HERO Significant Fish Species Project Report 3/3:

Pilot Emergency Response Action Plan
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Summary

This report forms the third component of the HERO Significant Fish Species Project and documents the short term emergency response actions to protect remnant habitat pools in priority waterways to ensure the survival of significant fish species during extreme climatic events.

The short term emergency actions target non-migratory threatened fish species that are dependent on refuge habitat during dry conditions. These species are Yarra Pygmy Perch (*Nannoperca obscura*) and Dwarf Galaxias (*Galaxiella pusilla*).

The emergency response actions are to deliver water to the sites and if necessary sandbag to prevent water escaping from the pool. These works will only be carried out in emergency situations when set water quality and depth trigger levels are reached during the summer months.

The trigger levels are:

- Salinity $\geq 20,000$ EC (Yarra Pygmy Perch) and $\geq 10,000$ EC (Dwarf Galaxias)
- Temperature $\geq 28^\circ$C
- Depth $\leq 30$cm
- Dissolved Oxygen (DO) $\leq 4$mg/L when depth is between 30cm and 1m

These trigger levels were determined in the Corangamite Catchment Management Authority (CMA) Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009), although some amendments have been made (for further information refer to the section on trigger levels).

If any of these trigger levels are exceeded at any of the four monitoring sites, a decision will be made by a decision support panel within the Corangamite CMA as to when to respond to trigger levels, based on water quality and depth levels, the species involved, project restraints and climatic conditions.

The four suitable sites selected for the Emergency Response Action Plan from those identified in the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) as sites where the non-migratory species of threatened fish were found to persist.

The emergency response works will be carried out to protect regionally important populations of significant fish species in the short term in emergency situations, and will be implemented until such time as longer term resilience works are effective in maintaining these populations into the future.

This report outlines the considerations and processes required to implement the emergency works safely from human health and ecological security perspectives.
Background

Australia is the driest inhabitant continent on earth. Drought is a common and natural feature of the Australian environment, however since European Settlement many of Australia’s freshwater rivers and streams have been modified through extraction and damming, thereby reducing flow and accentuating the effects of drought. Many streams now cease to flow or revert to a series of pools during the summer months. During dry periods remnant pools act as refuge habitat for aquatic fauna such as native fish (Jones et al., 2008). Under extreme circumstances remnant pools may contain a large proportion of the local fish population (Jones et al., 2008).

The Corangamite Catchment Management Authority (CMA) is responsible for the protection of natural resources within the river catchments in the region from Geelong to Ballarat and along the coast to Peterborough. The region encompasses four river basins; the Moorabool, the Barwon, Corangamite Lake and the Otway Coast.


Recent fish surveys of waterways in the Corangamite CMA region have identified shrinking distribution and abundance of these species due to the continued dry inflow conditions, with many populations now only found in remnant habitat pools of small unregulated waterways over the summer months.

In 2009 the Arthur Rylah Institute for Environmental Research produced The Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) for the Corangamite CMA, in consultation with a number of experts in the state.

The report outlined the key threats facing four significant fish species (protected under the EPBC Act and the FFG Act) that are found in the Corangamite Region; Australian Grayling, Yarra Pigmy Perch, Dwarf Galaxias and Australian Mudfish. These species are now dependant on refuge habitats which provide protection and ensure the survival of the species during periods of drought (Saddlier, Ryan and Woolley, 2009). These critical habitats have become more important over the last ten years as a result of drought conditions which exacerbate the impacts of threatening processes.

The Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) provided recommendations for actions to lessen the impact that reduced inflows have on remnant populations of these threatened fish species.

As per the recommendations in this report the Corangamite CMA has developed the HERO Significant Fish Project.
The objective of the HERO Significant Fish Species Project is to ensure the survival of threatened fish species known to occur in the Corangamite region. This will be achieved by implementing:

1. A water quality monitoring and assessment program in remnant habitat pools, for waterways identified as important for significant fish species (HERO Significant Fish Species Project Report 1/3: Water Quality Monitoring Plan);

2. A fencing and revegetation program targeted at remnant habitat pools to prevent stock access, improve shade/water quality, and reduce sedimentation in priority waterways (HERO Significant Fish Species Project Report 2/3: Resilience Works Long Term Action Plan); and

3. Short term actions to ensure survival of these species if monitoring identifies water quality is declining below established water quality trigger levels in priority waterways (HERO Significant Fish Species Project Report 3/3: Pilot Emergency Response Action Plan).

This report forms the third component of the HERO Significant Fish Species Project and documents the short term emergency response actions to protect remnant habitat pools in priority waterways to ensure the survival of significant fish species during extreme climatic events. The proposed interventions will be piloted to assess their capacity to reduce the risks to survival of important populations of the significant fish species in response to short term in emergency situations. The emergency actions will be implemented when triggered until such time as the long term resilience works are effective in maintaining these populations into the future.

This action plan aims to reduce the threat of adverse conditions associated with drought in the Corangamite region and the stress of dry inflow conditions.

The emergency response actions aim to reduce the impacts of reduced flows caused by continuing drought conditions on the remnant populations of these threatened fish species.

This project is a pilot for this region, based on success elsewhere, and is expected to be effective in improving conditions in the short term but it is uncertain how it will contribute to the long term survival of populations of significant fish species.
**Significant Fish Species**

There are four species of threatened fish within the Corangamite region with a wide range of habitat requirements. Two of these species are migratory and two are non-migratory.

The tendency for migratory fish to move large distances to deeper parts of the river when conditions begin to decline is an assumption that has been incorporated into this plan (Saddlier, Ryan and Woolley, 2009). The migratory species therefore would not be expected to benefit from emergency works to protect habitat pools, although they will benefit from the longer term habitat improvements associated with this project.

This action plan therefore concentrates only on the non-migratory species of threatened fish that take refuge in habitat pools during dry conditions; Yarra Pygmy Perch and Dwarf Galaxias.

**Yarra Pygmy Perch: Nannoperca obscura**

Yarra Pygmy Perch (figure 1) are a small bodied non migratory fish (Saddlier, Ryan and Woolley, 2009).

They are relatively tolerant and are able to adapt to poor water conditions, although it is unknown as to how long they are able to survive in these conditions and whether they are able to function and reproduce normally under such conditions (Saddlier, Ryan and Woolley, 2009).

Yarra Pygmy Perch occupy small stream and lakes and prefer flowing water with abundant cover in the form of submergent and emergent aquatic vegetation (Allen, 2003). Yarra Pygmy Perch have not been recorded historically where aquatic vegetation is lacking (Jones et al., 2008).

**Locations within the Corangamite Region:**

There are many locations within the region where Yarra Pygmy Perch populations can be found. The most significant are the isolated populations in Sutherland, Woady Yallock and Gnarkeet Creeks, and the Curdies River.

There are also scattered populations throughout the Barwon River Catchment (Saddlier, Ryan and Woolley, 2009).
**Dwarf Galaxias: Galaxiella pusilla**

Dwarf Galaxias (figure 2) are a small bodied non-migratory species.

They are wetland specialists and are able to survive short periods with very little water, however recent studies (Coleman 2009; in Saddlier, Ryan and Woolley, 2009) suggest that they may not enter a true state of aestivation.

Dwarf Galaxias are highly impacted by competition with introduced Mosquito fish (Gambusia holbrooki) (Saddlier, Ryan and Woolley, 2009).

Dwarf Galaxias inhabit marginal vegetation in still or slow moving waters of road side ditches, swamps and backwaters of creeks. This species occupies both ephemeral and permanent habitats (Allen, 2003).

**Locations within the Corangamite Region:**

There are only two populations of Dwarf Galaxias within the region found at Gosling Creek and Barwon Downs on the East Barwon River. Populations higher in the catchment are considered more significant due to their potential to provide natural restocking pathways (Saddlier, Ryan and Woolley, 2009).

The habitat locations of all four species within the Corangamite Catchment have been mapped in figure 3 below.
Whole Catchment Map of Species Habitat Locations

Figure 3: Whole catchment map showing habitat locations of each species
Key risks for each species

The key threats associated with drought for the four species of threatened fish, as outlined in the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) are:

- In-stream barriers to migration
- Loss of floodplain connectivity
- Habitat fragmentation (riparian and in-stream)
- Low flows preventing the river mouth/estuary opening to the sea
- Loss of wetlands
- Loss of seasonal flows
- Reduced flooding
- Habitat changes due to low flow
- Reduced flow volumes
- Reduced water-table levels
- Low Dissolved Oxygen (DO) levels
- Increased salinity – high electrical conductivity (EC) levels
- Algal blooms (nitrification).

For further information on the key risks for each species at each location, refer to the table in Appendix A. This table has been derived from the ‘Prioritisation of Population Sites’ and the ‘Determination and prioritisation of threats associated with each high value population’ tables found in the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009). The threats have been prioritised according to the ‘Threats, triggers and recommended actions’ tables, to correspond with the structure of the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009).


**Monitoring**

The emergency response works will be carried out in the event of set water quality and depth trigger levels being reached. A monitoring plan has been developed as a component of the Hero Significant Fish Species Project to monitor the priority sites where short term emergency response works can be implemented (Hero Significant Fish Species Project Report 1/3: Water Quality Monitoring Plan). Monitoring will be conducted weekly, or as often as possible depending on conditions, during the summer months by the Corangamite CMA at the priority sites. The aim of the monitoring plan is to enable the Corangamite CMA to determine when set trigger levels have been reached at the priority sites, so as to allow rapid implementation of emergency response works. Monitoring will also be carried out during and after emergency response works have been implemented to determine whether or not the emergency actions provide relief from triggers and for how long.

The monitoring program focuses on sites identified in the significant fish species scoping study. Of these identified sites monitoring will only be undertaken where short term actions are feasible.

These sites are; Gosling Creek at Division Road, Thompson Creek at Pettavel Road and at Nobles Road, and Waurn Ponds at the Surf Coast Highway (see figures 4 -8 for maps of the sites).

Although it is a relatively large site, a site at Horseshoe Bend Road has also been added. This site will provide additional protection to this site in catastrophically dry periods due to its physical characteristics including historically stable water levels and its large volume. Intensive monitoring will not need to be carried out at this site however the Corangamite CMA will regularly monitor water levels.

Corangamite CMA River Health Planning staff will implement monitoring where possible.

**Trigger Levels**

The set water quality and depth trigger levels are:

- Salinity $\geq 20,000$ EC (Yarra Pygmy Perch) and $\geq 10,000$ EC (Dwarf Galaxias)$^1$
- Temperature $\geq 28^\circ$C
- Depth $\leq 30$cm$^2$
- Dissolved Oxygen (DO) $\leq 4$mg/L when depth is between 30cm and 1m$^3$

These trigger levels were decided upon by the panel of experts involved in the workshop for the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report. While some of these triggers may be considered extreme, the aim of the emergency response works is to ensure that the fish survive emergency scenarios. It is expected that the resilience works carried out

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$^1$ The EC trigger for Dwarf Galaxias was altered following further consultation with fish experts

$^2$ Amended slightly from the original report which had two separate depth triggers (at 1m consider water delivery options and at 30cm deliver water).

$^3$ The depth clause has been added to the DO trigger because if the depth of the pool were greater than 1m and the DO was met, adding water would not alter DO.
as part of the HERO Significant Fish Species Project Report 2/3: Resilience Works Long Term Action Plan, will ensure that these species are able to persist into the future.

If monitoring detects that any of these trigger levels are exceeded at any of the four priority sites, a judgement call will need to be made by a Corangamite CMA decision support panel as to whether emergency response actions should be implemented.

**Ability to Act**

The ability of the Corangamite CMA to respond to trigger levels will depend on a number of factors such as available resources, weather conditions and the effectiveness of actions. All of these factors will have to be taken into account by the internal decision support panel when a decision is made as to whether to respond to triggers or not.

**Ability to influence parameters**

One of the key considerations that must be taken into account by the internal decision support panel is the effectiveness of the actions in restoring trigger levels and protecting threatened fish. This is why dissolved oxygen (DO) trigger has been modified to include the depth clause because if the DO content were to fall below the trigger level when the depth of the habitat pool is greater than 1m, adding water to the habitat pool would not be expected to adequately alter DO levels (refer to figure 10, decision support tool).

**Influence of weather conditions**

Weather conditions and forecasts will have to be taken into consideration when making a decision as to whether or not to respond to triggers as it may be an inefficient use of resources delivering water to habitat pools if a significant rainfall event is likely to occur in coming days.

**Cooperation of landholders**

In specific instances, some waterways may have private tenure for or require access across private land. Equally, the interventions could easily be compromised by stock access or other land management actions. In these circumstances, the cooperation of landholders is critical for the implementation of emergency works and is a key consideration when prioritising sites.

**Linkage with ongoing resilience works**

The emergency response works will be carried out to protect important populations of the significant fish species in the short term during emergency situations only, and will be implemented until such time as long term resilience works are effective in maintaining these populations into the future. Therefore the emergency sites need to be located in areas where resilience works are occurring or where there is potential for resilience works to be carried out in the future.

**Accessibility of sites**

A key factor in determining the suitability of sites for emergency response works is whether or not they are accessible as it will be necessary for a semi truck to access the sites in order for these works
to be carried out. As previously mentioned, land tenure may restrict access however other issues such as soft or uneven ground can also limit the ability to truck water to sites.

**Principles for monitoring**

Monitoring will focus on sites identified in the planning stage of the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report. These sites were selected based on accessibility and feasibility of implementing emergency response works.

Monitoring for triggers will allow rapid implementation of emergency works and evaluation of the pilot emergency response actions. These emergency works have been researched and listed for implementation at specific sites around the region in the event of water quality trigger values being met or exceeded.

Sites have been identified and prioritised for emergency works and tracking site condition is an important step in knowing when to act.

The Corangamite CMA will:

- Monitor where short term actions can be implemented – generic/information gathering is not the purpose of this project.
- Monitor for site specific trigger levels for emergency works actions at each site identified in the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009).
- Focus monitoring around high risk periods i.e. dry summer months.
- Spatially track progress, data and results.
- Provide guidance around any monitoring that is to be implemented by any other third party.

**Methods**

Dissolved oxygen, salinity, depth and temperature trigger levels have been developed. Monitoring will focus on four sites on Thompson Creek, Waurn Ponds Creek, and Gosling Creek.

A HARC water quality probe will be used to collect water quality data. This allows quick data collection for the parameters identified as being critical for the survival of threatened species during dry periods. Depth will be measured using a weighted rope with 10 centimetre increments. Every monitoring site is accessible by vehicle and all are in close proximity to parking.

Where possible the Corangamite CMA Environmental Water Reserve team will make use of data provided by WaterWatch volunteers at the priority sites. Efforts have been made to communicate with relevant volunteers about the HERO Significant Fish Species Project and the triggers associated with the emergency works.
Maps of Site Locations

Figure 4: Monitoring Site, Thompson Creek System, Pettavel Road
Figure 5: Monitoring Site, Thompson Creek System, Nobles Road
Figure 6: Monitoring site on Waurn Ponds Creek, Surf Coast Highway
Figure 7: Monitoring site on Gosling Creek, Division Road
Figure 8: Additional site on Thompsons creek, Horseshoe Bend Road
Prioritization of Sites

The sites selected for the Emergency Response Action Plan were identified in the region-wide fish survey and in the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) as sites where the non-migratory species of threatened fish were found to persist.

The sites were further narrowed down at an internal workshop with River Health Operations, River Health Planning Coordinator, River Health Planning Team, referring to significant fish report

Due to project restrictions such as funding, accessibility and feasibility, only four sites have been selected for the implementation of emergency response actions. The sites selected for the Emergency Response Action Plan are sites where the implementation of short term actions is feasible and where access is possible. Pool selection was also based on favorable bathymetry (whether or not the pool is able to hold sufficient water and the size of the pool).

While there may be better refuge habitat pools in the system the Corangamite CMA is unable to implement emergency response works upon them because of these restrictions. This pilot action plan will determine whether implementing actions on any pools where emergency response works are feasible is effective in maintaining as much suitable habitat for threatened fish in each system as possible.

Dwarf Galaxias

Selected Site:

Gosling Creek downstream of Division Road

The Gosling Creek site was selected because it was one of the key priority sites identified in the CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) known to support Dwarf Galaxias.

The Gosling Creek site (figure 9) is located on Division Road approximately eight kilometers north east of Barwon Down. The site runs through degraded farmland. One side is fenced with remnant vegetation and the other site has rare stock access. While no resilience works are currently planned for this site, it has been identified as a site where emergency works should be carried out because all the other sites focus on Yarra Pygmy Perch and because the population is in good condition and with continued stock restriction fish will have opportunities for recruitment and ultimately survival.
Sketch of Pool

**Figure 10:** Gossling Creek at Division Road pool sketch
Rationale

This site provides good refuge for Dwarf Galaxias due to the presence of dense beds of Macrophytes throughout the pool namely *Phragmites australis*, *Schoenoplectus* species and *Persicaria decipiens*. The presence of thick aquatic vegetation is essential in any Dwarf Galaxias refuge pool as it provides cover from predators, facilitates macro invertebrate habitat and also helps to regulate the temperature and water quality in the pool through dry periods.

The remnant riparian vegetation on the right bank also provides many benefits for Galaxias in this pool. Riparian vegetation benefits in stream habitat by filtering external toxicants, promoting general biodiversity insects etc, improving and maintaining water quality and regulating temperature in the pool.

Scattered small in stream wood also adds protection from predators and boosts the diversity of the pool.

The bathymetry of the pool is suitable for emergency works (see figure 10). The pool volume has been calculated 483000L and the site is easily accessible making it a suitable site for water delivery, ensuring the Corangamite CMA is able to reach the listed fill point for this site.

Other Potential Sites:

*Upstream site (wetland):*
- This site does provide suitable habitat but attempts to carry out previous works at this site have proved unsuccessful due to the land holder’s lack of participation. This site is also very difficult to access and the pool bathymetry is unsuitable for this project as it would require a very large volume to fill the pool.

*Barwon Downs Site:*
- This site was determined as unsuitable for this project at the internal workshop due to unwilling landholders, inaccessibility of site and unfavourable pool bathymetry. Further investigation is required as to the location of the population and to determine where the parent population is found.

*Yarra Pygmy Perch*

A recent fish survey found that Yarra Pygmy Perch appear to be more abundant in Thompsons Creek than elsewhere and that the mid-reaches of the creek provide critical habitat (McKinnon and Ryan, 2008). This survey identified four key sites in Thompsons Creek for Yarra Pygmy Perch. These include: a site just upstream of the Minya weir, the Horseshoe Bend Road site, Rices Reserve and Pettavel Road.
Selected Sites:

Thompsons Creek at Pettavel Road
This site is located on Thompsons Creek upstream of Pettavel Road, approximately five kilometers south of the intersection between Pettavel Road and the Princess Highway, roughly twelve kilometers west of Geelong (see figure 11). The habitat pool is located at the Pettavel Road Bridge on Thompsons Creek. The site is surrounded by farm land and is located within a highly modified landscape. The habitat pool is quite big in relation to other pools in the system and contains a large population of Yarra Pygmy Perch (McKinnon and Ryan, 2008).

Rationale
Records show that a large population of Yarra Pygmy Perch persist in this pool. This data along with the current in stream conditions provide the basis for selecting the site for emergency actions.

The Macrophyte diversity consisting of Phragmites, Persicaria and Typha species provide ideal harbour from predators and also provide essential habitat for the primary food source of Yarra Pygmy Perch, micro crustaceans.

The site is easily accessible and the bathymetry of the pool is suitable for water delivery and a volume of 335,000L ensures feasibility for the delivery by truck (see figure 12).

This pool is also directly connected with two sites immediately upstream undertaking resilience works through this project. This will help interconnectivity between pools and the provision of 3Ha of riparian revegetation and stock exclusion will benefit the site into the future.

This site on Thompson creek displays many of the features necessary to harbor Yarra Pygmy Perch during drought conditions as well as having previous records of the fish being present. Dense stands of Phragmites australis line both banks and help to shade the pool. These areas provide habitat and protection for the perch whilst boosting the potential for macro invertebrate (perch main diet) populations to flourish.

Pettavel Road pool is located immediately upstream of a causeway which provides an unnatural barrier to flow, however in dry periods this barrier would help raise the volume of water retained in the pool.

This site was also selected for emergency works because it is located close to the monitoring station at Ghazeepore Road, which will provide a good indication of water quality in the system.
Figure 12: Thompsons Creek at Pettavel Road pool sketch
**Thompsons Creek at Nobles Road**
This site is located in the upper reaches of Thompson Creek, downstream of Nobles Road, approximately five kilometers south west of Moriac, just south of Lake Modewarre (figure 13). The site is surrounded by farm land and is located within a highly modified landscape.

**Rationale**

This site has good population numbers recorded from several fish surveys and provides good features for fish refuge.

The presence of dense beds of Macrophytes (Typha, Triglochkin, and Phragmites) provides essential habitat and harbor from predators whilst helping to regulate water quality through dry periods.

The site is easily accessible and the bathymetry of the pool is suitable for emergency works, containing adequate volume for delivery of water by truck (see figure 14). Trucks can provide adequate volumes to reach the desired fill point for this location.
Sketch of site

Thompson Creek @ Nobles Road

Pool Volume = 111,000 L
Trigger Volume = 62,000 L
Delivery Volume = 49,000 L

Figure 14: Thompsons Creek at Nobles Road pool sketch
**Waurn Ponds Creek at Surf Coast Highway**

**Site Description**

The Waurn Ponds Creek site is located just east of the bridge on the Surf Coast Highway, approximately one kilometer from the intersection between the Surf Coast Highway and the Princes Highway, in the south-west suburbs of Geelong (see figure 15). The site is located within the urban zone of Geelong in a highly modified landscape but the creek forms part of the South Barwon Reserve and is therefore public land.

Yarra Pygmy Perch have been recorded at this site with indications of recruitment. The creek contains some in-stream vegetation including *Phragmites australis* and *vallisenaria*. The habitat pool is shaded by a mature Red Gum, which provides substantial benefits for fish refuge.

The system is essentially ephemeral but storm water runoff provides some degree of water security in habitat pools.

The pool is easily accessible and the pool bathymetry is suitable for emergency works (see figure 16).
Sketch of site

**Figure 16:** Waurn Ponds Creek at the Surf Coast Highway pool sketch

- **Waurn Ponds Creek @ Surf Coast Highway**

  - Pool Volume = 89,000 L
  - Trigger Volume = 43,000 L
  - Delivery Volume = 46,000 L
Additional Site:

**Thompsons Creek at Horseshoe Bend Road**
This site was included in this action plan as a backup site. In the event of either of the other sites on Thompson Creek being lost, this site will replace it. This site is not a standalone site however because it is a very deep pool and it is unclear whether larger pools would retain suitable in stream vegetation to support populations of threatened fish, if they were to dry out during extreme events.

However as this site currently supports a large population of Yarra Pygmy Perch and, being further downstream than the other two sites on this system, it is more difficult for re-colonization to occur, the Corangamite CMA determined that this site should not be discounted.

This site is located on Thompsons Creek at Horseshoe Bend Road, approximately two kilometers east of the intersection between the Surf Coast Highway and McCanns Road. The habitat pool is located downstream of the Horseshoe Bend Road Bridge on Thompsons Creek. The site is surrounded by farm land and is located within a highly modified landscape. The habitat pool is quite big in relation to other pools in the system and contains some in-stream vegetation including *Phragmites australis*. There are a number of native trees providing shade for the pool. A recent fish survey found a significant population of Yarra Pygmy Perch at this site (McKinnon and Ryan, 2008). The site is also easily accessible.

The Corangamite CMA will continue to assess this site.

Other Potential Sites:

**Thompsons Creek – upstream of Minya Weir**
The highest number of species was recorded at this site, however it was not considered for emergency works because it is inaccessible and the bathymetry of the pool makes it unsuitable for emergency works (McKinnon and Ryan, 2008).

**Thompsons Creek at Rices Reserve**
The site at Rices Reserve is very close to the Horseshoe Bend site and supports a much smaller population, and was therefore discounted. Protecting large populations is more feasible and adheres to Corangamite CMA policy, to protect the best assets first.

**Waurn Ponds Creek – Pioneer Road**
This pool is accessible but it is in poor condition and contains no in stream vegetation. The bathymetry of the pool is also unsuitable as it is a very shallow pool.

**Waurn Ponds Creek – Rossacks**
This site is accessible but it does not provide suitable habitat for fish refuge due to the lack of in stream vegetation, poor riparian zone and large quantities of rubbish litter the pool. A large volume of water would be required to fill this pool due to the culvert under the bridge.

**Woady Yallock River**
Works are not feasible in this area because landholders are uncooperative. The Corangamite CMA therefore has no ability to carry out emergency response actions in this area. Riparian works are not
currently been carried out in this catchment and it is therefore not a priority at this point in time due to certain limitations.

*Sutherland Creek*
This site is inaccessible for emergency works to be carried out. Long term riparian works are already being carried out in this catchment and the Corangamite CMA is relatively comfortable that these populations will be protected. There may be potential for further works to be carried out in this system in the future.

*Garneet Creek and Pennyroyal Creek*
Long term riparian works are being already carried out at these sites. Due to limited funding the Corangamite CMA is able to carry out emergency works at a few sites only and these sites have not been prioritised for actions.
Rationale for Emergency Response Actions

It is important to note that this action plan is a pilot and incorporates an adaptive management approach. While there are several uncertainties associated with this project, the Corangamite CMA has determined that it would be better to trial the emergency response actions to protect these species of threatened fish, which are high value assets (protected by the EPBC Act and the FFG Act), under extreme conditions, than to do nothing and allow the fish to die.

Physical water quality monitoring will be carried out before, during and after implementing actions to determine when trigger levels have been reached and to evaluate the effectiveness of emergency actions.
**Principles for Emergency Works**

The principles for this emergency response action plan are:

- This action plan is a pilot approach incorporating adaptive management. Monitoring must be carried out during and after implementing actions to evaluate their effectiveness.
- The emergency response works aim to protect important populations of the significant fish species in emergency situations only and are not a long term solution.
- The emergency response works aim to protect target populations until such time as long term resilience works are effective in maintaining these populations into the future.
- A judgement call (using the internal decision support panel and the decision support tool) will need to be made before implementing emergency works. Emergency works should only be carried out in a situation where the benefits exceed the costs.
- A decision support tool will be used by a decision support panel to determine whether or not to respond to triggers.
**Decision Support Tool**

Figure 17 below is a decision support tool that should be used in conjunction with the decision support panel to determine whether or not to respond to triggers. It draws on the recommendations of the Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009).

In summary a panel decision will be required when a trigger is reached based on ability to influence trigger levels, weather conditions and availability of resources. The DO trigger has a depth clause attached to it because if the depth of the pool is greater than 1m and the DO trigger is met, delivering water will not alter DO levels. Therefore the panel will only be consulted if the DO trigger is met and the depth of the pool is between 30cm and 1m.
**Decision Support Panel**

A decision support panel or committee within the Corangamite CMA will be formed to assist with the decision making process.

This panel will include:

- The project manager and project owner within the River Health Planning team;
- The Sub Program Manager Biodiversity Strategic Coordinator, or proxy;
- The Sub Program Manager River Health Implementation, or proxy; and
- The River and Catchment Program Manager.

If needed, the panel may also consult with additional experts.

The panel will be consulted with during the decision making process to determine whether or not to respond to triggers. The project manager will use the decision support tool to assist with the decision making process and determine the supporting information to bring to the panel. At least two panel members will need to be available in order for a decision to be made. Once a decision has been made by participating panel members, all of those on the panel will be notified in writing after the panel has convened and a formal record of the decision, signed by all panel members will be retained in the project file.

Panel members (as at the time of writing) have been provided with the opportunity to review this document; therefore in the event of the panel being convened, opportunity will not be provided to raise questions with regard to the actions proposed or the document itself. However as this project is a pilot and employs an adaptive management approach, any additional comments or recommendations from the panel, in addition to any lessons learned, will be recorded for incorporation in future iterations of the project.
Action Plan

Objectives

The aim of delivering water to the habitat pools is to reduce the impacts of declining water quality and quantity associated with drought conditions.

The objectives of the emergency response works are to:

- Prevent the loss of significant fish species as a result of drought conditions;
- Provide and maintain refuge habitats for significant fish species;
- Avoid catastrophic events such as fish kills or algal blooms;
- Maintain water quality in rivers at levels that are tolerable for significant fish species;
- Minimise impacts on human health;
- Manage community concern.

In the event of trigger levels being reached, the emergency response actions are to deliver water to the site by trucking in water and sandbag the pool if necessary (Table 1).

<table>
<thead>
<tr>
<th>Site</th>
<th>Parameters</th>
<th>Triggers</th>
<th>Emergency Response Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gosling Creek at Division Rd</td>
<td>Salinity, Temperature, Depth, Dissolved Oxygen</td>
<td>Salinity ≥ 10,000, Temperature ≥ 28°C, Depth ≤ 30cm, DO ≤ 4 mg/L when depth is between 30cm and 1m</td>
<td>Delivery of water to the site and sandbag if necessary</td>
</tr>
<tr>
<td>Thompson Ck at Pettavel Rd</td>
<td>Salinity, Temperature, Depth, Dissolved Oxygen</td>
<td>Salinity ≥ 20,000 EC, Temperature ≥ 28°C, Depth ≤ 30cm, DO ≤ 4 mg/L when depth is between 30cm and 1m</td>
<td></td>
</tr>
<tr>
<td>Thompson Ck at Nobles Road</td>
<td>Salinity, Temperature, Depth, Dissolved Oxygen</td>
<td>Salinity ≥ 20,000 EC, Temperature ≥ 28°C, Depth ≤ 30cm, DO ≤ 4 mg/L when depth is between 30cm and 1m</td>
<td></td>
</tr>
<tr>
<td>Waurn Ponds Ck at the Surf Coast Hwy</td>
<td>Salinity, Temperature, Depth, Dissolved Oxygen</td>
<td>Salinity ≥ 20,000 EC, Temperature ≥ 28°C, Depth ≤ 30cm, DO ≤ 4 mg/L when depth is between 30cm and 1m</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Site specific triggers and emergency response actions

Sandbagging is an extreme and invasive measure and should only be implemented if necessary depending on environmental and site specific conditions.

Emergency Response Works

The Corangamite CMA Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) identified potential emergency response works to enhance the resilience of remnant habitat pools under drought conditions, which include delivering water to the habitat pools and sandbagging if necessary.
**Sandbagging and lining of pools:**

The objective of sandbagging and lining of pools is to enhance the available habitat for fish by increasing the depth of the pool so as to alleviate the threat of dry conditions. The use of sandbags is mostly used as a temporary measure over summer when water levels are likely to decline.

Sandbagging of remnant pools involves piling sandbags across the choke of a river channel (where the pool narrows). The bags are usually piled 1m high and 2-3m wide. The bags are then lined with plastic to ensure that they are impermeable to water. The sandbags act as a weir and prevent water escaping from the habitat pool, ensuring that the water remains at a tolerable depth to provide physical habitat and buffer water quality for the threatened fish species. The bags can then be removed over winter or left in the pool, although they will require some maintenance works.

Melbourne Water has implemented a number of emergency drought response actions at key refuge sites across the Port Philip and Westernport region, including sandbagging and lining of pools, which proved successful in protecting threatened fish species (figure 18) (Melbourne Water, 2009).

When installing plastic lining in the pools it is important to ensure that other aquatic organisms, macro invertebrates and aquatic vegetation are not negatively impacted and that natural interaction with groundwater systems is not inhibited. The plastic lining should cover the sandbags only and not the bottom or the banks of the river.

The timing of the installation of sandbags is important. Sandbags will need to be maintained. External communication with key stakeholders, community groups and members of the public is important particularly if the area is monitored or maintained by volunteers or is a public site. Signage may be required to notify the public as to why the sandbags are in place. Subsequent monitoring of sites is important to determine the effectiveness of actions (Joanna Frame, 2010).

**Delivery of Water to Site – sourcing and trucking in water:**

The objective of delivering water to the site by sourcing and trucking in water is to enhance the available habitat for fish by increasing the depth of the pool so as to alleviate the threat of dry conditions. The delivery of water to the site involves transporting water from an external source to the habitat pools. It is important to ensure that the water is filtered before being added to the habitat pool to remove any unwanted organisms such as mosquito fish.
When delivering water to the habitat pools it is important to ensure that velocity dispersal measures are put in place to avoid any adverse effects on the significant fish populations. This may involve laying a tarpaulin on the river bank and having the contractors deliver the water onto that rather than directly into the river and allowing it to run from there into the pool.

**Water Requirements**

If trigger levels are reached, the Corangamite CMA decision support panel will determine whether delivery of water is an appropriate and viable intervention.

In order to determine the volume of water required for each pool, the length of the pool was measured using a range finder and the average width was calculated from five measurements. The depth was determined to be 70cm, because the water requirement is the volume needed to fill the pool from 30cm (trigger point) to 1m. The water requirements are rough estimates only as they assume that the shape of the habitat pools is rectangular.

The estimated water requirements and costs for each site are listed in the table below (Table 2).

<table>
<thead>
<tr>
<th>Site</th>
<th>Water requirement to fill pool from 30cm to 1m depth (L)</th>
<th>Approximate number of trucks required</th>
<th>Approximate total cost(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gosling Creek at Division Rd</td>
<td>333,000</td>
<td>12</td>
<td>$3,840</td>
</tr>
<tr>
<td>Thompson Ck at Pettavel Rd</td>
<td>238,000</td>
<td>9</td>
<td>$2,331 + GST</td>
</tr>
<tr>
<td>Thompson Ck at Nobles Rd</td>
<td>49,000</td>
<td>2</td>
<td>$518 + GST</td>
</tr>
<tr>
<td>Waurn Ponds Ck at the Surf Coast Hwy</td>
<td>46,000</td>
<td>2</td>
<td>$518 + GST</td>
</tr>
</tbody>
</table>

*Table 2: Estimated water requirements for each site (L) to restore water levels to one meter depth in the event of a habitat pool drying out (based on quotes provided in table 4)*

In the event of trigger levels being met, initially one truck load holding 27,000L (28,000L for Gossling Creek) will be delivered to the site. Monitoring will be carried out following the delivery of water to determine the impacts of water delivery. Additional deliveries will be made as required.

\(^4\) Costs current in 2010 (quotes from Drews Haulage Geelong and Eldridge Water Sales and Cartage Colac, refer to table 4).
**Contractors**

The relevant contractors for sandbagging and delivery of water at each of the priority sites are listed in the table below (Table 3).

<table>
<thead>
<tr>
<th>Monitoring Sites</th>
<th>Sandbagging</th>
<th>Delivery of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gosling Creek Site</td>
<td>State of Emergency Services</td>
<td>Eldridge Water Sales and Cartage Colac</td>
</tr>
<tr>
<td></td>
<td>South West Region</td>
<td>Ph: 0418 523 432</td>
</tr>
<tr>
<td></td>
<td>Geelong</td>
<td>03 52 348 345</td>
</tr>
<tr>
<td></td>
<td>Ph: 52 264 771</td>
<td></td>
</tr>
<tr>
<td>Thompson Creek and Waurn Ponds Creek Sites</td>
<td>(SES will provide sandbags, CCMA to supply sand)</td>
<td>Drews Haulage Geelong Ph: 0408 522 296</td>
</tr>
</tbody>
</table>

*Table 3: Contractors for sandbagging and delivery of water*

**Costs and Water Quality**

The costs of sandbagging and delivering water to each of the sites using the relevant contractors as well as the source and quality of water to be used are listed in the table below (Table 4). As stated above, the semi truck will be the most likely to be used due to the volumes of water required.

<table>
<thead>
<tr>
<th>Monitoring Site</th>
<th>Contractor</th>
<th>Quote (prices include water and cartage)</th>
<th>Source of water</th>
<th>Water Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gosling Creek Site</td>
<td>Eldridge Water Sales and Cartage Colac</td>
<td>27,000 L semi = $320 per load</td>
<td>Bore water</td>
<td>EC = 1800 µS/cm</td>
</tr>
<tr>
<td></td>
<td>State of Emergency Services</td>
<td>14,000 L Tray = $220</td>
<td></td>
<td>pH = 7.8</td>
</tr>
<tr>
<td></td>
<td>(Sandbagging)</td>
<td></td>
<td></td>
<td>Dissolved solids = 930 mg/L</td>
</tr>
<tr>
<td></td>
<td>SES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potential donation to SES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thompson Creek 2 Sites</td>
<td>Drews Haulage Geelong</td>
<td>28,000 L semi = $325 + GST per load</td>
<td>Barwon Water hydrant</td>
<td>Potable water as per Barwon Water legislations and regulations</td>
</tr>
<tr>
<td></td>
<td>13,000 L Water cart = $259 + GST per load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SES (Sandbagging)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potential donation to SES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waurn Ponds Creek Site</td>
<td>Drews Haulage Geelong</td>
<td>28,000 L semi = $270 + GST per load</td>
<td>Barwon Water hydrant</td>
<td>Potable water as per Barwon Water legislations and regulations (un-chlorinated)</td>
</tr>
<tr>
<td></td>
<td>13,000 L Water cart = $214 + GST per load</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SES (Sandbagging)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Potential donation to SES</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 4: Costs of sandbagging and water delivery and water source and quality*

While the water supplied by Barwon Water for the Waurn Ponds Creek and Thompson Creek sites is not chlorinated, the bore water to be used for the Gosling Creek site will need to be aerated and oxygenated while being delivered to the habitat pool because it is likely to have low oxygen content.
Traffic Management

All of the sites selected for emergency response works are easily accessible and have sufficient space for truck parking. The contractors will not completely block a road at any time without a permit. Should it be necessary to block a road in order to deliver water to any of the emergency sites, the Corangamite CMA will act responsibly and ensure that appropriate measures are pursued to obtain a permit.

Timelines

It is important to note that the water carting contractors will require one days notice in the event of water delivery to a site being required. State of Emergency Services (SES) volunteers may require 1-2 weeks notice and their availability may vary depending on other emergency situations.
Approvals Required

Requirements for the following approvals have been investigated:

- Land holder/manager permissions: Di Luscombe from the Environment and Natural Resource Unit at the City of Greater Geelong (CoGG) has been contacted with regards to the Waurn Ponds Creek Site to gain permission to access the site (see Appendix B for contact details).
- The Gosling Creek site occurs on private land. The landowner has been contacted to gain in principle permission to carry out works at the site if required (see Appendix B for contact details).
- The two sites on Thompsons Creek and the Waurn Ponds Creek site occur on unleased crown river frontage land. The Department of Sustainability and Environment has been contacted to gain approval for the proposed works (see appendix C for zoning maps).
- The Colac-Otway Shire and the Surf Coast Shire will need to be contacted if roads need to be obstructed at the Gosling Creek and Pettavel Road sites.
- Southern Rural Water has been notified of the proposed works.
- The Victorian Environment Protection Authority has been notified of the proposed works and approval is not required (refer to communications in the project file). Tony Robinson, the Manager of Statutory Facilitation was contacted in order to ascertain whether or not EPA approval would be required for emergency works to proceed. EPA approval is not required for these works to proceed as they are not at a scheduled premises, however the Corangamite CMA must ensure that reasonable care is taken
- A Works on Waterways Permit is not required because the Corangamite CMA is exempt
- Local Government Planning Permits are not required as sites are all on public land
- A referral to the Minister under the EPBC Act is not required. According to the Act, the onus lies with the proponent to decide whether an action requires referral. While the proposed actions may impact matters of national significance (threatened species), they are unlikely to have a significant impact. The Biodiversity Team and the River Health Operations Team within the Corangamite CMA were consulted before a decision was made that a referral would not need to be made. Because the proposed actions aim to enhance and preserve environmental values, it is not considered to be a controlled action; therefore a referral does not need to be made.
**Action Protocol**

In the event of trigger levels being met at any of the priority sites, the following actions must be taken immediately to protect the threatened fish species:

1. Trigger levels are met
2. Project manager uses the decision support tool to determine supporting information to take to the panel
3. Panel is consulted with and a decision is made whether or not to act and what action to take, based on site specific and environmental conditions
4. Contact Contractors to order trucks and water delivery and/or sandbags (Appendix B)
5. Contact DSE and land managers (CoGG for Waurn Ponds Creek site or Peter Gannon for Gosling Creek site) to inform them that works will be carried out (Appendix B)
6. Implement emergency response actions. Corangamite CMA staff must be onsite when delivering water to ensure velocity dispersal measures are implemented, filtering and aeration of water is carried out, and hygiene practices are followed
7. Follow appropriate measures for traffic management (if closure of road is necessary a permit must be obtained)
8. If sandbagging is required, put up a sign to let the public know why they are there
9. Monitor effectiveness of actions (before, during and after the event)
10. Determine whether additional water delivery is required, if necessary continue water delivery
11. Media release to inform public
12. Report and evaluate results
13. Reassess and modify action plan if necessary.
Implications

The table below outlines both the potential positives and negatives of not acting when habitat pools reach trigger levels or dry out and the potential positives and negatives of implementing emergency response works. The final column outlines some of the factors that need to be considered when implementing emergency response actions (table 5).

<table>
<thead>
<tr>
<th>Potential Impacts of No Action</th>
<th>Potential Impacts of Actions</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positives</td>
<td>Negatives</td>
<td>Positives</td>
</tr>
<tr>
<td>1. Allows the system to remain undisturbed</td>
<td>2. Less cost</td>
<td>Prevent pool from drying out</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevent fish kills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increase in the depth of pool and available habitat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beneficial for the overall river system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevent community outcry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disturbance to natural environment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inhibition of natural groundwater interaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential translocation of exotic species or diseases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential losses due to evaporation or stealing of water</td>
</tr>
</tbody>
</table>

Table 5: Positives and Negatives of no action and of acting on emergency response works and some considerations that need to be made
Biodiversity Risk Assessment

The Corangamite CMA Biodiversity Protocol for On-Ground Works (OP 203.1) outlines measures that must be taken to avoid or minimise impacts to biodiversity when planning and undertaking on-ground works for natural resource management, environmental or catchment health improvement or protection works. On-ground works should not negatively impact on the environment. There will be some situations where some impact must occur to produce a net benefit. This protocol will be followed to ensure that negative impacts are avoided, or at worst, minimised and managed to a satisfactory level. In order to meet the requirements of the biodiversity risk protocol, the following steps have been taken:

1. Aerial photographs of the sites and surrounding landscape have been inspected (figures 10, 11 and 12), all of the sites have been visited, photographed and observations made on the biodiversity values present (Appendix C), those species most likely to be affected were included in the biodiversity risk assessment.
2. The Environment Protection and Biodiversity Conservation (EPBC) Act 1999 interactive map was used to search for EPBC listed species and ecological communities (Appendix D), those species most likely to be affected were included in the biodiversity risk assessment.
3. The FAST (Fish Assessment Support Tool) did not need to be used because a fish survey had already been conducted to identify the threatened fish at each of the sites.
4. No native vegetation will need to be cleared or damaged at any of the sites.
5. The site on Waurn Ponds Creek is located within a Public Conservation and Resource Zone and all other sites are located within a Farm Zone. There are no overlay provisions that apply to any of the sites.
6. The DSE biodiversity interactive map was used to identify vegetation and threatened species that may be affected (Appendix E), those species most likely to be affected were included in the biodiversity risk assessment.
7. No additional species/communities were found on the knowledge base.
8. The Biodiversity Risk Assessment was completed and Corangamite CMA biodiversity staff was consulted to ensure that important species and communities found at the sites were not likely to be impacted by the proposed actions.
9. No additional species/communities were found on the list of species and communities of flora and fauna listed under the Flora and Fauna Guarantee Act 1988.
10. None of the sites are significant wetlands but are within the same catchment as the Port Phillip Bay (Western Shoreline) and Bellarine and the Western District Lakes wetlands, however all of the priority sites are located a long way from these wetlands (Appendix F).
11. A field survey has already been conducted.
12. For each of the important species/communities that could potentially occur at the proposed sites, the FFG Act’s list of potentially threatening processes and the Flora and Fauna Action Statements were consulted to assess whether the intended works will have a significant impact on the species’ life cycles and habitat needs (Appendix G).
13. Activities to avoid biodiversity risks were identified.
14. The risks involved in the proposed actions were assessed in the Biodiversity Risk Assessment and the assessment was approved by the Sub-Program Manager and Program Manager.
15. Further measures to avoid these risks were identified.
16. Statutory approval from EPA is not required (refer to approvals).
17. If risks are too great measures may need to be adapted or works will be ceased. Contractors must be supervised for adherence to required work procedures.
1. Site Investigation – Are important species or ecological communities present? If so, which?

**Important species present at the proposed sites include:** *Litoria raniformis* (Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog), *Galaxiella pusilla* (Eastern Dwarf Galaxias, Dwarf Galaxias), *Nannoperca obscura* (Yarra Pygmy Perch), *Prototroctes maraena* (Australian Grayling), *Ardea alba* (Great Egret, White Egret), *Ardea ibis* (Cattle Egret), *Gallinago hardwickii* (Latham’s Snipe, Japanese Snipe), *Rostratula benghalensis s. lat.* (Painted Snipe), *Stictonetta naevosa* (Freckled Duck), *Aythya australis* (White-eyed/Hardhead Duck), *Eucalyptus yarraensis* (Yarra Gum)

**Ecological Communities:** Swampy Riparian Woodland, Riparian Forrest, Swamp Scrub

2. Risk Assessment – What are the biodiversity risks associated with the proposed actions? (Refer to risk matrix reference tables (Appendix I))

<table>
<thead>
<tr>
<th>Risk description</th>
<th>Scenario</th>
<th>Existing Mitigation</th>
<th>Likelihood</th>
<th>Consequences</th>
<th>Initial Risk</th>
<th>Further Actions to Reduce Risks</th>
<th>Residual Risk: Likelihood</th>
<th>Residual Risk: Consequence</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical disturbance to other organisms</td>
<td>Benthic organisms may be impacted by sandbagging</td>
<td>Important species that potentially occur at sites have been identified</td>
<td>B</td>
<td>3</td>
<td>H</td>
<td>Communicate with contractors and supervise works</td>
<td>C</td>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>Inhibition of natural groundwater interaction</td>
<td>Plastic lining for sandbags may be placed on bottom of pool</td>
<td>Plastic lining need only cover sandbags</td>
<td>C</td>
<td>3</td>
<td>H</td>
<td>Communicate with contractors and supervise works</td>
<td>D</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Translocation of exotic species and/or diseases</td>
<td>Delivery of water to habitat pools may result in inadvertent translocation of exotic species and/or diseases</td>
<td>Water to be used is of suitable quality and EPA approval has been sought. Bore water and town water is to be used and is therefore unlikely to carry exotic species or pathogens</td>
<td>C</td>
<td>5</td>
<td>E</td>
<td>Filter water and adhere to hygiene practices <em>(Keeping it Clean, Allan K. &amp; Gartenstein S., 2010)</em></td>
<td>D</td>
<td>4</td>
<td>H</td>
</tr>
<tr>
<td>Risk description</td>
<td>Scenario</td>
<td>Existing Mitigation</td>
<td>Likelihood</td>
<td>Consequences</td>
<td>Initial Risk</td>
<td>Actions to Reduce Risks</td>
<td>Residual Risk: Likelihood</td>
<td>Residual Risk: Consequence</td>
<td>Residual Risk Category</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>------------</td>
<td>--------------</td>
<td>-------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Alteration to the natural flow regimes of rivers and streams</td>
<td>Sandbags may inhibit natural flow</td>
<td>Sandbags are only to be in place when habitat pools are isolated and natural flow is already not occurring</td>
<td>E</td>
<td>3</td>
<td>M</td>
<td>Remove sandbags if natural flow returns</td>
<td>D</td>
<td>3</td>
<td>M</td>
</tr>
<tr>
<td>Alteration to the natural temperature regimes of rivers and streams</td>
<td>Water delivered to pools may be of a different temperature to that in habitat pools and therefore alter the water quality of pools</td>
<td>Refrigerated trucks will not be used and the trucks will be travelling short distances only therefore the ambient temperatures of the trucks will be similar to that of the creeks</td>
<td>A</td>
<td>2</td>
<td>H</td>
<td>Monitor temperatures</td>
<td>D</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Degradation of riparian vegetation along rivers and streams</td>
<td>Vehicles may damage vegetation</td>
<td>All sites are accessible to trucks</td>
<td>C</td>
<td>3</td>
<td>H</td>
<td>Communicate with contractors, mark out important areas, supervise works, use a long hose to deliver water to prevent trampling of vegetation</td>
<td>C</td>
<td>2</td>
<td>M</td>
</tr>
<tr>
<td>Increase in sediment input into rivers and streams due to human activities</td>
<td>Potential for sandbags to burst. Trucks may add sediment to rivers if they drive to close or if water from hoses hits the pool at high pressure.</td>
<td>All sites are accessible to trucks and the trucks will be located away from the stream</td>
<td>B</td>
<td>3</td>
<td>H</td>
<td>Ensure that sand walls are strong and unlikely to be damaged, ensure maintenance works are carried out. Implement measures for velocity dispersal when delivering water to sites and use long hoses</td>
<td>C</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>Input of toxic substances into rivers and streams</td>
<td>Water delivered to pools may carry toxic substances</td>
<td>Water to be used is of suitable quality and EPA approval has been sought.</td>
<td>C</td>
<td>3</td>
<td>H</td>
<td>Ensure water quality of trucked water is appropriate and adhere to hygiene practices (Keeping it Clean, Allan K. &amp; Gartenstein S., 2010)</td>
<td>D</td>
<td>3</td>
<td>M</td>
</tr>
<tr>
<td>Risk description</td>
<td>Scenario</td>
<td>Existing Mitigation</td>
<td>Likelihood</td>
<td>Consequences</td>
<td>Initial Risk</td>
<td>Actions to Reduce Risks</td>
<td>Residual Risk: Likelihood</td>
<td>Residual Risk: Consequence</td>
<td>Residual Risk Category</td>
</tr>
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<td>-------------------------</td>
</tr>
<tr>
<td>Prevention of passage of aquatic biota</td>
<td>Presence of in-stream structures/sandbags may inhibit the passage of aquatic biota</td>
<td>Sandbags are only to be in place when habitat pools are isolated and natural flow is already not occurring</td>
<td>E</td>
<td>2</td>
<td>L</td>
<td>Remove sandbags if natural flow returns</td>
<td>D</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Translocation of weeds</td>
<td>Delivery of water to habitat pools may result in inadvertent translocation of exotic species and/or diseases</td>
<td>Hygiene practices will be implemented</td>
<td>C</td>
<td>3</td>
<td>H</td>
<td>Adhere to hygiene practices (Keeping it Clean, Allan K. &amp; Gartenstein S., 2010), ensure equipment and trucks are cleaned before arriving at site</td>
<td>D</td>
<td>3</td>
<td>M</td>
</tr>
<tr>
<td>Noise</td>
<td>In built up areas noise from trucks may become an issue</td>
<td>Delivery of water will only occur during business hours</td>
<td>D</td>
<td>2</td>
<td>L</td>
<td>If it is an issue potentially issue a notice to local residents</td>
<td>D</td>
<td>2</td>
<td>L</td>
</tr>
<tr>
<td>Dust</td>
<td>Dust may be created by trucks travelling along gravel road, potentially disturbing nesting birds etc</td>
<td>Trucks will not be making multiple trips and only one truck will be used at a time</td>
<td>D</td>
<td>1</td>
<td>L</td>
<td>Ensure only one truck is used at a time</td>
<td>D</td>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>Fire</td>
<td>Potential for contractors to start a fire from truck exhausts etc which may harm the environment</td>
<td>Works will not be carried out on days of total fire ban</td>
<td>C</td>
<td>3</td>
<td>H</td>
<td>Ensure vehicles are diesel engines and carry fire fighting equipment</td>
<td>D</td>
<td>2</td>
<td>L</td>
</tr>
</tbody>
</table>
## 3. Approvals

<table>
<thead>
<tr>
<th>Sub-Program Manager:</th>
<th>If Initial Risk = M (or higher): SPM – Biodiversity:</th>
<th>If Initial Risk = H: Program Manager:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td>Name:</td>
<td>Name:</td>
</tr>
<tr>
<td>Date:</td>
<td>Date:</td>
<td>Date:</td>
</tr>
</tbody>
</table>
Rationale

In order to meet the requirements of the biodiversity risk protocol, the advised steps were carried out; however some discretion had to be used in order to compile the species lists for each site. The Environment Protection and Biodiversity Conservation (EPBC) Act 1999 interactive map was used to search for EPBC listed species and ecological communities (Appendix D), however this tool provides very broad information and therefore only those species likely to be impacted by the proposed works were included in the risk assessment (aquatic organisms and wading birds). The FFG Act’s list of potentially threatening processes was consulted to determine whether the intended works will have a significant impact on any important species’ life cycles and habitat needs. Only those threatening processes that could potentially result from the proposed works were included in the risk assessment.

Key Findings of the Biodiversity Risk Assessment

In summary, the key risks of the proposed works identified in the risk assessment are:

- Potential disturbance to other organisms;
- Potential for the translocation of exotic species and diseases;
- Potential for increased sediment in rivers;

In carrying out the risk assessment the proposed actions have not been changed but it has highlighted a number of important considerations that will need to be made. These include:

- Communicating with contractors to ensure that appropriate care is taken and supervising the works carried out by contractors.
- Ensure hygiene practices are adhered to by Corangamite CMA staff conducting monitoring of sites and by contractors. Corangamite CMA staff will need to be on site when actions are being carried out to ensure that appropriate measures are taken to reduce risks.
- Implement velocity dispersal measures when delivering water to sites (lay tarpaulin on river bank, deliver water on to the tarpaulin and allow it to flow into the pool).
- It may also be necessary to employ fish experts to determine whether the fish remain in the habitat pool after emergency works have been carried out in order for appropriate reporting and evaluation to be carried out and to determine the effectiveness of the emergency works.
General Risk Assessment

A Safe Work Method Statement for the Corangamite CMA has been completed for the emergency response works and for the monitoring (see appendix I).

Prior to works commencing the Corangamite CMA must obtain a Safe Work Method Statement from the relevant contractors, accept and sign off, and issue work authority if required.

Key Findings of the Corangamite CMA Safe Work Method Statement

In summary, the key risks of the proposed works identified in the Corangamite CMA’s Safe Work Method Statement are:

- Risks associated with manual handling
- Risks associated with extreme weather conditions (fire etc)
- Risks associated with driving to and from sites
- General risks to health and well being associated with field work
- Risks associated with obstruction of roadways by delivery trucks.

Measures that will be implemented to mitigate these risks include:

- Ensure that Corangamite CMA staff and contractors follow safe manual handling procedures.
- Check weather forecasts before going out into the field or sending contractors out into the field, don’t go out in the field or send contractors out on days of total fire ban.
- Ensure that all staff/contractors are appropriately licensed to drive and have completed driver training.
- Ensure all vehicles carry a first aid kit, snake bite kits and fire blankets. Ensure Corangamite CMA staff carries a mobile phone with them in the field, ensure Corangamite CMA staff wear appropriate clothing, gaiters, insect repellent and sunscreen and take water with them into the field.
- Ensure that trucks do not obstruct roads and if required obtain a permit to close roads
- Safe Work Method Statement to be completed by contractors
- Only diesel engines should be used and fire fighting equipment should be to be taken in the field. Works should not be carried out on days of total fire ban.
References

Allan K. & Gartenstein S., 2010, Keeping it Clean Keeping it Clean, A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens, NRM South


CCMA, 2010, Significant Fish Species: Action Plan for Protection Under Dry Inflow Conditions, management plan for HERO project


Frame J., 2010, Email: Drought refuge response action info – sandbags, Joanna Frame, Aquatic Scientist, River Health Team, Waterways Group, Melbourne Water


McKinnon L. and Ryan T., 2008, Assessment of Yarra Pygmy Perch and Other Fish Species in Thomsons Creek, Prepared for Jayden Woolley, Corangamite CMA, Colac

Melbourne Water, 6 July 2009, Melbourne Water Memo: expenditure on short-term drought response actions, Joanna Frame

Melbourne Water, 2008/09, Drought Action Plan, Port Phillip and Western Port Region, Version 2


Internet Resources:


The Stormwater Manager’s Resource Centre (SMRC), retrieved 18th January 2010 <www.stormwatercenter.net/.../Restoration/flow_deflection.htm>


## Appendix A: Key risks for each species at each location

### **Australian Grayling**

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Map and Coordinates</th>
<th>Population structure (A) [0-10]</th>
<th>Location Values (B) [0-10]</th>
<th>Total Score (A+B)</th>
<th>Additional Values</th>
<th>Prioritised Key Threats</th>
<th>Impact (C) [0-8]</th>
<th>Severity (D) [0-8]</th>
<th>Total score (2x3)</th>
<th>Consequences of no action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barwon R.</td>
<td>7721</td>
<td>9</td>
<td>9</td>
<td>18</td>
<td>Excellent population, recruitment documented</td>
<td>Loss of seasonal flows</td>
<td>8</td>
<td>7</td>
<td>56</td>
<td>Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Water quality may reach critical trigger levels – fish kills or loss of fish from certain areas. Inability to migrate may result in reduced population abundance and resilience. Restricted movement will prevent access to preferred habitats for breeding and feeding.</td>
</tr>
<tr>
<td>Barham R.</td>
<td>7620</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>Estuary mouth openings less frequent due to low flow</td>
<td>Reduced water quality (DO)</td>
<td>6</td>
<td>6</td>
<td>36</td>
<td>Loss of fish species if estuary mouth is not open at critical times. Water quality may reach critical trigger levels – fish kills or loss of fish from certain areas. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Inability to migrate may result in reduced population abundance and resilience.</td>
</tr>
<tr>
<td>Gellibrand R.</td>
<td>7620</td>
<td>Unknown: absence of reliable data</td>
<td>Large system</td>
<td></td>
<td>Estuary mouth openings less frequent due to low flow</td>
<td>Reduced water quality (DO)</td>
<td>6</td>
<td>6</td>
<td>36</td>
<td>Loss of fish species if estuary mouth is not open at critical times. Water quality may reach critical trigger levels – fish kills or loss of fish from certain areas. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Inability to migrate may result in reduced population abundance and resilience.</td>
</tr>
<tr>
<td>Aire River</td>
<td>7520</td>
<td>Unknown: absence of reliable data</td>
<td>Large system</td>
<td></td>
<td>Estuary mouth openings less frequent due to low flow</td>
<td>Reduced water quality (DO)</td>
<td>6</td>
<td>7</td>
<td>42</td>
<td>Loss of fish species if estuary mouth is not open at critical times. Water quality may reach critical trigger levels – fish kills or loss of fish from certain areas. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation.</td>
</tr>
</tbody>
</table>

**Note:** Total score (2x3) indicates the combined impact and severity scores for each key threat.
## Dwarf Galaxias

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Map and Coordinates</th>
<th>Population structure (A) (0-10)</th>
<th>Location Values (B) (0-10)</th>
<th>Total Score (A+B)</th>
<th>Additional Values</th>
<th>Prioritised Key Threats</th>
<th>Impact (C) (0-8)</th>
<th>Severity (D) (0-8)</th>
<th>Total score (2x3)</th>
<th>Consequences of no action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barwon R. (Barwon Downs)</td>
<td>7621 7391/5735</td>
<td>7.5</td>
<td>10</td>
<td>17.5</td>
<td>YPP also present</td>
<td>Loss wetlands</td>
<td>8</td>
<td>8</td>
<td>64</td>
<td>Amount of habitat available will decline. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Water quality may reach critical trigger levels – fish kills or loss of fish from certain areas. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Gosling Ck.</td>
<td>7621 7458/57416</td>
<td>7.5</td>
<td>10</td>
<td>17.5</td>
<td></td>
<td>Loss wetlands</td>
<td>8</td>
<td>8</td>
<td>64</td>
<td>Amount of habitat available will decline. Water quality may reach critical trigger levels – fish kills or loss of fish from certain areas. Toxic blue-green algal blooms = fish kills. Surface water levels will decline if water table levels continue to decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation</td>
</tr>
</tbody>
</table>

## Australian Mudfish

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Map and Coordinates</th>
<th>Population structure (A) (0-10)</th>
<th>Location Values (B) (0-10)</th>
<th>Total Score (A+B)</th>
<th>Additional Values</th>
<th>Prioritised Key Threats</th>
<th>Impact (C) (0-8)</th>
<th>Severity (D) (0-8)</th>
<th>Total score (2x3)</th>
<th>Consequences of no action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aire Valley (combined sites)</td>
<td>7520 7147/57063</td>
<td>9</td>
<td>8</td>
<td>17</td>
<td>Heritage River, Australian Grayling also present.</td>
<td>Loss of wetlands</td>
<td>8</td>
<td>5</td>
<td>40</td>
<td>Amount of habitat available will decline. Loss of fish species if estuary mouth is not open at critical times. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Surface water levels will decline if water table levels continue to decline. Loss of spawning triggers (seasonal flows) resulting in reduced numbers.</td>
</tr>
<tr>
<td>Barwon R. (Belmont Common)</td>
<td>7721 2686/57718</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td></td>
<td>Loss of wetlands</td>
<td>8</td>
<td>7</td>
<td>56</td>
<td>Amount of habitat available will decline. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Inability to migrate may result in reduced population abundance and resilience. Restricted movement will prevent access to preferred habitats for breeding and feeding.</td>
</tr>
<tr>
<td>Waterbody</td>
<td>Map and Coordinates</td>
<td>Population structure (A) (0-10)</td>
<td>Location Values (B) (0-10)</td>
<td>Total Score (A+B)</td>
<td>Additional Values</td>
<td>Prioritised Key Threats</td>
<td>Impact (C) (0-8)</td>
<td>Severity (D) (0-8)</td>
<td>Total score (2x3)</td>
<td>Consequences of no action</td>
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</tr>
<tr>
<td>Calder R.</td>
<td>7620 7178/57056</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>Australian Grayling present</td>
<td>Loss of wetlands</td>
<td>8</td>
<td>8</td>
<td>64</td>
<td>Amount of habitat available will decline. Loss of fish species if estuary mouth is not open at critical times. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Wye R.</td>
<td>7620 7514/57196</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>Australian Grayling present</td>
<td>Australian Grayling present</td>
<td>Estuary mouth openings less frequent due to low flow</td>
<td>8</td>
<td>8</td>
<td>64</td>
</tr>
<tr>
<td>Yarra Pygmy Perch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Loss of wetlands</td>
<td>8</td>
<td>6</td>
<td>48</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Curdies R.</td>
<td>7421 6706/57425</td>
<td>8</td>
<td>8</td>
<td>16</td>
<td>High rainfall area</td>
<td>Loss of wetlands</td>
<td>8</td>
<td>6</td>
<td>48</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Sutherland Ck</td>
<td>7721 2582/57886</td>
<td>6</td>
<td>10</td>
<td>16</td>
<td>Low flow habitat changes</td>
<td>Loss of wetlands</td>
<td>8</td>
<td>6</td>
<td>48</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Waterbody</td>
<td>Map and Coordinates</td>
<td>Population structure (A) (0-10)</td>
<td>Location Values (B) (0-10)</td>
<td>Total Score (A+B)</td>
<td>Additional Values</td>
<td>Prioritised Key Threats</td>
<td>Impact (C) (0-8)</td>
<td>Severity (D) (0-8)</td>
<td>Total score (2x3)</td>
<td>Consequences of no action</td>
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<tr>
<td>Woady Yallock Ck at Cressy</td>
<td>7621 7307/57883</td>
<td>6</td>
<td>10</td>
<td>16</td>
<td></td>
<td>Loss of wetlands</td>
<td>8</td>
<td>7</td>
<td>56</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Thompson Ck. At Rice's Reserve (Horseshoe bend)</td>
<td>7721 2682/57608</td>
<td>9</td>
<td>5</td>
<td>14</td>
<td></td>
<td>Low flow habitat changes</td>
<td>7</td>
<td>7</td>
<td>49</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Pennyroyal Ck. – Upper Barwon at Railway crossing</td>
<td>7621 7495/57449</td>
<td>9</td>
<td>5</td>
<td>14</td>
<td></td>
<td>Low flow habitat changes</td>
<td>7</td>
<td>8</td>
<td>56</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Thompson Ck – Pettavel Rd</td>
<td>7721 2585/57613</td>
<td>9</td>
<td>5</td>
<td>14</td>
<td></td>
<td>Low flow habitat changes</td>
<td>7</td>
<td>7</td>
<td>49</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience. Surface water levels will decline if water table levels continue to decline.</td>
</tr>
<tr>
<td>Waterbody</td>
<td>Map and Coordinates</td>
<td>Population structure (A) (0-10)</td>
<td>Location Values (B) (0-10)</td>
<td>Total Score (A+B)</td>
<td>Additional Values</td>
<td>Prioritised Key Threats</td>
<td>Impact (C) (0-8)</td>
<td>Severity (D) (0-8)</td>
<td>Total score (A+B)</td>
<td>Consequences of no action</td>
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</tr>
<tr>
<td>Waurn Ponds Ck – Bailey St to Pioneer Rd Grovedale</td>
<td>7721 2683/57701 to 7721 2656/57687</td>
<td>8</td>
<td>5</td>
<td>13</td>
<td></td>
<td>Loss of wetlands</td>
<td>8</td>
<td>7</td>
<td>56</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Low flow habitat changes</td>
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<td>Reduced flooding</td>
<td>6</td>
<td>7</td>
<td>42</td>
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<td></td>
<td></td>
<td></td>
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<td>Habitat fragmentation</td>
<td>5</td>
<td>7</td>
<td>35</td>
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</tr>
<tr>
<td>Barwon R. At Pollocksford</td>
<td>7721 2535/57744</td>
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<td>5</td>
<td>13</td>
<td></td>
<td>Low flow habitat changes</td>
<td>7</td>
<td>7</td>
<td>49</td>
<td>Amount of habitat available will decline. Decline in habitat quality and availability, fish will be concentrated in remaining habitat, potentially resulting in increased competition and predation. Loss of spawning triggers (seasonal flows) resulting in reduced numbers. Riparian habitat degradation and reduced ecosystem resilience.</td>
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<td></td>
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<td></td>
<td></td>
<td>Loss seasonal flow</td>
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<td></td>
<td>Loss wetlands</td>
<td>8</td>
<td>6</td>
<td>48</td>
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<td></td>
<td>Reduced flooding</td>
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<td>Habitat fragmentation</td>
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</tr>
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<td></td>
<td></td>
<td>Reduced water table levels</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>Surface water levels will decline if water table levels continue to decline.</td>
</tr>
</tbody>
</table>
# Appendix B: Emergency Contacts

<table>
<thead>
<tr>
<th><strong>City of Greater Geelong</strong></th>
<th><strong>Southern Rural Water</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Di Luscombe</td>
<td>Angus Ramsay</td>
</tr>
<tr>
<td>Environment and natural resource unit</td>
<td>P: 5564 1713</td>
</tr>
<tr>
<td>PO box 104 Geelong 3220</td>
<td><a href="mailto:angusr@srw.com.au">angusr@srw.com.au</a></td>
</tr>
<tr>
<td><a href="mailto:diluscombe@geelongcity.vic.gov.au">diluscombe@geelongcity.vic.gov.au</a></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Peter Gannon</strong></th>
<th><strong>Surf Coast Shire</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Landowner at Gosling Creek site</td>
<td>Leanne Rolfe Environment Officer</td>
</tr>
<tr>
<td>Ph: 5236 3333 Mob: 0427 041 831</td>
<td><a href="mailto:LRolfe@surfcoast.vic.gov.au">LRolfe@surfcoast.vic.gov.au</a></td>
</tr>
<tr>
<td></td>
<td>Ph: 03 5261 0519 Mob: 0437 239 525</td>
</tr>
<tr>
<td></td>
<td>If road closure is necessary contact:</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:dleeson-rabie@surfcoast.vic.gov.au">dleeson-rabie@surfcoast.vic.gov.au</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Eldridge Water Sales and Cartage</strong></th>
<th><strong>Drews Haulage</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Colac</td>
<td>Geelong</td>
</tr>
<tr>
<td>Ph: 0418 523 432</td>
<td>Ph: 0408 522 296</td>
</tr>
<tr>
<td>03 52 348 345</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>State of Emergency Services</strong></th>
<th><strong>DSE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>South West Region Geelong</td>
<td>Otway District</td>
</tr>
<tr>
<td>Ph: 52 264 771</td>
<td>Andrew Morrow</td>
</tr>
<tr>
<td></td>
<td><a href="mailto:andrew.morrow@dse.vic.gov.au">andrew.morrow@dse.vic.gov.au</a></td>
</tr>
<tr>
<td></td>
<td>Ph: 5226 4694 Mob: 0419 589 793</td>
</tr>
</tbody>
</table>
Appendix C: Zoning Maps
Appendix D: EPBC Listed Species and Ecological Communities for each of the Monitoring Sites

<table>
<thead>
<tr>
<th>Site</th>
<th>Biodiversity</th>
<th>Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gosling Ck at Division Rd</td>
<td>Threatened Species: 12 Migratory Species: 13 Listed Marine Species: 11</td>
<td>Within same catchment as Port Phillip Bay (Western Shoreline) and Bellarine and the Western District Lakes wetlands.</td>
</tr>
<tr>
<td>Waurn Ponds Ck at Surf Coast Hwy</td>
<td>Threatened Species: 18 Migratory Species: 14 Listed Marine Species: 12</td>
<td>Within same catchment as Port Phillip Bay (Western Shoreline) and Bellarine and the Western District Lakes wetlands.</td>
</tr>
<tr>
<td>Thompsons Ck at Pettavel Rd</td>
<td>Threatened Species: 19 Migratory Species: 13 Listed Marine Species: 11</td>
<td>None</td>
</tr>
<tr>
<td>Thompsons Ck at Nobles Rd</td>
<td>Threatened Species: 16 Migratory Species: 13 Listed Marine Species: 11</td>
<td>None</td>
</tr>
</tbody>
</table>

**Gosling Creek at Division Road: 6 species likely to be affected;** *Litoria raniformis* (Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog), *Galaxiella pusilla* (Eastern Dwarf Galaxias, Dwarf Galaxias), *Ardea alba* (Great Egret, White Egret), *Ardea ibis* (Cattle Egret), *Gallinago hardwickii* (Latham’s Snipe, Japanese Snipe), *Rostratula benghalensis s. lat.* (Painted Snipe)

**Waurn Ponds Creek at Surf Coast Highway: 8 species likely to be affected;** *Litoria raniformis* (Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog), *Galaxiella pusilla* (Eastern Dwarf Galaxias, Dwarf Galaxias), *Nannoperca obscura* (Yarra Pygmy Perch), *Prototroctes maraena* (Australian Grayling), *Ardea alba* (Great Egret, White Egret), *Ardea ibis* (Cattle Egret), *Gallinago hardwickii* (Latham’s Snipe, Japanese Snipe), *Rostratula benghalensis s. lat.* (Painted Snipe)

**Thompsons Creek at Pettavel Rd: 7 species likely to be affected;** *Litoria raniformis* (Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog), *Galaxiella pusilla* (Eastern Dwarf Galaxias, Dwarf Galaxias), *Prototroctes maraena* (Australian Grayling), *Ardea alba* (Great Egret, White Egret), *Ardea ibis* (Cattle Egret), *Gallinago hardwickii* (Latham’s Snipe, Japanese Snipe), *Rostratula benghalensis s. lat.* (Painted Snipe)

**Thompson's Creek at Nobles Rd: 7 species likely to be affected;** *Litoria raniformis* (Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog), *Galaxiella pusilla* (Eastern Dwarf Galaxias, Dwarf Galaxias), *Prototroctes maraena* (Australian Grayling), *Ardea alba* (Great Egret, White Egret), *Ardea ibis* (Cattle Egret), *Gallinago hardwickii* (Latham’s Snipe, Japanese Snipe), *Rostratula benghalensis s. lat.* (Painted Snipe)
Appendix E: DSE Biodiversity Interactive Map; Vegetation and Threatened Species likely to be affected

Waurn Ponds Creek

- No threatened flora
- Threatened fauna: *Pteropus pilioccephalus* (Grey-headed flying fox)
- Vegetation classes: Swamppy Riparian Woodland

Thompson Creek at Nobles Rd

- Threatened flora: *Eucalyptus yarraensis* (Yarra Gum)
- Threatened fauna: *Stictonetta naevosa* (Freckled Duck), *Aythya australis* (White-eyed/Hardhead Duck)
- Vegetation classes: Swamppy Riparian Woodland

Thompson Creek at Pettavel Rd

- No threatened flora
- Threatened fauna: none
- Vegetation classes: Swamppy Riparian Woodland

Gosling Creek

- Threatened flora: *Senecio psilocarpus* (Swamp Fireweed)
- Threatened fauna: none
- Vegetation classes: Riparian Forrest, Swamp Scrub
Appendix F: Location of RAMSAR Wetlands in relation to priority sites

Department of Sustainability and Environment

Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar Site

Western District Lakes
Appendix G: Potential for works to impact important species and communities


- Alteration to the natural flow regimes of rivers and streams
- Alteration to the natural temperature regimes of rivers and streams
- Degradation of riparian vegetation along Victorian rivers and streams
- Increase in sediment input into Victorian rivers and streams due to human activities
- Input of toxic substances into Victorian rivers and streams
- Prevention of passage of aquatic biota as a result of the presence of in stream structures


Action Statements exist for the following species that potentially occur at the proposed sites:

*Nannoperca obscura (Yarra Pygmy Perch)*: prefer slow-flowing or still, shallow waters, cannot tolerate heavy sediment loads, alteration to the natural flow regimes of rivers and streams poses a threat to the species, threatened by predatory species

*Ardea alba (Great Egret, White Egret)*: alteration to natural flow regimes of rivers and streams poses a threat to the species, pollution and salinisation may destroy nest trees,

*Stictonetta naevosa (Freckled Duck)*: unlikely to be impacted by proposed actions
## Appendix H: Biodiversity Risk Matrix Reference Tables

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Negligible 1</th>
<th>Minor 2</th>
<th>Moderate 3</th>
<th>Major 4</th>
<th>Catastrophic 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (almost certain)</td>
<td>H</td>
<td>H</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>B (likely)</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>C (moderate)</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>D (unlikely)</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>E</td>
</tr>
<tr>
<td>E (rare)</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>


Legend:
- **E**: Extreme risk, immediate action required
- **H**: High risk, senior management attention needed
- **M**: Moderate risk, management responsibility must be specified
- **L**: Low risk, manage by routine procedures
<table>
<thead>
<tr>
<th><strong>Likelihood</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptor</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Almost Certain (A)</td>
<td>Is expected to occur in most circumstances (more than 85% chance of occurring within the specified time frame).</td>
</tr>
<tr>
<td>Likely (B)</td>
<td>Will probably occur in most circumstances (50 – 85% chance of occurring with the specified timeframe)</td>
</tr>
<tr>
<td>Possible (C)</td>
<td>Might occur at some time (21 – 49% chance of occurring within specified timeframe)</td>
</tr>
<tr>
<td>Unlikely (D)</td>
<td>Could occur at some time (1-20% chance of occurring within specified timeframe).</td>
</tr>
<tr>
<td>Rare (E)</td>
<td>May occur only in exceptional circumstances (less than 1% chance of occurring within specified time frame)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Consequence</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptor</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Extreme (5)</td>
<td>Major ecological kill (economic/social/cultural incident), long-term or permanent disruption of ecological (economic/social/cultural) processes, extreme ecological (economic/social/cultural) change.</td>
</tr>
<tr>
<td>Major (4)</td>
<td>Likelihood of long-term major ecological (economic/social/cultural) change.</td>
</tr>
<tr>
<td>Moderate (3)</td>
<td>Temporary ecological (economic/social/cultural) impact extending beyond originating disturbance, some local or short term ecologically (economically/socially/culturally) important consequences.</td>
</tr>
<tr>
<td>Minor (2)</td>
<td>Temporary and non serious ecological (economic/social/cultural) impact.</td>
</tr>
<tr>
<td>Negligible (1)</td>
<td>No serious ecological (economic/social/cultural) impact.</td>
</tr>
</tbody>
</table>
## Appendix I: CCMA Safe Work Method Statement

### Corangamite CMA
Safe Work Method Statement

<table>
<thead>
<tr>
<th><strong>JOB TITLE</strong></th>
<th><strong>Out of Office – Field Work</strong></th>
<th><strong>Date</strong> 30/11/2010</th>
<th><strong>SWMS Reference No 1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Site / Location</td>
<td>Thompsons Creek (Pettavel Rd and Horseshoe Bend Rd), Waurn Ponds Creek (Surf Coast Hwy) and Gosling Creek (Division Rd)</td>
<td>Is there a previous SWMS? No</td>
<td>If Yes, SWMS Reference:</td>
</tr>
<tr>
<td>Is there a previous SWMS?</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review Date:</td>
<td></td>
<td>Review Number:</td>
<td></td>
</tr>
<tr>
<td>Reviewed by Manager</td>
<td>Manager’s Name: Jayden Woolley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewed OHS Coordinator</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Description of the Job:
Conducting water quality monitoring

#### List Items of Plant, tools and equipment required:
- Mobile phone, snakebite first aid kit, vehicle with first aid kit and fire blanket, water quality monitoring probes, camera

#### Staff skills / competencies required for safe job performance:
- Training in conducting water quality monitoring

#### Accredited Operators:

---

### Safe Work Procedures

All staff must read and understand safe work procedures applicable to their work. These are available from your OHS Coordinator.

### List PPEs Required (circle required PPE)
- Appropriate footwear, sunscreen, wide brim hat, gaiters
- Other:
<table>
<thead>
<tr>
<th>PROCESS STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>RISKS</th>
<th>RISK RATING</th>
<th>RISK CONTROL PROCESS MEASURES</th>
<th>RESIDUAL RISK</th>
<th>RESPONSIBLE PERSONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>List the steps required to perform the job in the sequence they are carried out.</td>
<td>Against each job list the hazards that could cause injury</td>
<td>For each hazard identified describe the risk(s) that may be present. (What are the risks and what could go wrong?)</td>
<td>1 – HIGH 6 - LOW</td>
<td>Describe the preferred Risk Control measures. Apply the Hierarchy of Control measures; Elimination, Substitution, Engineering &amp; Administration controls, PPE</td>
<td>What is risk rating after controls are put in place</td>
<td></td>
</tr>
<tr>
<td>1. Preparation Loading and unloading of vehicle</td>
<td>Manual handling</td>
<td>• Strains and sprains, cuts or bruises caused by handling gates, often with rusty wires which may lead to infection</td>
<td>4</td>
<td>• Use your knees when lifting  • Only handle loads within your capacity  • Seek assistance if required  • Use team handling  • Handle with care  • Update tetanus vaccination  • Bend your knees when lifting  • Use team handling  • Use gloves if handling items that are potential cut hazards or slippery or hand to handle</td>
<td>5</td>
<td>Project Officer</td>
</tr>
<tr>
<td></td>
<td>Slips, trips, falls</td>
<td>• Strains, sprains, bruises, fractures</td>
<td>4</td>
<td>• Keep parking environment clear of any obstacles  • Avoid obstacles while walking  • Consult landowner to identify any on-site hazards, e.g. dangerous chemicals, aggressive animals hazardous areas (mines / extremely rough grounds / surfaces / cliffs, etc)</td>
<td>5</td>
<td>Project Officer</td>
</tr>
<tr>
<td></td>
<td>Traffic conditions/management</td>
<td>• Strains, sprains, bruises,  • Fractures  • Disability</td>
<td>3</td>
<td>• Obey traffic rules when walking to parked vehicle and loading equipment  • Position vehicles for loading in a safe area or zone away from other potential traffic  • Wear safety vest or high visibility clothing if loading in a traffic area</td>
<td>5</td>
<td>Project Officer</td>
</tr>
<tr>
<td>PROCESS STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>RISKS</td>
<td>RISK RATING</td>
<td>RISK CONTROL PROCESS MEASURES</td>
<td>RESIDUAL RISK</td>
<td>RESPONSIBLE PERSONS</td>
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</tr>
</tbody>
</table>
| 2. Driving to and from sites | Plant & Equipment | • Vehicle malfunction, potentially leading to fatality | 4 | • Be familiar with the vehicle prior to leaving – braking, lights, fuel, etc.  
• Undertake a basic functionality and safety check prior to use of the vehicle.  
• Ensure first aid and safety kit is present and complete  
• Monthly mechanical check by vehicle park manager | 5 | Project Officer |
| | Traffic conditions / management | See No 1 Preparation |  |  |  |  |
| | Extreme weather conditions | • Vehicle accident  
• Falling trees  
• Falling power lines  
• Strains  
• Lacerations  
• Fatality | 4 | • Find out about local road conditions (dirt road, gravel road, sealed road) and any potential hazards from landowners or local community  
• Find out about weather forecasts prior to leaving  
• Drive according to the weather conditions  
• Do not travel during extreme storm conditions  
• Avoid using petrol vehicles in grassy areas if conditions are dry  
• Drive with lights on  
• Only drive on surfaces that are suitable for the vehicle type and capacity | 5 | Project Officer |
| | Site (road) conditions | • Vehicle collision  
• Strains  
• Lacerations  
• Fatality | 4 | • Drive according to the road conditions  
• Field officers must not drive a vehicle in conditions which are unsafe or that staff are not competent.  
• Field officers required to drive in off road conditions must complete an approved 4WD training course. | 5 | Project Officer |
<table>
<thead>
<tr>
<th>PROCESS STEPS</th>
<th>POTENTIAL HAZARDS</th>
<th>RISKS</th>
<th>RISK RATING</th>
<th>RISK CONTROL PROCESS MEASURES</th>
<th>RESIDUAL RISK</th>
<th>RESPONSIBLE PERSONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Driving to and from sites</td>
<td>Health &amp; Well Being</td>
<td>Fatigue, leading to:</td>
<td>3</td>
<td>Check the map only when stationary</td>
<td>4</td>
<td>Project Officer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Loss of control of vehicle</td>
<td></td>
<td>• Be familiar with the vehicle prior to leaving – braking, lights, fuel, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Running off the road</td>
<td></td>
<td>• Travel at a safe speed allowing for weather conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hitting wildlife</td>
<td></td>
<td>• Only use mobile phones / hands free communication radios when safely parked</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fatigue is more likely to occur when driving back home or to the office.</td>
<td></td>
<td>• Ensure appropriate storage of items within vehicles so they don’t create missiles during braking or move underfoot</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• After 2 hrs of driving, take a 15 min. break.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Pull over safely to rest when tired</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• Do not drive for more than 4 hrs after an 8 hr workday</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Do not drive if taking medication that causes drowsiness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Wear a seatbelt</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Avoid arguments</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>• Refer to manager</td>
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<td></td>
<td>• Leave uncomfortable situations</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>• Don’t have a discussion with someone who has obviously been drinking or appears under the influence of drugs</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Take your mobile phone with you</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Avoid going out in extreme weather conditions</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Don’t go to bush blocks at days of total fire ban</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Leave the site at the first sight of smoke</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Avoid using petrol vehicles in grassy areas if conditions are dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROCESS STEPS</td>
<td>POTENTIAL HAZARDS</td>
<td>RISKS</td>
<td>RISK RATING</td>
<td>RISK CONTROL PROCESS MEASURES</td>
<td>RESIDUAL RISK</td>
<td>RESPONSIBLE PERSONS</td>
</tr>
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<td>---------------</td>
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<td>---------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>List the steps required to perform the job in the sequence they are carried out.</td>
<td>Against each job list the hazards that could cause injury</td>
<td>For each hazard identified describe the risk(s) that may be present. (What are the risks and what could go wrong?)</td>
<td>1 – HIGH \n 6 - LOW</td>
<td>Describe the preferred Risk Control measures. Apply the Hierarchy of Control measures; Elimination, Substitution, Engineering &amp; Administration controls, PPE</td>
<td>What is risk rating after controls are put in place</td>
<td></td>
</tr>
<tr>
<td>3. Working near rivers/creeks</td>
<td>Unstable banks etc.</td>
<td>• Sprains, strains, bruises, fractures \n • Drowning</td>
<td>4</td>
<td>• Carefully check the stability of creek/river bank area to ensure firm footing. \n • Ensure the correct equipment is used Ensure all risks are considered</td>
<td>5</td>
<td>Project Officer</td>
</tr>
<tr>
<td>4. Inspections, taking water samples etc</td>
<td>Manual handling</td>
<td>See No 1 Preparation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Waders</td>
<td>• Drowning \n • Strains, sprains, cuts and bruises</td>
<td>4</td>
<td>• Wear an accredited personal floatation device \n • Do not use waders in water with strong currents \n • Wear a wader belt to ensure water does not get into waders \n • Take small steps to ensure safe foot</td>
<td>5</td>
<td>Project Officer</td>
<td></td>
</tr>
<tr>
<td>Electrical wires</td>
<td>Electrocution</td>
<td>4</td>
<td>• Identify overhead power lines and do not contact with sampling pole.</td>
<td>5</td>
<td>Project Officer</td>
<td></td>
</tr>
<tr>
<td>Electric Fences</td>
<td>Electric shock</td>
<td>5</td>
<td>• Use gates to avoid electric fences where possible \n • Look for insulators to identify electric wires in work area/ Ask the landholder which wires are hot \n • Ask landholder if electric fences can be turned off while operators are in the work area</td>
<td>6</td>
<td>Project Officer</td>
<td></td>
</tr>
<tr>
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<td>Describe the preferred Risk Control measures. Apply the Hierarchy of Control measures; Elimination, Substitution, Engineering &amp; Administration controls, PPE</td>
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| 4. Inspections, taking water samples etc | Fire | • Getting caught in a bushfire, possibly resulting in fatality | 4 | • Don’t go into the field on days of total fire ban  
• Leave the site at the first sight of smoke  
• Avoid using petrol vehicles in grassy areas if conditions are dry | 5 | Project Officer |
|                     | Slips/trips/falls | See No 1 Preparation |               | | | | |
|                     | Site conditions  | See No 1 Preparation |               | | | | |
|                     | Exposure to UV   | • Sunburn, potentially resulting in melanoma | 3 | • Wear appropriate clothing and shoes, hat and glasses  
• Wear sunscreen and apply cf. instructions | 5 | Project Officer |
|                     | Working in isolation | • No assistance in case of an accident | 4 | • Check in with manager before leaving for site, after arriving on site, upon leaving site and upon arriving home or at the office  
• Complete ‘Working in isolation’ form | 5 | Project Officer |
|                     | Communication issues | • No mobile coverage | 4 | • Inform Manager before leaving  
• Ask to use the landholders landline, if needed | 6 | Project Officer |
|                     | Health & Well Being | • Stress from getting lost  
• Dehydration | 3 | • GPS the position of the car  
• Carry water with you at all times  
• Medication must be carried on person  
• Avoid strenuous activities during the middle (hot) part of the day  
• Avoid scheduling heavy physical work (including prolonged hiking) during extreme weather days | 5 | Project Officer |
|                     | Animals and insects | • Bites & Stings  
• Lacerations  
• Fatality | 4 | • Wear gaiters, insect repellent, appropriate clothing, safety boots, carry mobile phone  
• Ensure your first aid kit is fully equipped  
• Carry any personal medication | Medium | Project officer |
Safe Work Method Statement
The Safe Work Method Statement is a simple safety tool which will allow staff to logically examine a job so that all the hazards associated with that job can be identified, assessed and documented. It will also further allow us to determine the appropriate control measures.

Seven steps to effective JSA

1. **Document the job**
   Break the job down into basic steps and record them on the Worksheet. Too many steps make the analysis too complicated and too few lead to hazards not being identified.

2. **Identify the hazards**
   Look at each step in turn and identify all of the hazards that are present for each job step. The "specific hazards" prompts below may assist with hazard identification.

3. **Determine and describe the risks.**
   Look at each hazard in turn and determine what specifically the risk that may be present is.

4. **Rate the risk**
   Using the Risk Rating Matrix provided, determine the level of risk that may be present.

5. **Document the control measures**
   Document the most practicable, preferred, control measures required to eliminate or minimise these risks. This should be in line with the Hierarchy of Control (see control measures listed on Worksheet).

6. **Rate the remaining risk**
   Rate the risk which remains if the controls are implemented.

7. **Identify who is responsible**
   Document the name of the person responsible for implementing and undertaking the control measure.

8. **Monitor and Review**
   Ensure supervision of the job to confirm the documented process is followed. Review the JSA after a 12 month period

Have you considered the following:

**SPECIFIC HAZARDS**
- Manual Handling
- Plant & Equipment
- Hazardous Substances
- Dangerous Goods
- Asbestos
- Loud or excessive noise
- Potential to fall from height
- Animals/ Infectious diseases
- Electrical wires (overhead/ underground)
- High Pressure Equipment (Fluid/Air/Gas)
- Fire/Explosion
- Vibration
- Confined spaces
- Slips/Trips/Falls
- Contractors/General Public
- Traffic Conditions / Traffic Management
- Extreme weather conditions (heat/cold/storms)
- Site conditions (dusty/ wet/slippery/etc)
- Site conditions (access/egress/terrain/ canopy/roads)
- Exposure to excessive UV / Sun
- Working in Isolation
- Communication issues
- Welfare of individuals (fatigue/stress/hydration)

**OTHER SAFETY CONSIDERATIONS**
- Induction
- First Aid
- Work area ergonomics
- PPE
- Supervision
- Communication
- Clean Up/Waste Disposal
- OHS Policies & procedures
- Safe Work Practices
- Plant & Equipment Manuals
- Risk Assessments
- Work Safe resources
- Appropriate accreditation & licences
- Experienced staff

**SAFETY RESOURCES TO CHECK**
- SWMS's completed previously
- Material Safety Data Sheets (MSDS)
- Equipment Maintenance

**RISK RATING MATRIX**

<table>
<thead>
<tr>
<th>LIKELIHOOD</th>
<th>CONSEQUENCES</th>
<th>Death or disability</th>
<th>Several days off work</th>
<th>First aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very likely</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Likely</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Unlikely</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Very unlikely</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Note: 1 - it is extremely important to do something about this hazard as soon as possible
6 - this hazard may not need your immediate attention

In the JSA process, risks rated at levels 1, 2 or 3 may need to have an additional risk assessment undertaken, to better understand the risks and determine the most practicable control.
# Corangamite CMA
## Safe Work Method Statement

**JOB TITLE**
Out of Office – Field Work

**Site / Location**
Thompsons Creek (Pettavel Rd and Horseshoe Bend Rd), Waurn Ponds Creek (Surf Coast Hwy) and Gosling Creek (Division Rd)

**Date**

**SWMS Reference No**
2

---

**Is there a previous SWMS?**
No

**Review Date:**

**If Yes, SWMS Reference:**

**Review Number:**

---

**Prepared By**
Katrina Itin

**Reviewed by Manager**

**Manager’s Name:** Jayden Woolley

**Reviewed OHS Coordinator**
Yes

---

**Description of the Job:**
Sandbagging and delivery of water to habitat pools

**List Items of Plant, tools and equipment required:**
Mobile phone, snakebite first aid kit, vehicle with first aid kit and fire blanket

**Staff skills / competencies required for safe job performance:**

**Accredited Operators:**

---

**Safe Work Procedures**
All staff must read and understand safe work procedures applicable to their work. These are available from your OHS Coordinator.

---

**List PPEs Required**
(circle required PPE)
Appropriate footwear, sunscreen, wide brim hat, gaiters
Other:
<table>
<thead>
<tr>
<th>PROCESS STEPS</th>
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<th>RESIDUAL RISK</th>
<th>RESPONSIBLE PERSONS</th>
</tr>
</thead>
</table>
| 1. Preparation Loading and unloading of vehicle | Manual handling | • Strains and sprains, cuts or bruises caused by handling gates, often with rusty wires which may lead to infection  
• Strains, sprains, bruises caused by heavy lifting | 4 | • Use your knees when lifting  
• Only handle loads within your capacity  
• Seek assistance if required  
• Use team handling  
• Handle with care  
• Update tetanus vaccination  
• Bend your knees when lifting  
• Use team handling  
• Use gloves if handling items that are potential cut hazards or slippery or hard to handle | 5 | Project Officer |
| | Slips, trips, falls | • Strains, sprains, bruises, fractures | 4 | • Keep parking environment clear of any obstacles  
• Avoid obstacles while walking  
• Consult landowner to identify any on-site hazards, e.g. dangerous chemicals, aggressive animals hazardous areas (mines / extremely rough grounds / surfaces / cliffs, etc) | 5 | Project Officer |
| | Traffic conditions / management | • Strains, sprains, bruises, fractures  
• Disability | 3 | • Obey traffic rules when walking to parked vehicle and loading equipment  
• Position vehicles for loading in a safe area or zone away from other potential traffic  
• Wear safety vest or high visibility clothing if loading in a traffic area | 5 | Project Officer |
<table>
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<tr>
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</tr>
</thead>
</table>
| **2. Driving Driving to and from sites** | Plant & Equipment | • Vehicle malfunction, potentially leading to fatality | 4 | • Be familiar with the vehicle prior to leaving – braking, lights, fuel, etc.  
• Undertake a basic functionality and safety check prior to use of the vehicle.  
• Ensure first aid and safety kit is present and complete  
• Monthly mechanical check by vehicle park manager | 5 | Project Officer |
| Traffic conditions / management | See No 1 Preparation | | | | | |
| Extreme weather conditions | | • Vehicle accident  
• Falling trees  
• Falling power lines  
• Strains  
• Lacerations  
• Fatality | 4 | • Find out about local road conditions (dirt road, gravel road, sealed road) and any potential hazards from landowners or local community  
• Find out about weather forecasts prior to leaving  
• Drive according to the weather conditions  
• Do not travel during extreme storm conditions  
• Avoid using petrol vehicles in grassy areas if conditions are dry  
• Drive with lights on  
• Only drive on surfaces that are suitable for the vehicle type and capacity | 5 | Project Officer |
| Site (road) conditions | | • Vehicle collision  
• Strains  
• Lacerations  
• Fatality | 4 | • Drive according to the road conditions  
• Field officers must not drive a vehicle in conditions which are unsafe or that staff are not competent.  
• Field officers required to drive in off road conditions must have completed an approved 4WD training course. | 5 | Project Officer |
<table>
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</thead>
</table>
| 2. Driving Driving to and from sites | Health & Well Being | Fatigue, leading to:  
- Loss of control of vehicle  
- Running off the road  
- Hitting wildlife | 3 | Check the map only when stationary  
Be familiar with the vehicle prior to leaving – braking, lights, fuel, etc.  
Travel at a safe speed for weather conditions  
Only use mobile phones / hands free communication radios when safely parked  
Ensure appropriate storage of items within vehicles so they don’t create missiles during braking or move underfoot  
After 2 hrs of driving, take a 15 min. break  
Pull over safely to rest when tired  
Do not drive for more than 4 hrs after an 8 hr workday  
Do not drive if taking medication that causes drowsiness  
Wear a seatbelt  
Avoid arguments  
Refer to manager  
Leave uncomfortable situations  
Don’t have a discussion with someone who has obviously been drinking or appears under the influence of drugs  
Take your mobile phone with you  
Avoid going out in extreme weather conditions  
Don’t go into the field on days of total fire ban  
Leave the site at the first sight of smoke  
Avoid using petrol vehicles in grassy areas if conditions are dry | 4 | Project Officer |
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<td>1 – HIGH 6 - LOW</td>
<td>Describe the preferred Risk Control measures. Apply the Hierarchy of Control measures; Elimination, Substitution, Engineering &amp; Administration controls, PPE</td>
<td>What is risk rating after controls are put in place</td>
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<tr>
<td>3. Working near creeks, steep slopes, unstable creek/river banks/general outdoor environment etc.</td>
<td>Unstable banks etc.</td>
<td>• Sprains, strains, bruises, fractures  • Drowning</td>
<td>4</td>
<td>• Carefully check the stability of creek/river bank area to ensure firm footing.  • Ensure the correct equipment is used  • Ensure all risks are considered</td>
<td>5</td>
<td>Project Officer</td>
</tr>
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<td>4. Inspections, taking water samples etc</td>
<td>Manual handling</td>
<td>See No 1 Preparation</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Use of Waders</td>
<td>• Drowning  • Strains, sprains, cuts and bruises</td>
<td>4</td>
<td>• Wear an accredited personal floatation device  • Do not use waders in water with strong currents  • Wear a wader belt to ensure water does not get into waders  • Take small steps to ensure safe footing</td>
<td>5</td>
<td>Project Officer</td>
</tr>
<tr>
<td></td>
<td>Electrical wires</td>
<td>• Electrocution</td>
<td>4</td>
<td>• Ask the landholder if electric fences can be turned off while the property is being assessed  • Ask the landholder which wires are hot  • Test, using a piece of grass</td>
<td>5</td>
<td>Project Officer</td>
</tr>
<tr>
<td></td>
<td>Fire</td>
<td>• Getting caught in a bushfire, possibly resulting in fatality</td>
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<td>See No 1 Preparation</td>
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| | Exposure to UV | • Sunburn, possibly resulting in melanoma | 3 | • Wear appropriate clothing and shoes, hat and glasses  
• Wear sunscreen and apply cf. instructions | 5 | Project Officer |
| | Working in isolation | • No assistance in case of an accident | 4 | • Check in with manager before leaving for site, after arriving on site, upon leaving site and upon arriving home or at the office  
• Complete ‘Working in isolation’ form | 5 | Project Officer |
| | Communication issues | • No mobile coverage | 4 | • Inform Manager before leaving  
• Ask to use the landholders’ landline, if needed | 6 | Project Officer |
| | Health & Well Being | • Stress from getting lost  
• Dehydration | 3 | • GPS the position of the car  
• Carry water with you at all times  
• Medication must be carried on person  
• Avoid strenuous activities during the middle (hot) part of the day  
• Avoid scheduling heavy physical work (including prolonged hiking) during extreme weather days | 5 | Project Officer |
| | Animals and insects | • Bites & Stings  
• Lacerations  
• Fatality | 4 | • Wear gaiters, long pants, insect repellent, long sleeved shirts, safety boots  
• Ensure your first aid kit is fully equipped  
• Carry any personal medication with you at all times  
• Carry your mobile phone with you at all times | 5 | Project Officer |
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| 5. Delivery of water | Obstruction of roadways by delivery trucks | • Vehicle collision  
• Vehicle accident  
• Traffic obstruction - delays | 4 | • Communicate with Colac-Otway Shire and Surf Coast Shire.  
• Pedestrian management is required to direct people around the works area. | 5 |  


### Appendix J: List of Amendments made to Draft 1

<table>
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<tr>
<th>Recommendation</th>
<th>Accepted Y/N</th>
<th>Reasoning</th>
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<tr>
<td>It was suggested that it was necessary to make the justification of site locations clearer so that it is more transparent why the sites were selected for emergency response works</td>
<td>Y</td>
<td>This amendment was accepted because the justification of site selections was not clear in draft 1 of the report. All of the sites mentioned in The Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009) were revisited and the site selections were reassessed.</td>
</tr>
<tr>
<td>It was suggested that it was necessary to create a better description of the site locations</td>
<td>Y</td>
<td>This amendment was accepted because the recommendation highlighted the fact that some of the maps showing the site location were slightly inaccurate</td>
</tr>
<tr>
<td>It was suggested that it was necessary to establish pool bathymetry and conduct surveys to determine the depth of the habitat pools</td>
<td>N</td>
<td>While this would be invaluable information to collect the budget is insufficient for this work to be carried out</td>
</tr>
<tr>
<td>It was suggested that maintaining suitable in-stream vegetation in the habitat pools should be a primary management objective</td>
<td>N</td>
<td>Such works are not emergency response actions, however this recommendation was followed when reassessing the site selections by ensuring that all of the habitat pools selected for emergency works still contain suitable in-stream vegetation when the water level drops</td>
</tr>
<tr>
<td>It was suggested that the justification of the water quality trigger levels needs to be clarified</td>
<td>Y</td>
<td>This amendment was accepted because a number of people that reviewed the document were confused by the trigger levels</td>
</tr>
<tr>
<td>It was suggested that the water delivered to the habitat pools will need to be oxygenated</td>
<td>Y</td>
<td>This amendment was accepted. While the quality of the water that would be delivered to the pools was investigated and taken into consideration, the fact that bore water would contain low levels of</td>
</tr>
<tr>
<td>It was suggested that the sections on Australian Mudfish and Australian Grayling should be removed because there are no actions for these species in this report</td>
<td>N</td>
<td>This amendment was rejected because these sections were included so as to keep this report a part of the overall HERO Significant Fish Species Project, however this recommendation highlighted the need to better explain the link between this report and other works being done as part of this project to provide a clearer overall picture of the project as a whole</td>
</tr>
<tr>
<td>Recommendation</td>
<td>Accepted Y/N</td>
<td>Reasoning</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>It was suggested that a decision support tool should be used to assist in making a judgment call on whether or not to act when trigger levels are reached</td>
<td>Y</td>
<td>This recommendation highlighted the need to develop a decision support tree and an internal decision support panel to assist with decision making and to ensure that the decision making process is transparent</td>
</tr>
<tr>
<td>A suggestion was made to involve Waterwatch volunteers in monitoring of sites</td>
<td>Y</td>
<td>This is unfeasible because Waterwatch volunteers would not be able to provide instantaneous data</td>
</tr>
<tr>
<td>It was suggested that it may not be a safe position to assume that Dwarf Galaxias are able to survive in little water given that there is only one main population of this species in the region of the Corangamite CMA</td>
<td></td>
<td>This will be covered by having an internal decision support panel to help make decisions as to when to act</td>
</tr>
<tr>
<td>It was suggested that the EC trigger of 20,000 µS/cm should be reduced to 10,000 µS/cm for Dwarf Galaxias because the highest reading that the species has been recorded at in this region is ≈ 13,000 µS/cm and readings at the Gosling Creek site are normally around 2,600 µS/cm</td>
<td>Y</td>
<td>This amendment was accepted because the recommendation was made by Rhys Coleman who is an expert in Dwarf Galaxias and because he was not consulted on the trigger levels when they were determined for The Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009)</td>
</tr>
<tr>
<td>It was suggested that the dissolved oxygen trigger should be raised to 5 mg/L</td>
<td>N</td>
<td>This recommendation was rejected because a trigger level of this high is not practical. Because of the limited ability to influence DO when the pools are full, DO was placed as a secondary trigger to depth</td>
</tr>
<tr>
<td>It was suggested that the water level trigger should be changed to a minimum of 0.3m as opposed to 0.5m</td>
<td>N</td>
<td>Trigger levels were re-examined and compared with those identified in The Significant Fish Species Protection under Dry Inflow Conditions Report (Saddlier, Ryan and Woolley, 2009). The report states that when the level of the pools reach 1m or 50% available habitat that water delivery options should be investigated and when the level reaches 30cm emergency actions should be implemented. It was therefore decided that the depth trigger should be altered to 30cm-1m to allow for greater flexibility and adaptive management</td>
</tr>
<tr>
<td>It was suggested that Corangamite CMA staff should be onsite with the contractors when the emergency works are being carried out to ensure that the water is filtered adequately to prevent the translocation of pest species such as Gambusia</td>
<td>Y</td>
<td>This recommendation was accepted and an amendment was made in the report because the translocation of exotic species into the habitat pools is undesirable and would impact the long term survival of the threatened fish species in these systems and should therefore be prevented</td>
</tr>
<tr>
<td>Recommendation</td>
<td>Accepted Y/N</td>
<td>Reasoning</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>It was suggested that it was not necessary to notify Simone Wilkinson, Regional Statutory Functions Coordinator within the Corangamite CMA, of the proposed works because works on waterways approval is not required</td>
<td>Y</td>
<td>This recommendation was accepted and the relevant sections were removed</td>
</tr>
<tr>
<td>It was suggested that the proposed works may constitute the construction of a dam, as per the definition of a dam described in the Water Act 1989 and therefore require approval from Southern Rural Water</td>
<td>Y</td>
<td>This recommendation was accepted and Southern Rural Water was contacted to ask their advice on this matter.</td>
</tr>
<tr>
<td>Various recommendations with regards to general editing</td>
<td>Y</td>
<td>All general editing recommendations were accepted and amendments made</td>
</tr>
</tbody>
</table>