification and hierarchy
- Critical operations in times of emergencies
- Critical communications for the emergency services
- Communications for the communities affected

The EAP should be tested and periodically practiced, and the existence of the plan should be communicated with relevant stakeholders, and the community at large.

- **Public Rescue Equipment** - There should not be too heavy a reliance on the provision of public rescue equipment. Some land managers may see it as the most important or the only option in regard to their drowning prevention policy. It should be remembered that it is a reactive and not a pro-active measure. In some circumstances it may not be appropriate at all. It should only be seen as one element of an overall treatment strategy.

There is at present no internationally agreed standard for distribution/placement of public rescue equipment. As a minimum equipment provided for public use should be: a) clearly positioned and b) in colours of red and yellow at an optimal height for ease of access. The frequency of placement and
locality should be determined by visitor numbers and based on a systematic risk assessment. Regular inspection of the equipment throughout the year is required and replaced/ repaired when necessary. Vandalism of rescue equipment is a very real problem experienced by all waterway authorities, so budgetary provisions are advisable. Evidence suggests that rescue equipment in secure housing may provide a better deterrent to vandalism. The housing should be secure but easy to open when required.

- **Floatation Devices** – Personal flotation devices (PFDs) are more commonly known as lifejackets. A lifejacket is designed to help you stay afloat in the water but cannot guarantee your safety and ultimate rescue. Lifejackets need be the right type based on your activity requirements. They are required when on vessels. PFDs are required to comply with manufacturing standards. For use on vessels there are three types of PFD being; Type 1, 2 and 3. They range in buoyancy, price, style, and comfort and maintenance level.

  **Type 1**: These are readily available at minimal cost. They can however be uncomfortable to wear and are extremely difficult to put on once you are in the water. These jackets can also become easily tangled.

  A PFD **Type 2** is a buoyancy vest, not a lifejacket. They are comfortable to wear and less bulky than a PFD Type 1. They are manufactured in a range of high visibility colours and are designed with sufficient buoyancy to keep the wearer’s head above water. Some PFD Type 2s are designed for specific activities such as canoeing or kayaking. These PFDs often include special features to suit individual activities.

  A PFD **Type 3** is a buoyancy garment, not a lifejacket. They have similar buoyancy to a PFD Type 2 and are manufactured in a wider variety of colours than other PFDs. PFD Type 3s can be built into wetsuits and are commonly used by waterskiers, wakeboarders and kiteboarders.

  Where land managers are facilitating a variety of activities requiring the use of PFD localised signage should ideally provide a reinforcement of the type of PFD required for the type of activity being facilitated within the managed waterways.

### 3.1.5 Monitor and Review

Continuous monitoring and review of risks ensures new risks are detected and managed, and that action plans are implemented and progressed effectively. Review processes are often implemented as part of the regular risk management process cycle (and if not should be), supplemented by major reviews periodically (e.g. annual review).

Monitoring and review activities link risk management to other management processes and administrative processes e.g. capital works plans. This incorporated approach facilitates better risk management and continuous improvement. The main input to this step is the watch list of the major risks that have been identified for risk treatment action (Risk Register). The outcomes of any review process should be in the form of revisions to the risk register and a list of new action items proposed for risk treatment or funding opportunities for already identified treatment options.
3.2 Conclusion

This report as a summary report. It aimed to achieve a number of tasks. These tasks included presenting the site under assessment (physical extent and type of use) and providing some background context to the risk management functions of the project. These risk management functions focused on the assessment of Lysterfield Lake specific to a minimisation of recreational drowning and injury events project objective.

The risk assessment included the functions of identification of relevant environmental and residual hazards in order to analyse and evaluate them against the project risk objective and criteria. The completion of these tasks flowed into the construction of a risk treatment options table. This table was used by the concerning Lysterfield Lake land managers and/or vested parties as a method of exploring various risk treatment options that:

I. Aimed to reduce the risk of drowning and injury at Lysterfield Lake Beach relative to the known hazards at the site, and;
II. Suit the organisational risk philosophies and risk resourcing capacities of the land manager and/or interested parties.

3.3 References