

Giant Gippsland Earthworm Assessment at a proposed residential development – 99 Bena Rd, Korumburra

November 2019



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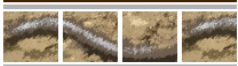
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ABBREVIATIONS

SGSC: South Gippsland Shire Council
 DELWP: Department of Environment, Land, Water and Planning
 DoE: Department of the Environment
 DPO; Development Plan Overlay
 EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999*
 EVC: Ecological Vegetation Class
 FFG Act: *Flora and Fauna Guarantee Act 1988*
 GGE: Giant Gippsland Earthworm, *Megascolides australis*
 WGCMA: West Gippsland Catchment Management Authority

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ATTACHMENT 3 Fact Sheet 2 PROTECTING GGE HABITAT - guidelines for revegetation and plantation projects

SUMMARY

PROJECT BACKGROUND

INVERT-ECO was commissioned by Planning Central on behalf of Hill Rise View Pty Ltd to undertake a targeted survey for the Giant Gippsland Earthworm *Megascolides australis* (GGE) at the site of a proposed residential development at 99 Bena Rd, Korumburra. The subject land occurs within the South Gippsland Shire and is subject to Schedule 6 of the Development Plan Overlay (DPO). This Schedule specifies the requirement for a Flora and Fauna survey to include the Giant Gippsland Earthworm to support a permit application. The GGE is listed under Federal (*Environment Protection Biodiversity Conservation Act 1999*) and State (*Flora and Fauna Guarantee Act 1988*) planning policies.

The purpose of this assessment is to facilitate the planning and design of the proposed subdivision to avoid or reduce any environmental impacts to GGEs should they occur within the subject land.

A field assessment was undertaken on October 29th 2019.

RESULTS

No evidence of Giant Gippsland Earthworms was identified from within the subject land and suitable habitat was limited. Suitable habitat includes moist blue grey or red clay soils in sites that generally retain moisture all year round. This includes creekbanks and soaks on south facing slopes. Adequate soil moisture maintained all year round is thought to be critical for the survival of this species. The area with the most potential habitat was along the banks of the tributary of Foster Creek in the north-west corner of the site. However no suitable clay soils were found. The soils were primarily dry, silty and were comprised of large amount of sandstone/mudstone in parts. No evidence of soaks was observed on the south-facing slopes.

LEGISLATIVE AND POLICY REQUIREMENTS

The most relevant policies applicable to GGE are summarised below

Policy/ Legislation	Relevant Fauna	Requirement	Comment
EPBC Act	Giant Gippsland Earthworm	Required if action deemed significant to an <u>important</u> GGE population	No GGE were located within the study area No significant impact
FFG Act	Giant Gippsland Earthworm	A permit is required from DELWP if an action on public land proposes to collect, kill, injure or disturb protected flora and fauna and ecological communities.	Permit not required as site private land
DPO Schedule 6	Giant Gippsland Earthworm	GGE Assessment required	Results of GGE assessment must be presented in a planning permit application to SGSC

IMPACTS and RECOMMENDATIONS

The construction of housing developments has the potential to substantially modify GGE habitat from both direct and indirect impacts. These include loss and degradation of suitable habitat from soil disturbance (excavation & infrastructure, compaction & isolation of colony) and hydrological disturbances (increased run-off, lower infiltration rates and lowering of base flows).

The construction of the proposed development at 99 Bena Road, Korumburra is unlikely to have any impact on the Giant Gippsland Earthworm as they were not identified from within the study area. As a consequence, there is no impact minimisation actions required. A contingency plan is attached in the unlikely event that undetected GGE colonies are discovered during the construction of the development.

1 BACKGROUND

INVERT-ECO was commissioned by Planning Central on behalf of Hill Rise View Pty Ltd to undertake a targeted survey for the Giant Gippsland Earthworm *Megascolides australis* (GGE) at the site of a proposed residential development at 99 Bena Rd, Korumburra.

The subject land at 99 Bena Road, Korumburra occurs within the South Gippsland Shire and is zoned General Residential Zone (GRZ1). The land is subject to Schedule 6 of the Development Plan Overlay (DPO). This Schedule specifies the requirement for a Flora and Fauna survey to include the Giant Gippsland Earthworm to support a permit application. The GGE is listed under Federal (*Environment Protection Biodiversity Conservation Act 1999*) and State (*Flora and Fauna Guarantee Act 1988*) planning policies.

Background information on the Giant Gippsland Earthworm is provided in Appendix 1.

The purpose of this assessment is to facilitate the planning and design of the proposed subdivision to avoid or reduce any environmental impacts to GGEs should they occur within the subject land.

Specifically,

- Identify any presence and locations of GGE within the study area by a targeted field assessment;
- Provide an assessment of the potential impacts on GGE associated with the proposed subdivision;
- Provide recommendations for the mitigation and management of potential impacts on any GGE colonies recorded on site.

2 STUDY AREA

The subject land (Lot 1 PS321371) is 19.6 ha and is situated approximately 1 km south-west of the township of Korumburra (Figure 1). The site is zoned General Residential (GRZ 1) and is covered by the Development Plan Overlay (DPO).

The land has a moderate to steep topography with north and south facing slopes. The site is presently covered with pasture grasses but was planted for Millet crops about 12 months ago. (Plate1). Scattered Eucalypts occur along the water course and as wind rows which have recently been removed.

A tributary of Foster Creek flows through the north-west corner of the site (Plate 1).

The site occurs within the Strzelecki Ranges Bioregion. The Pre 1750 Ecological Vegetation Class (EVC) was Wet forest (EVC 30) found around the creekline and Damp Forest (EVC 29) over the remainder of the site (NatureKit Victoria 2019).

Figure 1 Location of subject land 99 Bena Rd, Korumburra

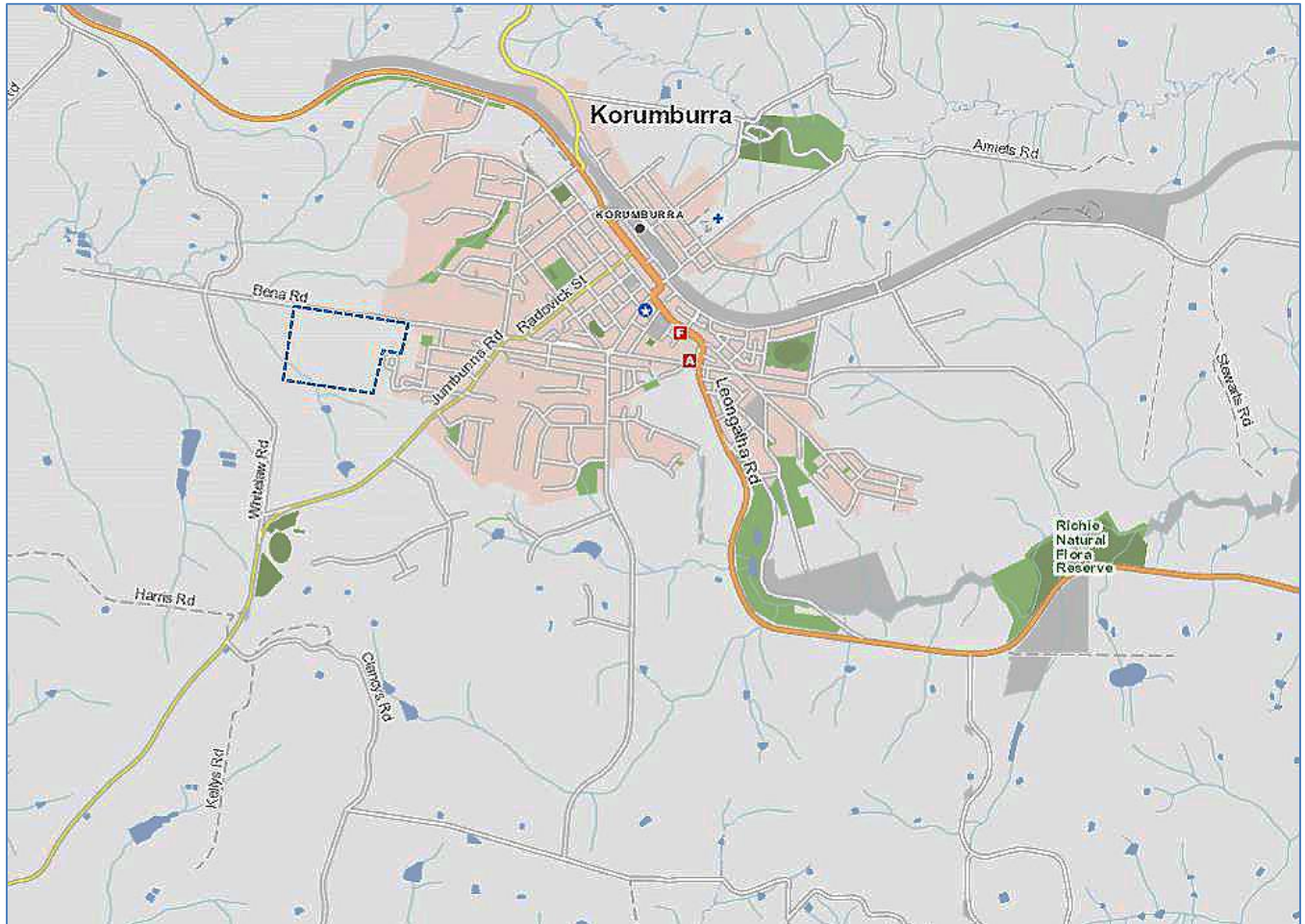




PLATE 1 Subject land at 99 Bena Rd, Korumburra
A) Creekline in north- west of site -view east
B) Site topography -view north
C) Recent windrow removal-view south

3 METHODS

3.1 Survey Methodology

A field assessment targeting potential GGE habitat was undertaken on October 29th 2019.

A survey for the GGE was undertaken by hand digging soil quadrats (< 50 x 50 x 50 cm) in potential habitat within the subject land. Potential GGE habitat includes well drained, clay soils along waterways, terraced south facing slopes, soaks and wet gullies.

Potential habitat targeted for sampling included the creekbanks of the tributary of Foster Creek and some minor terraced areas on the south-facing slopes. Quadrats were examined for GGEs burrows and cast (waste) material. These areas were also walked over while banging a shovel to listen for the gurgling sounds sometimes made by the worms as they retreat down their burrows.

AMG data was recorded using a hand held GPS (GDA 94, accuracy ± 5 m)

3.2 Assessment Qualifications and Limitations

The assessment was undertaken during relatively good sampling conditions though the soils are beginning to dry out with the recent burst of very warm weather. GGE are more easily detected by the gurgling sound they make as they retreat down their wet burrows. This is more notable during the wetter months but movement can still be heard if local site conditions remain moist, as is often the case when GGE habitat occurs within a spring or soak. However, GGE burrows are present all year round and can be detected by the excavation of small soil quadrats.

There were some limitations to accessing parts of the creekbanks due to the presence of blackberries.

Overall, the results of this assessment are considered relatively robust.

4 RESULTS

No evidence of Giant Gippsland Earthworms was identified from within the subject land and limited suitable habitat was observed. The area with the most potential was along the banks of the tributary of Foster Creek. However, no suitable clay soils were found. The soils were primarily dry, silty and comprised of a large amount of sandstone/mudstone in some sections.

There were no soaks observed over the south facing slopes within the study area. The steeper banks adjacent to the creek were very dry and did not include soaks or areas of increased moisture (Plate 2). There was also no evidence of the presence of the chimneys constructed by burrowing crayfish (*Engaeus* sp) that often reflect the presence of moist clay soils. Soil moisture maintained all year round is thought to be critical for the survival of this species (Van Praagh *et. al* 2007) it is predominantly restricted to areas where there is adequate soil drainage.

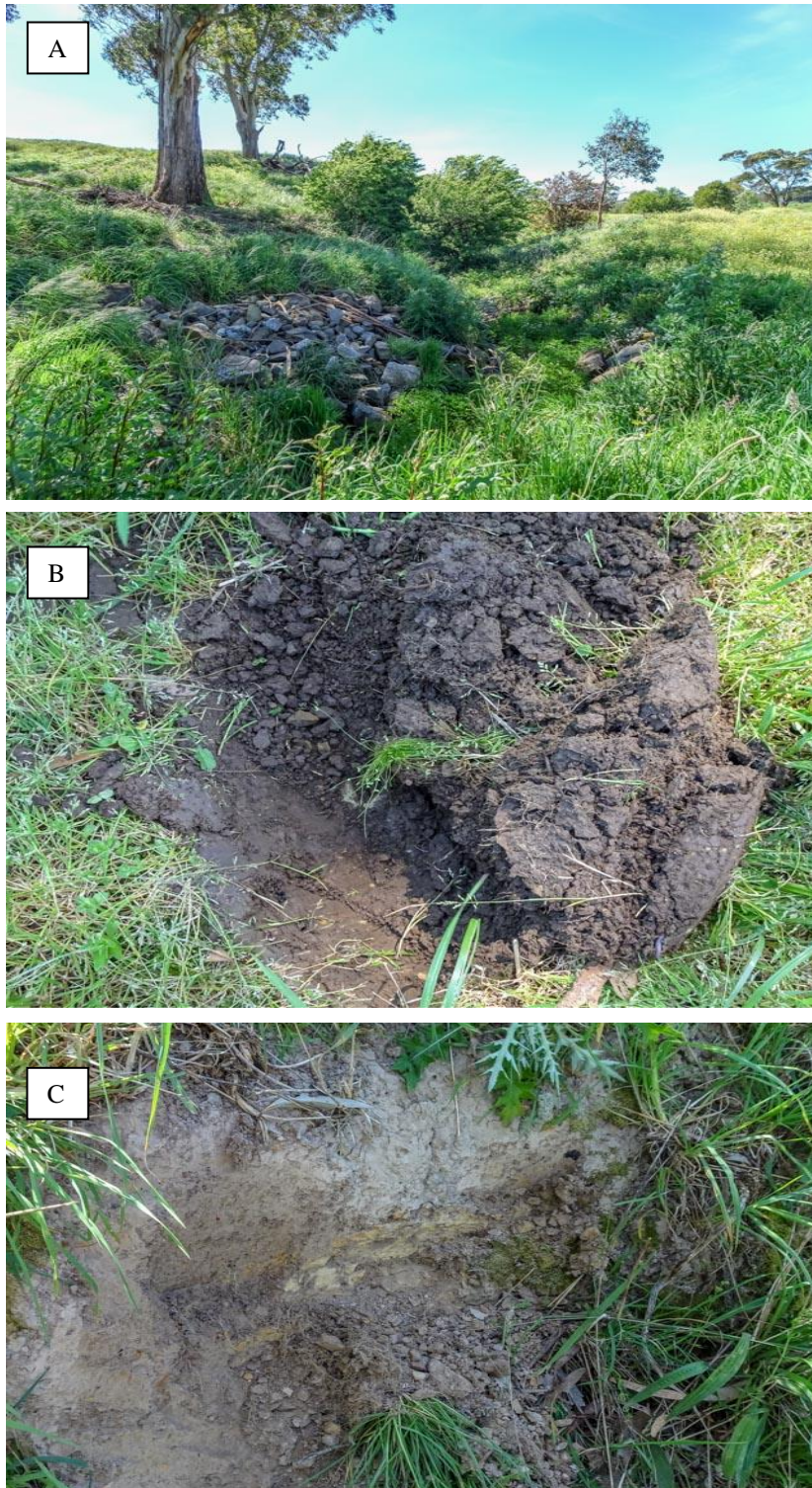


PLATE 2 Soils found along tributary of Foster Creek

- A) Creek- line with potential habitat
- B) Dry silty soils along the creek bank
- C) Dry soils with sandstone along south facing embankment of waterway

5 POTENTIAL IMPACTS

GGEs often live in small, isolated areas that support a complex of interrelated variables that create suitable habitat. They live entirely underground in permanent burrow systems (Kretzschmar and Aries 1992) and have very low dispersal abilities (Woods 2006). This means that they are unable to move away from threatening processes and as such are highly vulnerable to changes in their environment.

The potential impacts of the proposed construction of a housing development on GGE include habitat loss and degradation. These processes result from soil disturbance and alterations to local hydrological and drainage patterns and construction of houses and related infrastructure within or adjacent to habitat. Threatening processes resulting from urban development on GGE can be found in Table 1.

As no GGE were located within the study area, there are unlikely to be any impacts on GGEs from the proposed housing development.

TABLE 1 Summary of threats to GGE

THREATS	IMPACT
<p>Direct Disturbance and fragmentation</p> <p>Direct disturbance of habitat: Excavation for housing, dams, pipes and road construction Addition of fill resulting in alteration to natural topography and removal of wetlands Soil compaction and churning from machinery</p> <ul style="list-style-type: none"> - Removal of existing vegetation - Destruction of stream bank integrity 	<p>Loss and degradation of habitat</p> <p>Loss of colonies -death and injury of individuals and egg cocoons</p> <p>Fragmentation of colonies & reduced gene flow</p> <p>Compaction and churning of soil resulting in loss of burrows</p> <p>Exposing burrows, changing hydrology and causing drying out of sites</p>
<p>Hydrological Disturbance -alteration in flows</p> <ul style="list-style-type: none"> -Changes in surface and subsurface flows -Changes to water table -Dense revegetation within or adjacent to habitat -Storm water diversion and increased inflow -Clearing of riparian vegetation 	<p>Direct loss of habitat by drying or flooding soils/wetlands</p> <p>Loss of colonies</p> <p>Fragmentation of colonies & reduced gene flow</p>
<p>Hydrological Disturbance - Reduced Water quality</p> <ul style="list-style-type: none"> -sedimentation from soil disturbance activities (e.g. Road construction, trenching) -Increased nutrient loads from fertilisers -Chemical pollutants from chemicals e.g biocides and hydrocarbons 	<p>Degradation of habitat through reduced water quality</p>

6 ENVIRONMENTAL POLICY AND LEGISLATION

This section explores environmental policy and legislation most pertinent to the Giant Gippsland Earthworm and Warragul Burrowing Crayfish. However, it is not a comprehensive list of all legislation and the guidance provided does not constitute legal advice.

6.1 *Environment Protection and Biodiversity Conservation Act 1999*

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for assessment of proposed actions that are likely to have a significant impact on Matters of National Environmental Significance (MNES). It applies to both public and private land. Matters of National Environmental Significance include nationally threatened species and ecological communities.

A person who proposes to take an action that will have, or is likely to have, a significant impact on a matter of national environmental significance must refer that action to the minister for a decision on whether assessment and approval is required under the EPBC Act.

A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

As the Giant Gippsland Earthworm is listed as **Vulnerable** under the EPBC Act, a referral to the Commonwealth Minister for DoE may be necessary if the works are deemed to have a **significant impact** on an **important population**. The criteria to consider in determining an important population under the Act are outlined below and assessment of the impacts of the proposed development on GGE in relation to the significant impact criteria for Vulnerable species are given in Table 2.

An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

TABLE 2 Assessment of the impacts of the proposed development on the GGE in reference to the *significant impact criteria* for *Vulnerable* EPBC Act listed species

CRITERION	ASSESSMENT
There is a real chance or possibility that the action will lead to a long-term decrease in the size of a population.	No GGE identified within the study area and little suitable habitat found No significant impact.
There is a real chance or possibility that the action will reduce the area of occupancy of an important population	No GGE identified within the study area and little suitable habitat found. No significant impact
There is a real chance or possibility that the action will fragment an existing important population into two or more populations	No GGE identified within the study area. The works proposed will not split or provide a barrier between the potential occurrence of the species and any other known population. No significant impact
There is a real chance or possibility that the action will adversely affect habitat critical to the survival of a species	No GGE identified within the study area. The action will not adversely affect habitat critical to the survival of a species No significant impact
There is a real chance or possibility that the action will disrupt the breeding cycle of an important population	No GGE identified within the study area. The action will not disrupt the breeding cycle No significant impact
There is a real chance or possibility that the action will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No GGE identified within the study area. As a precautionary approach potential habitat along the waterway will be protected within a buffer and planted as per the recommended guidelines and managed accordingly. No significant impact
There is a real chance or possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No GGE identified within the study area. No significant impact
There is a real chance or possibility that the action will introduce disease that may cause the species to decline	No GGE identified within the study area. No significant impact
There is a real chance or possibility that the action will interfere with the recovery of the species	No GGE identified within the study area. The works proposed will not interfere with the management or recovery of these areas. No significant impact

Implications

According to the significant impact criteria (Table 2), the current proposal is unlikely to have a significant impact on the Giant Gippsland Earthworm as they were not recorded within the study area.

A referral under the *EPBC Act 1999* is unlikely to be triggered as no GGE colonies will be impacted by this proposal.

6.2 Flora and Fauna Guarantee Act

The Giant Gippsland Earthworm and Warragul Burrowing Crayfish are both listed under the *Flora and Fauna Guarantee Act 1988* (FFG Act) which is the key piece of Victorian legislation for the conservation of threatened species and communities and for the management of potentially threatening processes. The FFG Act has limited direct application to private land. The local planning authority is likely to consider impacts on FFG Act-listed species and communities under the Planning Scheme when deciding on planning permit applications.

Further information on the FFG Act can be found at:

<http://www.depi.vic.gov.au/environment-and-wildlife/threatened-species-and-communities/flora-and-fauna-guarantee-act-1988>

Implications

A permit is required from DELWP if an action on public land proposes to collect, kill, injure or disturb protected flora and fauna and ecological communities. An FFG Act permit is generally not required for private land.

A permit under the *FFG Act 1999* is not required as the proposal is on privately owned land.

6.3 Wildlife Act 1975

This Act forms the procedural, administrative and operational basis for the protection and conservation of native wildlife, specific use of, and prescriptions for access, prohibition and regulation of associated activities involving native wildlife within Victoria. This Act is the basis for the majority of wildlife permit/licensing requirements within the state. All terrestrial invertebrates listed under the *FFG Act 1988* are considered "wildlife".

Implications

The GGE is listed under the *FFG Act* and are thus considered “wildlife” for the purposes of this Act. A license is required under this Act to take or destroy wildlife. This includes any handling, salvage and translocation of wildlife and a permit may be required if these activities are undertaken as a result of this proposal.

A permit under the *Wildlife Act* is unlikely to be required as the proposal is unlikely to involve any of the above activities.

6.4 Victorian Planning Provisions

- SCHEDULE 6 TO CLAUSE 43.04 DEVELOPMENT PLAN OVERLAY (DPO)

Applies to Korumburra residential growth areas

Under the conditions required for a permit under Schedule 6 of the DPO, Flora and Fauna, a Giant Gippsland Earthworm assessment is required. This assessment must include how any earthworms located will be protected from negative impacts associated with a proposed development.

This assessment satisfies the requirements under Schedule 6 of the DPO. No specific mitigation is required for GGEs as none were identified from the subject land.

Results of the GGE assessment must be presented in a planning permit application to South Gippsland Shire Council.

7 IMPACT ASSESMENT AND MITIGATION RECOMMEDATIONS

Threatening processes associated with the construction of housing developments have the potential to substantially modify GGE habitat from both direct and indirect impacts (Refer to Table 1).

Mitigation has the principle aim of avoiding significant impacts to threatened species that might arise from proposed works and should be applied in a hierarchical order:

1. **Avoid** adverse impacts-avoid habitat loss
2. **Minimise and/or mitigate** impacts-minimise habitat loss through appropriate consideration in planning processes and expert input to project design construction and management
3. **Offset** Identify appropriate offset options if avoidance or minimisation is not achievable.

Potential GGE habitat was identified along the banks of the tributary of Foster Creek. However no evidence of the species was found and the field assessment revealed that the soils were largely unsuitable due to disturbance and unsuitable soils. The site has been subject to cropping over the past 12 months.

The absence of any evidence of GGE, combined with the lack of a suitable habitat at the site suggests that this species is unlikely to occur within the subject land. No GGE colonies should be impacted by the proposal development of the site.

As a consequence, there are no impact minimisation actions required.

In some circumstances, a precautionary approach to mitigation is recommended even when no GGE colonies are identified due to the possibility that colonies can remain undetected. However, it is considered by INVERT-ECO that the area is unlikely to support suitable habitat. As the waterway is likely to be protected from building works by the installation of a 30 m buffer under the West Gippsland Catchment Authority recommendations (WGCMA) (Glenn Kell pers.com.), the creek banks will be afforded some protection in the event that small areas of habitat occur at the site.

7.1 Contingency Plan

While a targeted assessment aims to identify all GGE colonies and habitat, due to their subterranean and cryptic habits, there is a low likelihood that colonies may remain undetected. A contingency plan has been developed to address this (Attachment 1).

A Contingency Plan should be implemented in the event that undetected Giant Gippsland Earthworms are accidentally exposed during project construction. An immediate 30 m buffer zone should be established if live populations are found. This contingency plan requires the local translocation of uninjured worms to a suitable nearby site. Suitable release areas must be

secure sites with long-term protection. There should be a minimum of 30 m between the release site and project works.

- Ensure all contractors and on-site workers are familiar with the identification of Giant Gippsland Earthworms and the rescue and release procedures outlined in the Contingency Plan should any GGE colonies be accidentally unearthed during site works by providing the following information during inductions.

- Attachment 1 Contingency Plan Contingency Plan for the accidental unearthing of Giant Gippsland Earthworms
- Attachment 2 Fact Sheet 1- GIANT GIPPSLAND EARTHWORM - recognising habitat on your property
- Attachment 3 Fact Sheet 2 PROTECTING GGE HABITAT - guidelines for revegetation and plantation projects
- GGE website <http://www.giantearthworm.org.au/>

8 REFERENCES

- IUCN (International Union for Conservation of Nature) 2014. *Megascolides australis*. The IUCN Red List of Threatened Species. Version 2015.2
- Kretzschmar, B. & Aries, F. 1992 An analysis of the structure of the burrow system of the Giant Gippsland Earthworm *Megascolides australis* McCoy 1878, using 3D-images. *Soil biology and Biochemistry* 24:1583-1586.
- Van Praagh, B. D. 1992. The Ecology, Distribution and Conservation of the Giant Gippsland Earthworm *Megascolides australis* McCoy 1878. *Soil Biology and Biochemistry* 24(12): 1363-1368.
- Van Praagh, B. D. 1996. Reproductive biology of *Megascolides australis* McCoy (Oligochaeta: Megascolecidae). *Australian Journal of Zoology* 43:489-507.
- Van Praagh, B.D., Yen, A.L., and Rosengren, N. 2007. The Conservation of the Giant Gippsland Earthworm *Megascolides australis* in relation to its distribution in the landscape. *The Victorian Naturalist* 124(4): 249-253.
- Victorian Department of Sustainability and Environment. 2009. Advisory List of Threatened Invertebrate Fauna in Victoria - 2009. Department of Sustainability and Environment, East Melbourne, Victoria.
- Woods, R. 2006. Genetic diversity and population structure of the Giant Gippsland Earthworm *Megascolides australis* Unpublished Honours thesis. Department of Genetics La Trobe University, Bundoora, Victoria

APPENDIX 1 - Giant Gippsland Earthworm *Megascolides australis*

EPBC Act 1999 Conservation Status: Vulnerable
FFG Act 1988 Conservation Status: Threatened
 IUCN Red List of Threatened Species (2015): Endangered
 DEPI Advisory List of Threatened Invertebrates
 (2009): Listed



The Giant Gippsland Earthworm is one of the largest species of earthworm in the world, with adults reaching lengths of over 1.5 m and weights of up to 400 g (Van Praagh 1992). The species is restricted to south and west Gippsland, Victoria with Warragul and Drouin representing the north of its range and Almurta and Korumburra in the south. Mt Worth represents the most easterly point of distribution. The closest GGE records occur within 50 m to the east and west of the waterway (Van Praagh 2010).

The majority of habitat occupied by this species occurs on private land used for agriculture. GGE colonies are most commonly found along clayey creek banks and drainage lines, usually above the areas prone to flooding. Away from waterways, they occur near underground springs and soaks, either in gullies or on south-facing slopes with terracettes. The species is generally found in the deep blue-grey or red clayey soils.

While the species occurs over an area of approximately 40,000 ha, suitable habitat within its range is patchy leading to small, fragmented populations. A combination of many interrelated factors such as slope, micro-topography, nature and depth of the soil and hydrological processes determine suitable habitat (Van Praagh *et.al.* 2007). GGEs live in complex, permanent burrows that extend to around 1.5 m in depth. Worms remain underground, feeding on the root material and organic matter ingested in the soil. They breed in spring and summer when they lay large, amber coloured egg cocoons (Van Praagh 1996).

Aspects of the biology and ecology of the GGE such as long lifespan, low reproductive and recruitment rates, and poor dispersal ability render the fragmented populations particularly vulnerable to threatening processes (Van Praagh 1992). There are a range of processes that threaten GGE colonies. The most widespread and serious are the physical disturbance and compaction of soils, alterations to water tables and drainage patterns at the local and regional level.

Further information can be found at www.giantearthworm.org.au