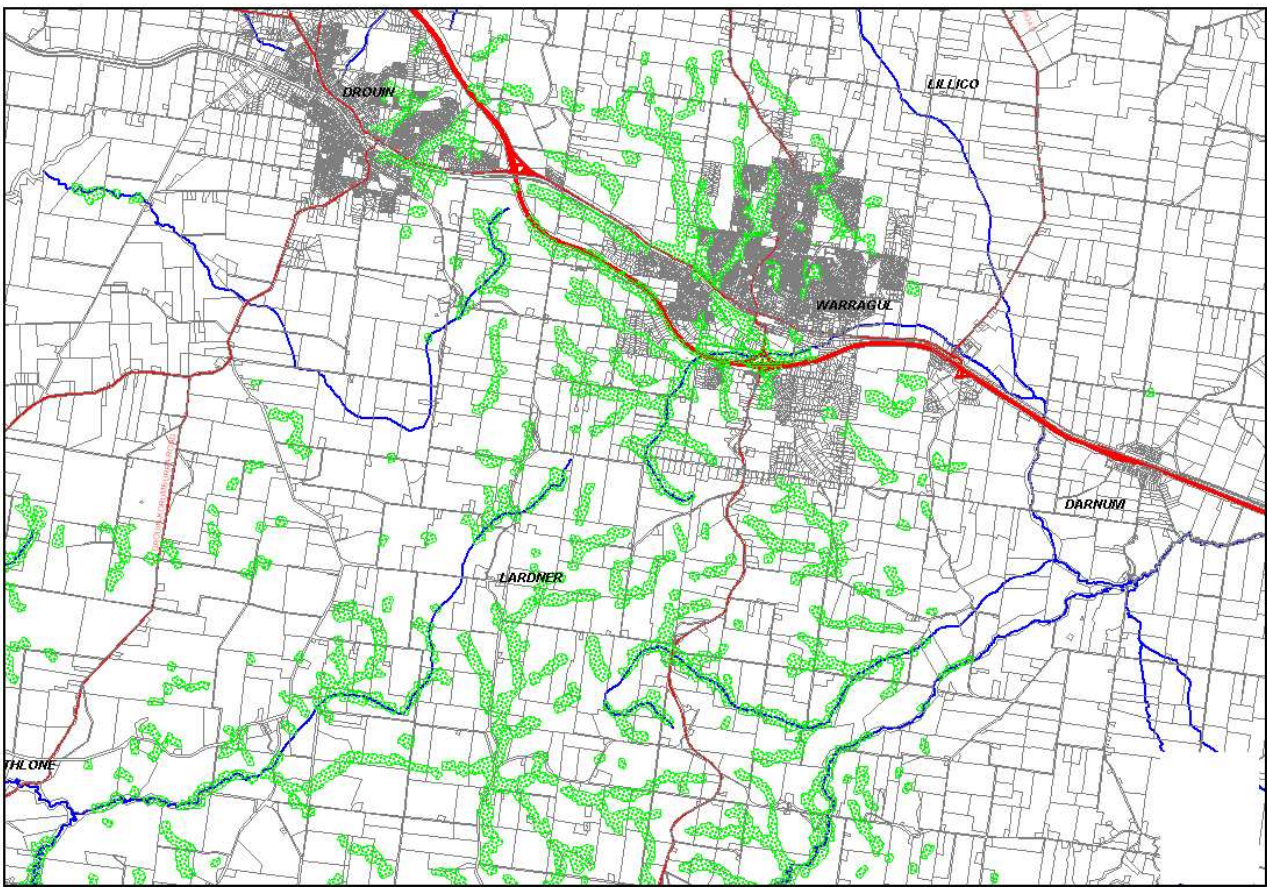


## REFERENCE DOCUMENT

# GIANT GIPPSLAND EARTHWORM ENVIRONMENTAL SIGNIFICANCE OVERLAY



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## **Acknowledgements**

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## **1.0 Introduction**

### **1.1 Reference Document Objective**

This Reference Document has been incorporated into the Baw Baw Planning Scheme provide information to proponents, landholders, planners and consultants on Giant Gippsland Earthworm planning matters and conservation requirements, including details on legislation and planning provisions, ecology and habitat features, threatening processes, implementation of the Environmental Significance Overlay, preparation of a Giant Gippsland Earthworm Land Management Plan, a contingency plan for unearthed worms and survey standards for conducting a census for GGE and its habitat and for establishing a monitoring program.

### **1.2 Conservation Status, Legislation and Planning Provisions**

The Giant Gippsland Earthworm (GGE) is listed as a threatened species under both Commonwealth and State legislation and as an endangered species on the Department of Sustainability and Environment's *Advisory List of Threatened Invertebrate Fauna in Victoria – 2009*. The species is also listed as protected wildlife under the *Wildlife Act 1975*.

Under Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999*, the GGE is listed as a vulnerable species. This legislation provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the *Act* as matters of national environmental significance. Actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for the Sustainability, Environment, Water, Population and Communities. The national Recovery Plan for GGE (Van Praagh and Yen 2010a) identifies a number of actions to protect the habitat of the species.

The Victorian *Flora and Fauna Guarantee Act 1988 (FFG Act)* is the key piece of legislation for the conservation of threatened species and communities and for the management of Potentially Threatening Processes in Victoria. A permit issued under the *FFG Act* may be required for development that may impact on GGE and its habitat. Securing GGE populations or habitat from potentially incompatible land uses is listed as an objective within the revised Action Statement for the species (DSE 2011).

Under Victoria's *Planning and Environment Act 1987*, due consideration for the conservation requirements of threatened species such as GGE is required. The State Planning Policy Framework includes the following objective for planning in Victoria (VC37):

- *To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.*

Clause 12.01-1 of the State Planning Policy Framework – *Protection of habitat* also includes the following objectives:

- *Assist with the conservation of the habitats of threatened and endangered species and communities,*
- *Address potentially threatening processes identified under the Flora and Fauna Guarantee Act 1988,*

This policy states that planning should help to protect the health of ecological systems and the biodiversity they support (including ecosystems, habitats, species and genetic diversity) and conserve areas with identified environmental and landscape values. It also states that Potentially Threatening Processes listed on Schedule Three of the *FFG Act* should be addressed. Those relevant to the conservation of GGE include:

- *Alteration to the natural flow regimes of rivers and streams;*
- *Habitat fragmentation as a threatening process for fauna in Victoria; and*
- *Increase in sediment input into Victorian rivers and streams due to human activities.*

Clause 21.03-2 of the Local Planning Policy Framework – *Environmental Management and Values* includes the following objective:

- *Protecting and further developing the Shire's wealth of natural attributes, including its tall Ash forests with shady fern gullies and cool mountain streams, its undulating alpine herbfields and its leafy reserves and parks.*

Clause 21.07-2 of the LPPF – *Biodiversity* includes the following objectives:

- *To protect and manage native flora, fauna and habitats across the Shire.*

The development of an Environmental Significance Overlay for GGE specifically addresses this policy by protecting and managing populations and habitat of the species.

Clause 22.03-3 of the Local Planning Policy Framework – *Use and development of land for conservation purposes* includes the following objectives:

- *To use and manage land that has substantial natural attributes for the conservation of vegetation, habitat, flora and fauna,*
- *To ensure that the conservation values of the site are enhanced and that environmental management plans are implemented,*
- *To ensure that design, siting and location of all development does not affect water quality or habitat.*



This policy applies to the use or development of land within the Farming Zone which has not been cleared of native vegetation. Remaining native vegetation within the Farming Zone is restricted mostly to stream and waterway environments which also represents potential habitat for GGE. The implementation of this provision would indirectly assist with the protection of habitat for GGE within the Farming Zone.

## 2.0 Giant Gippsland Earthworm Ecology and Biology

The Giant Gippsland Earthworm (*Megascolides australis*, McCoy) is one of the largest known earthworms in world, with an average length of 80 cm, a diameter of 2 cm, 300-500 body segments and weighing up to 400 g (DSE 2011, Van Praagh 1992; 1994). The colour of the worm is purple for the front third, including the head, and pinkish-grey for the remaining two-thirds of the body (DSE 2011) (see Fig. 1 and 2).

The GGE is endemic to South and West Gippsland, being restricted to approximately 40,000 hectares in an area bounded by the districts of Loch and Korumburra in the south, Warragul and Drouin in the north (Brandy Creek and Buln Buln) and Mt Worth in the east (Smith and Peterson 1982; Van Praagh and Yen 2010a, DSE 2011) (Fig. 3). The Victorian Biodiversity Atlas identifies records of GGE as far south as Archies Creek. This and several other records in the vicinity of Blackwood Forest and Glen Forbes remain unsubstantiated to date. (Van Praagh and Yen 2010a) (Fig. 3). Within this distribution range, suitable habitat for GGE is restricted to relatively small areas (10-2500 m<sup>2</sup>); generally in moist, blue-grey clay soils on flats near the banks of streams or along soaks and watercourses on south or west-facing slopes. The species lives in complex system of permanent burrows that extend to around 1.5 m in depth (Van Praagh and Yen 2010a; DSE 2011).

The GGE is now found almost entirely on privately owned land used predominantly for dairy production or grazing. Although there are attributes of the habitat of GGE that still remain unknown, information collected date indicates that suitable habitat for the species results from a combination of several interrelated factors, including slope, micro-topography, aspect, soil properties and underground hydrological processes (Van Praagh *et.al.* 2007).

Aspects of the biology and ecology of the GGE render the species vulnerable to threatening processes (Van Praagh 1992, McCarthy *et al.* 1994). These aspects include the species' limited ability to disperse through the landscape, its low rates of reproduction and subsequent recruitment and highly fragmented nature of habitat. These aspects also indicate that present-day populations are likely to have been isolated for significantly long periods of evolutionary time, potentially evolving as distinct genetic entities. Recent genetic investigations support this pattern of population isolation, with neighbouring GGE colonies examined having distinct genetic profiles (Woods 2006).

GGE is hermaphroditic (having both male and female gender parts), with breeding occurring predominantly in spring and summer (September to February). Large amber-coloured egg cocoons are laid in chambers branching from the adult burrow at an average depth of 22 cm. Only one embryo is found in each egg cocoon, which is thought to take over 12 months to hatch (DSE 2011). The species remains underground, feeding on root material and organic matter in the soil.



(Photo: Greg Hollis)

Fig. 1. Giant Gippsland Earthworm, showing Dark purple head grading into a pink-flesh colour for the rest of the body.



(Photo: Kurt Pitts)

Fig. 2 Example of a large Giant Gippsland Earthworm

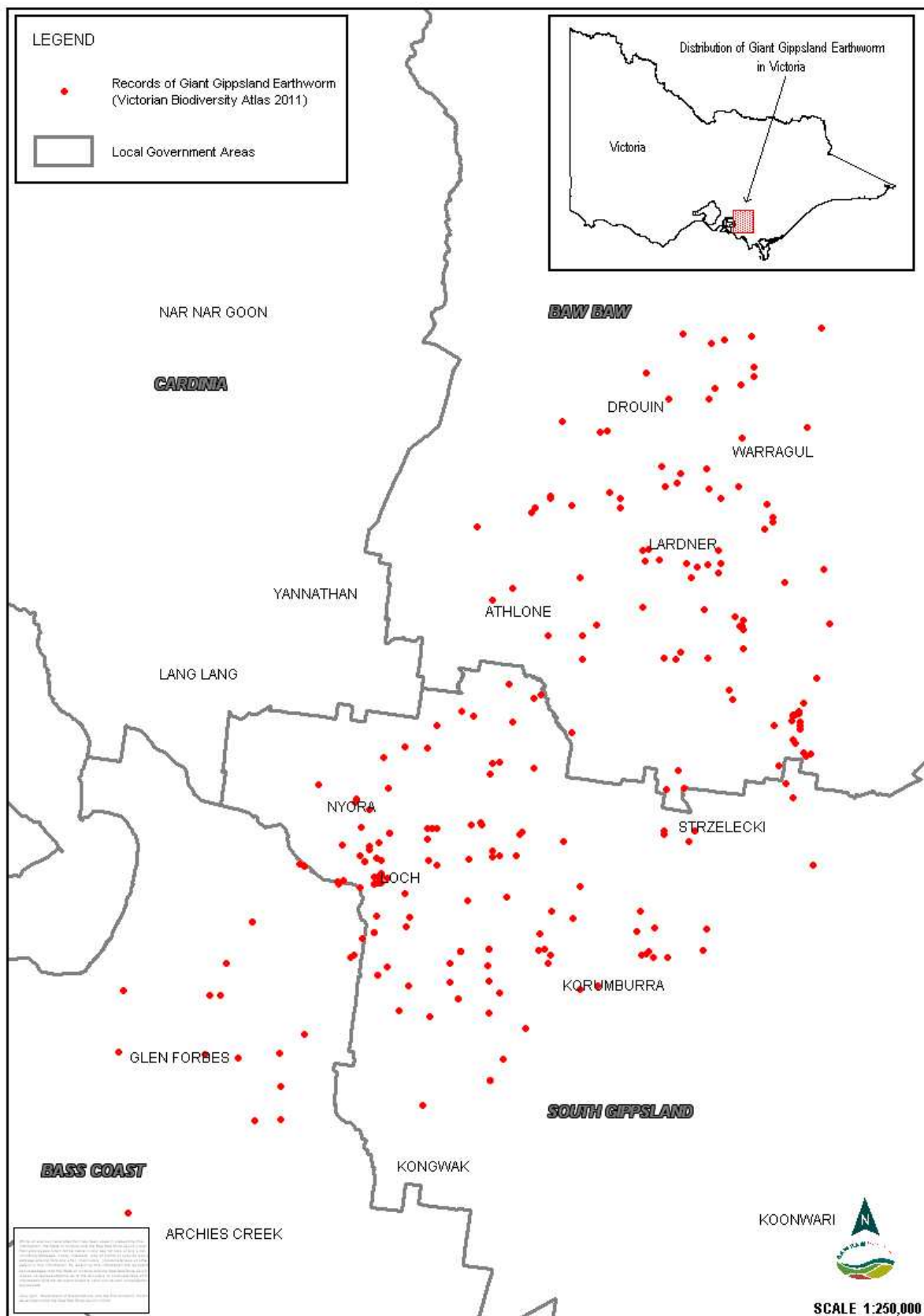


Fig. 3. Location of Giant Gippsland Earthworm records (Victorian Biodiversity Atlas).



The number of individuals within a population can vary, with the amount of available contiguous habitat likely to be the most limiting factor. In some instances, only one or two individuals have been observed at a site, although where suitable habitat is more extensive, larger populations have been found. The largest known population of GGE was uncovered at Loch Hill during the translocation of the species threatened by road construction where over 800 individuals were recovered from an area of approximately 2500 m<sup>2</sup> (Van Praagh *et. al.* 2002).

Further detail on the biology, ecology and habitat requirements of GGE can be found in Van Praagh and Yen (2010a) and DSE (2011).

### **3.0 Threats to Giant Gippsland Earthworm**

#### **3.1 *Pre-European Settlement***

There is no historical information on GGE populations before vegetation was cleared from the west and south Gippsland region during European settlement, nor are there any details relating to the acknowledgment or usage of GGE by the local indigenous people of the area.

#### **3.2 *European Land Management***

Extensive forest-clearing and establishment of exotic pastures followed the arrival of Europeans to the Gippsland area. The continued presence of GGE within areas cleared and developed for agriculture indicates that the species has some degree of tolerance to disturbance (Van Praagh & Hinkley 1999). However, broad-scale development for agriculture appears to have had some affect on the species given the number of anecdotal reports suggesting many earthworms were killed during clearing and development activities (Barrett 1931, 1935; Smith & Peterson 1982) and the species breeding ecology, dispersal characteristics and fragmented distribution suggest that there may be unknown longer-term negative impacts and consequences of agricultural land management practices on the species (Van Praagh and Yen 2010a).

Other impacts of agricultural practices on GGE populations have been derived from information known about other earthworms similar to GGE which do not survive vegetation clearance (Van Praagh and Yen 2010a).

Surveys conducted for GGE to date have detected a high proportion adults compared to juveniles, indicating that little recruitment into populations occurring. If this is the case, populations of GGE may not be sustainable in the long-term as they may comprise mostly of long-lived adults that may become extinct unless recruitment occurs (Van Praagh and Yen 2010a).

#### **3.3 *Threatening Processes***

The presence of GGE within the agricultural systems throughout its distribution range indicates that the species may have adapted to survive quite well under improved pastoral systems providing certain threatening processes are absent or limited.

Key threats to GGE have been identified by Van Praagh and Yen (2010a) and DSE (2011), although Van Praagh and Yen (2010a) note that not all threatening processes operating on GGE are known or understood. There also may be multiple and interacting factors that may threaten GGE and its habitat. These threats include:

1. Physical disturbances to soil (e.g., road and dam making, ploughing, urbanisation),
2. Altered hydrology (e.g., changes to water table, flood regimes and drainage patterns),
3. Chemical disturbances (e.g., use of fungicides and pesticides, effluent),
4. Extreme Weather or Climate change.

Below is a summary of discussion on threatening processes to GGE provided by Van Praagh and Yen (2010a).

### **3.3.1 Key Threats**

#### **Soil Disturbances**

Physical damage to individual earthworms and egg cocoons can occur through activities that result in disturbances to the soil profile, including mechanical earthworks such as excavations, road construction, dam building and cultivation. GGE generally occurs within the top 1.5 m of the soil profile at an average depth of 0.5 m, while egg cocoons are found within 40 cm of the soil surface. When soil conditions are moist or wet, GGE can be found just under the soil surface and are therefore vulnerable to shallow earthworks.

Other physical disturbances to soil can also impact on GGE indirectly by influencing drainage characteristics (see altered hydrology) and earthworm burrow systems through soil compaction and pugging from stock or machinery use.

#### **Altered Hydrology**

Proximity to water and soil moisture is extremely important in governing the distribution of and movement of GGE. Alteration to drainage and water table characteristics is considered one of the most serious threats to GGE populations. Other indirect disturbances to hydrological conditions adjacent GGE habitat can also have adverse impacts by reducing or increasing water flows within the habitat of GGE. For example, such disturbances can occur as a result of inappropriate subdivision and road construction design in the vicinity of GGE habitat.

Establishment of plantations and dense revegetation within or adjacent to GGE habitat may also be detrimental to the species. Newly established plantations or regenerating eucalypt forests are known to significantly alter hydrological regimes by reducing catchment water yields in the first two to three decades of growth due to high transpiration rates of growing trees.

## **Chemical Disturbances**

There is no direct information on the potential impact of chemicals on GGE or its habitat. However, there is information that examines the effects of chemicals on other earthworm species from which to gain an understanding of how chemicals may impact on GGE. Fungicides, fumigants and insecticides are known to be very toxic to earthworms, whilst herbicides have been noted to have low toxicity to earthworms when used at the prescribed rates. The effect of chemicals on earthworm populations is also known to persist after residues are no longer detectable in the soil.

Application of fertiliser in the form of nitrogen, superphosphate and organic inputs can have a beneficial effect on earthworm populations by increasing plant production and soil organic matter. Responses to fertiliser inputs by earthworms, however, may vary depending upon the preference by species for specific conditions of soil PH. Information available on preference by earthworms for particular soil PH conditions indicate that soils with a PH of 7 are generally preferred. Continued use of ammonium-based fertilisers may lead to soils becoming too acidic and therefore could be detrimental to earthworm populations.

## **Extreme Weather or Climate Change**

The confinement of GGE to suitably moist habitats in the vicinity of creek banks, soaks and south-facing hill slopes indicates that the species is likely to be sensitive to extreme weather, such as drought, or permanent changes to cycles of temperature and rainfall through climate change. Declines in precipitation in the vicinity of the distribution of GGE from the late 1990s through to 2010, and subsequent drier soil conditions, appear to have resulted in both declines in populations of GGE as well as lower densities of the earthworm within extant populations (DSE 2011).

## **4.0 Planning Matters**

### ***4.1 Giant Gippsland Earthworm Distribution Model***

Prior to the preparation of an Environmental Significance Overlay for GGE, Baw Baw Shire Council used the Department of Sustainability and Environment's (DSE) GGE 'biosite' (a spatial layer identifying the distribution range of the species) to identify planning permit applications that are located within the distribution range of GGE and therefore require further planning consideration. However, the use of this biosite and associated GGE data records still resulted in some inconsistent planning decisions being made when determining if a planning application is located within suitable or unsuitable habitat for species, or if a site evaluation for GGE should be undertaken as part of the planning process.

In 2009, the DSE commissioned the development a GGE distribution model (White *et al.* 2011). This distribution model uses presence-only modelling (Maximum Entropy) and examine 80 physiographic, climatic, radiometric and spectral variables to identify localities in the landscape that are most likely to contain suitable habitat for GGE. Information on the identity of suitable GGE habitat derived from this model represents a significant advancement on the basic level of information provided by the DSE biosite. The completed distribution model uses a 95% habitat threshold, resulting

in modelled localities (polygons) that comprise 95% of data records used to derive the distribution model. This distribution threshold was selected by the GGE Recovery Team to best capture the preferred habitat of GGE and to provide information to enable informed planning decisions about the protection of key habitat for GGE.

## **4.2 Environmental Significance Overlay Preparation**

Both Commonwealth and State threatened species legislation and state and local Planning Provisions require planning consideration be given to the protection and management of GGE and its habitat. Prior to the preparation of the GGE distribution model (see Section 4.1), no statutory planning mechanism existed that identified when works proposed on a planning permit might impact negatively on the conservation requirements of GGE.

The line work derived from the GGE distribution model has been used as the baseline information to prepare an Environmental Significance Overlay (ESO) for GGE. Preparation of the ESO also involved alterations to the model line work to reflect existing developed areas and protection buffers currently applied to development applications involving GGE habitat. These alterations included:

- excision of modelled localities from all residential (Residential 1 Zone) and industrial parcels less than 8000 m<sup>2</sup> within the urban growth zones of Warragul and Drouin,
- excision of modelled localities from existing developed parcels of lands (e.g., government roads) within the urban growth zones of Warragul and Drouin, subject to GIS assessment and/or site evaluation, and
- addition of a 30 m protection buffer applied to the distribution model line work.

Within the urban growth zones of Warragul and Drouin, areas of potential suitable habitat for GGE as identified by the distribution model were retained within public open space, reserves, urban floodway zones and undeveloped residential and industrial land parcels greater than 8000 m<sup>2</sup>. The distribution model for GGE remained unchanged within areas outside the urban growth zones. Figure 4 presents the GGE ESO in Baw Baw Shire following the alterations made to the GGE distribution model identified above.

## **4.3 Environmental Significance Overlay Practice Note**

Proposed buildings or works located within the Environmental Significance Overlay (ESO) for GGE will be subject to the requirements of the ESO schedule, including objectives to be achieved, application and referral requirements and decision guidelines. Because over 90% of the ESO for GGE is located within 100 m of a waterway where existing planning provisions under the *Planning and Environment Act 1987* and *Water Act 1989* may require a planning permit for buildings or works, it is expected that only a small number of additional development applications will require a planning permit (see below).

Schedule 4 to the ESO contains an exemption from requiring a planning permit for proponents that have prepared a GGE Land Management Plan to the satisfaction of the Department of Sustainability and Environment and the responsible authority (see section 4.3.4). Existing exemptions for buildings and works under clause 42.01-3 to the ESO and under clauses 62.02-1 and 62.02-2 for Uses, Buildings, Works, Subdivisions and Demolition continue to apply. Existing entitlements to undertake agricultural practices within the Farming Zone remain unchanged.

Although there will be no requirement for proponents to acquire a planning permit for development proposals that may impact on GGE outside the boundaries of the GGE ESO, it must be noted that there may be other planning provisions that trigger the requirement for a planning permit under the *Planning and Environment Act 1987 (PE Act)* or the *Water Act 1989*. It must also be noted in this Reference Document that compliance under the *PE Act* does not exempt proposed development from other State and Commonwealth legislation obligations. For example, under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, developers are still required to seek approval from the Commonwealth Minister for Environment (currently the Minister for Sustainability, Environment, Water, Population and Communities) for activities that may impact negatively on the conservation requirements of nationally listed threatened species or communities prior to commencement of work. A permit may also be required under the State *Flora and Fauna Guarantee Act 1988 (FFG Act)*.

It is anticipated that the conservation requirements of GGE will be addressed through the GGE ESO for most development proposals. However, it is possible that the GGE ESO may not capture potential negative impacts resulting from a small proportion of development proposals that are located outside the ESO. For example, a development proposal involving the establishment of a timber plantation may not be located within the GGE ESO, but due to the scale of potential earthworks and plantings, may impact indirectly on the conservation requirements of GGE. For development proposals such as this it is considered that other legislation and planning provision requirements will flag and capture the requirement for further planning consideration regarding GGE conservation. In cases such as this, Council may also utilise its own discretionary powers to request assessment of the impact of a development proposal on GGE conservation requirements. It is recommended that for development proposals such as this that pre-planning advice be first sought from Council, the Department of Sustainability and Environment or the Commonwealth Department of Sustainability, Environment, Water, Population and Communities.

#### **4.3.1 Assessing the Impact of Proposed Development on Giant Gippsland Earthworm**

When a proposed development is located within the Environmental Significance Overlay (ESO) for GGE, in addition to the application requirements of the ESO schedule, proponents should attempt to provide answers to the following questions to evaluate potential impact on GGE and its habitat:

1. Does the proposed development involve physical disturbance to the soil profile within or adjacent to the ESO (type and extent)?



2. Does the proposed development involve alterations to above and below ground hydrology or drainage characteristics within or adjacent to the ESO (type and extent)?
3. Does the proposed development involve the substantial use of fungicides, herbicides or pesticides, or the release of effluent within or adjacent to the ESO (type and extent)?
4. How much of the ESO does the proposed development impinge upon (hectares, square metres)?
5. Does the proposed development involve removal or planting of vegetation (type and extent)?
6. What is the significance of any GGE populations identified within or adjacent to the proposed development location (e.g., population extent, size, genetic distinctiveness, scientific importance and overall ecological value)?

#### **4.3.2 Mitigating the Impact of Proposed Development on the Habitat Requirements of Giant Gippsland Earthworm**

Mitigating for negative impacts to populations and habitat of GGE arising from proposed development should involve consideration of measures to avoid, minimise and/or offset such impacts. Proposed development should first consider measures to avoid impact on locations known to contain suitable habitat for GGE, as identified in the ESO for the species. This might include adjustments to proposed development to relocate or re-align works activities or layout design so as to avoid impact on GGE (e.g., re-alignment of pipelines, cable routes or roads, positioning of GGE habitat in public open space).

If impacts to GGE cannot be avoided, measures to minimise impacts should be examined. This might include changes to the development design so as to result in only minor impacts to GGE populations or habitat (e.g., works that minimise disturbance to soil, creek bank integrity and hydrology, direct drilling under GGE populations, low density planting of shrubs and grasses rather than higher density of trees). The level of impact by a proposed development on GGE will also be influenced by the conservation significance of the GGE population present at a site. Factors used to determine the conservation significance of a GGE population might include population extent, size, genetic distinctiveness, scientific importance and overall ecological value. Development applications that identify measures to minimize impact on GGE may also require approval from the Commonwealth Environment Minister under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* before the issue of a planning permit.

If impacts to GGE cannot be avoided or minimised, consideration of measures to offset the impact of development on GGE could be explored. Offset measures that might be considered include:

- (1) provision of long-term security to a population of commensurate significance whose habitat is currently not managed for conservation, via a conservation covenant or other on-title agreement;
- (2) provision of funding that would be allocated to increase the area of land currently reserved and managed for conservation of GGE; and

(3) provision of funding that would be allocated to research for improving knowledge on the species conservation requirements and threatening processes; and

(4) provision of funding that would be allocated to experimental research for improving knowledge on translocation of GGE populations.

Consideration of opportunities to mitigate through an offsetting mechanism would be influenced by the conservation significance of the GGE population present at a site and the extent to which it will be impacted on by a proposed development. As the responsible authority, Baw Baw Shire Council would seek advice from the Department of Sustainability and Environment or the Commonwealth on the suitability of any proposed mitigation measures.

#### **4.3.3 Giant Gippsland Earthworm – Protected Wildlife**

The ESO for GGE identifies localities in the landscape that are most likely to contain suitable habitat for GGE. Because this information is public knowledge, this Reference Document notes and emphasises that GGE is a protected species under Victorian and Commonwealth legislation (*Wildlife Act 1975*; *Flora and Fauna Guarantee Act 1988*; *Environment Protection and Biodiversity Conservation Act 1999*). As a result, permits and approvals are required from both levels of government to interfere with GGE and or its habitat. Substantial penalties may apply for non-adherence.

Figures 5 and 6 below present planning pathways for appraisal of development proposals or permit applications that may impact negatively on conservation requirements of GGE.

#### **4.3.4 Planning Permit Exemption – Approved Land Management Plan**

The schedule to the ESO specifies that a planning permit will not be required to construct a building or construct or carry out works if a GGE Land Management Plan has been approved by the Department of Sustainability and Environment and the responsible authority. This Land Management Plan must contain the following information to be considered for approval by the relevant authorities:

- Summary of the conservation status of GGE and details on legislation (Commonwealth and State) and planning provisions relating to the protection and management of the species,
- Description of the purpose for which the subject land is to be used,
- Clear and concise details of buildings and works proposed to be undertaken, particularly in relation to any proposed ground disturbance or changes to drainage or hydrology,
- Detailed scale map or recent aerial photograph of the subject land indicating north and showing:
  - property boundaries and dimensions;
  - proposed works site(s);

- all waterways, including creeks, streams, soaks, seepages or wetlands within and adjacent works site;
- the location of the GGE ESO
- Results of any surveys undertaken for GGE by an earthworm expert,
- An assessment of impact of proposed land use on Giant Gippsland Earthworm. This assessment must be conducted by a suitably qualified person, and be in accordance with Baw Baw Shire's Giant Gippsland Earthworm Reference Document,
- Details on how the proposed use of the land has attempted to avoid, minimise or offset negative impact on Giant Gippsland Earthworm or its habitat.

## **5.0 Accidental Unearthing of Giant Gippsland Earthworm**

Undetected populations of the GGE may still be accidentally unearthed during works for permitted development after assessment and planning for GGE have been undertaken. Such incidents may occur both within and outside the ESO for GGE. Unearthing incidents may occur because the distribution model upon which the ESO has been derived uses a 95% habitat threshold (see Section 4.1) and that field survey techniques used to sample for populations and habitat of GGE (see Section 6) do not have a 100% detection probability. The following guidelines have been prepared in consultation between the GGE Recovery Team and Department of Sustainability and Environment to manage incidents involving the accidental unearthing of GGE.

### **5.1 Guidelines**

In the event of the accidental unearthing of GGE, the following guidelines should be implemented:

- 1 All works must cease within a 50-metre perimeter around the location of the unearthing incident,
- 2 The Site Supervisor must be alerted to the incident,
- 3 The Site Supervisor must establish the unearthing location as an 'incident site' by securing the boundary and preventing any movement of machinery into the site or any further disturbance to the soil,
- 4 The Site Supervisor must ensure that biodiversity staff from the Department of Sustainability and Environment (DSE) regional office at Traralgon are contacted within 24 hours regarding the incident (Ph: 03 51722111).
- 5 The Site Supervisor must ensure that any earthworms unearthed at a development site and appearing uninjured are left covered with a 10cm layer of moist soil prior to a decision being made about relocation or collection,
- 6 The Site Supervisor must ensure that an Incident Report provided in this Reference Document (Appendix 1) is completed and sent to the Agency

responsible for authorising the works (e.g. Council, DSE, DPI) within 24 hours of the incident.

- 7 The Site Supervisor must ensure that any uninjured earthworms identified as being suitable for relocation must be collected and relocated according to the protocols identified in this Reference Document (Appendix 2).

A subsequent assessment of the impact of works on an unearthed GGE population may be required by the authorising agencies (e.g. Council, DSE, DPI). Advice will be given on how to proceed with work activities as quickly as possible.

The GGE is listed under Commonwealth and State threatened species legislation and as native fauna under Victoria's *Wildlife Act* 1975. As a result, permits may be required to either remove animals or interfere with their habitat.

## **6.0 Survey and Monitoring Techniques for Giant Gippsland Earthworm Population and Habitat Assessment**

### **6.1 Survey Methodology**

Detection of GGE within the landscape is difficult because there are no obvious above-ground signs left behind by the worm. Due to the current lack of non-destructive sampling techniques, survey methods to detect GGE primarily rely on the use of direct excavation of soil quadrats and subsequent searching for earthworms or evidence of the presence of earthworms (Van Praagh 1994; Van Praagh and Yen 2010b). Excavation of soil quadrats, however, can result in disturbance to the worm and its habitat and risks injuring or killing individual worms or egg cocoons.

The location of GGE populations can also be detected on the surface of the ground without the use of soil quadrats. This technique involves walking over a site and listening for 'gurgles'; sounds heard when worms move within their wet burrows (Van Praagh 1994; Van Praagh and Yen 2010b). However, the success of this technique is likely to be variable depending upon seasonal conditions, weather, the density and activity of worms and the skill of the person listening for earthworm activity. This census technique is more often used as a non-destructive detection technique to support the use of soil quadrats when surveying for GGE (B. Van Praagh *Pers Comm.*).

The use of soil quadrats as the primary technique to detect GGE involves the excavation of quadrats (approximately 50 cm x 50 cm x 50 cm) by hand and looking for earthworms or signs of earthworms (Van Praagh 1994; Van Praagh and Yen 2010b). Earthworm signs include the presence of burrows, cast (waste material produced by the worms) or cocoons. The sampling interval of soil quadrats can vary depending on the local site conditions and the presence or evidence of earthworms or suitable habitat. More regular soil quadrat sampling can be undertaken at sites when there is evidence of earthworms (e.g., 10 m intervals). At sites where conditions are less suitable (e.g., waterlogged areas and hill-tops), sampling intervals can be greater (Van Praagh 1994; Van Praagh and Yen 2010b).

An assessment of GGE activity at a site can be undertaken using the following census techniques, listed in order of increasing probability of injury or damage to GGE or its habitat (Beverley Van Praagh *Pers Comm.*):

- Walking over the a site and listening for ‘gurgles’(defined above);
- Hand excavation of a set number of shallow soil quadrats (depending on size of site) looking for signs of activity. Burrows can usually be located within the top 20 cm of soil. Burrow density and moisture levels within burrows should be noted. Burrows can remain in the soil for long periods of time, even after an individual has died. Old, disused burrows are dry and often infiltrated with plant roots. Similarly, old cast material will have plant roots growing through and around it. Burrows that are actively being utilised by a worm are wet.
- If required, a smaller number of deeper quadrats (<1m) can be excavated to partially expose adults to look for evidence of breeding (e.g., swollen clitella, and presence of egg cocoons).

The use of other non-destructive sampling techniques are currently being investigated by the Department of Sustainability and Environment. This includes the potential use of a geophone (an acoustic listening apparatus) for detecting the presence of GGE without the requirement for excavation of soil quadrats.

## **6.2 Population and Habitat Monitoring**

The monitoring of a GGE population and its habitat may be requested at council’s discretion for proposed, large-scale developments (e.g., subdivisions, establishment of timber plantations) when GGE is known to be present, as identified in the schedule to the ESO. Although measures to avoid or mitigate for potential negative impacts to GGE will be required by planning permit for such developments, there is currently little information available in the literature that demonstrates the success of avoidance or mitigation measures as currently applied to the protection GGE populations. It is therefore important to evaluate the success of avoidance or mitigation measures implemented to protect GGE and its habitat in some cases.

The use of soil quadrats and listening for ‘gurgles’ (described in Section 6.1) are more suited for detecting the presence or absence of GGE rather than establishing more detailed information on population numbers of GGE at a site. However, the use of these census techniques could be structured into a grid format to enable systematic sampling of earthworm relative abundance over time. Such a methodology could be used monitor a population of earthworms over time and answer questions about population persistence, movement and distribution. However, the use of such a monitoring methodology could result in considerable disturbance to earthworms or habitat due to the excavation of soil quadrats. Consideration of the use of such a monitoring methodology, and subsequent grid-sampling density, should be critiqued carefully before implementation.

In addition to the types of questions that a population monitoring program might be trying to answer, factors such as the conservation significance, extent and density of a GGE population should be carefully considered before designing and implementing a

population monitoring program. For example, smaller sites, or those with small populations, would necessitate a more minimalist approach to monitoring whereas larger populations occurring over larger areas may withstand more rigorous (frequent) or invasive survey techniques. It may also be important, for example, to examine the breeding activity of earthworms at a site. The design of such a monitoring program in this case would be based on searches for breeding adults (e.g., adults with swollen clitella) during the breeding season of the species (September-December) or egg cocoons.

Based on the census techniques and monitoring considerations identified above, a monitoring program should generally occur at a site at least once a year, during winter or spring when GGE is most active (Beverley Van Praagh *Pers. Comm.*)

### **6.2.1 Population Monitoring Surrogate**

An alternative, less intrusive approach to population monitoring for fauna species is the use of a population surrogate such as habitat. Monitoring of habitat condition could be used as an indirect measure of population health and persistence. For GGE populations, the monitoring of soil condition (moisture and drainage characteristics) should be considered as a monitoring approach prior to utilisation of the disturbance-based sampling census techniques described above.

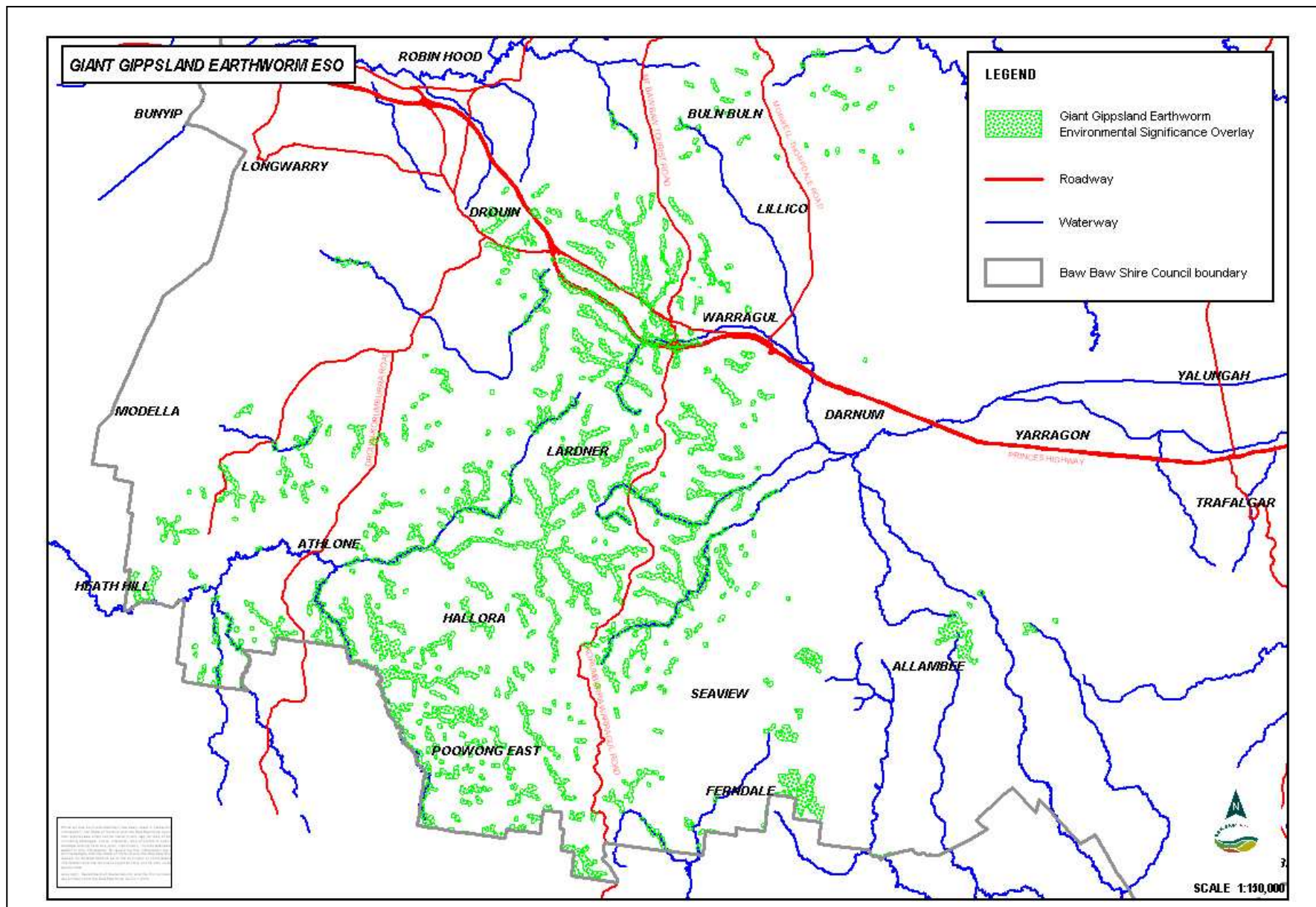


Fig. 4. Giant Gippsland Earthworm Environmental Significance Overlay in Baw Baw Shire.

# Giant Gippsland Earthworm Pre-planning Pathway

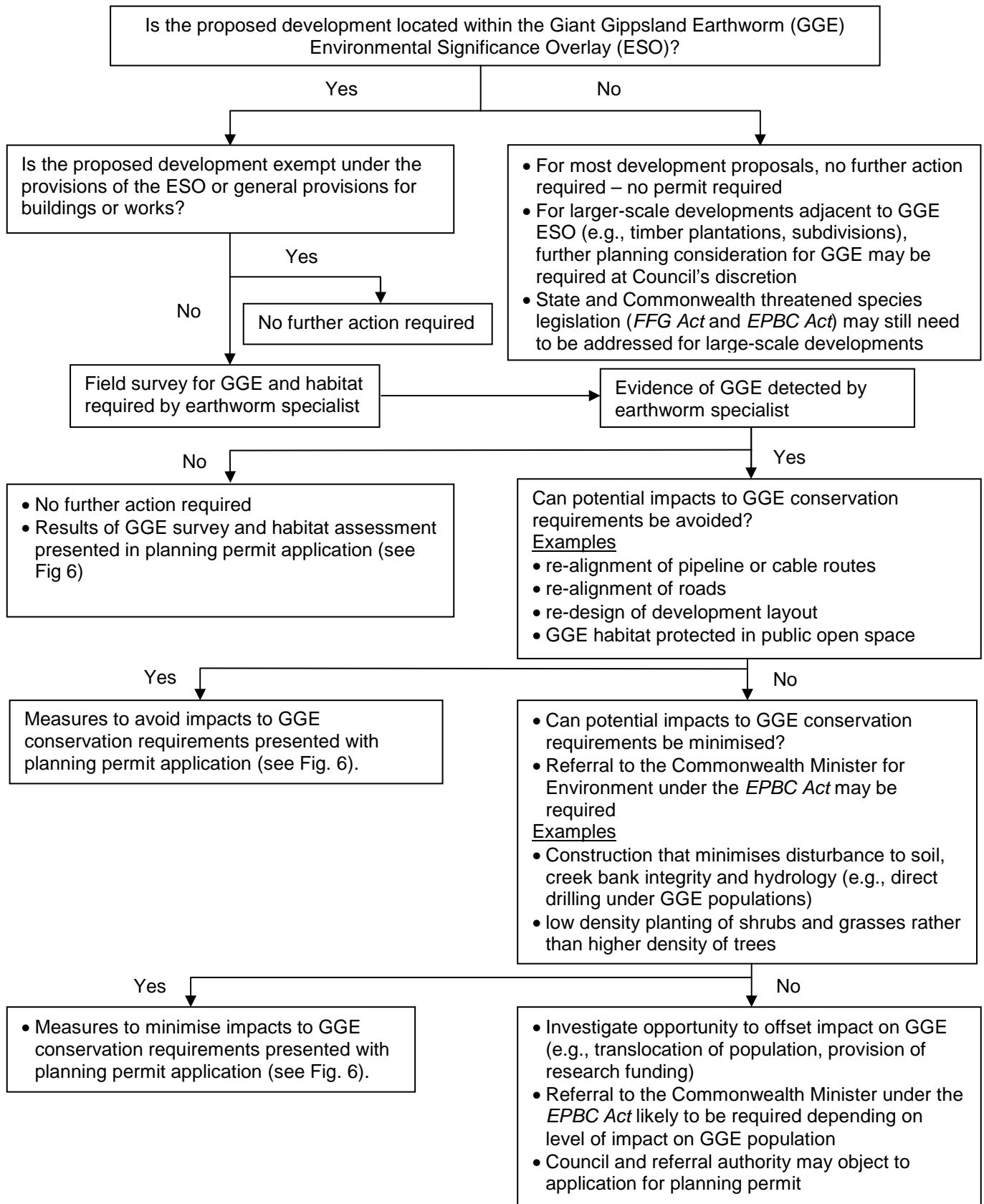


Fig. 5. Pre-planning pathway for assessing the impact of proposed development on the conservation requirements of the Giant Gippsland Earthworm.



# Giant Gippsland Earthworm Planning Permit Pathway

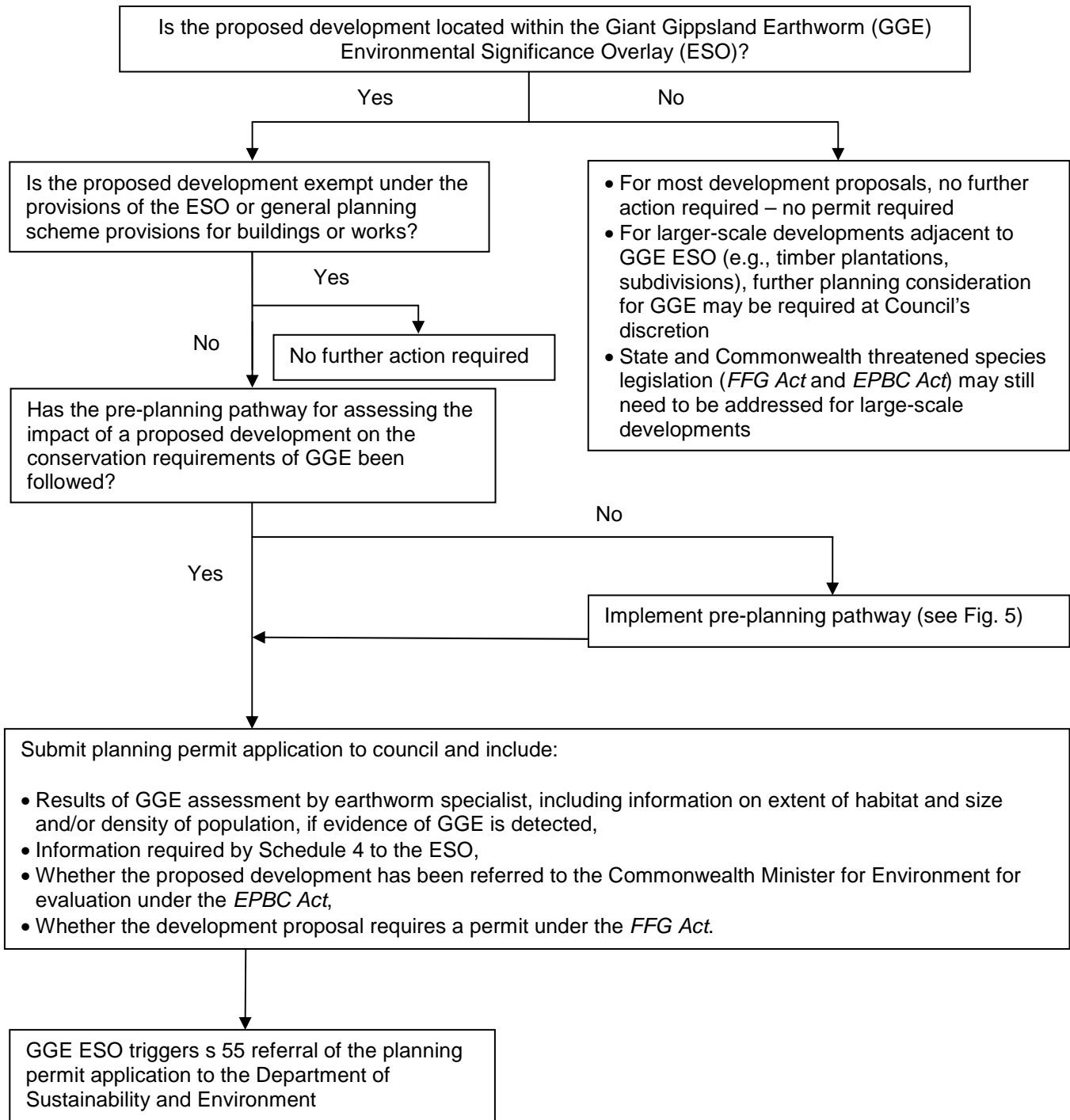


Fig. 6. Planning permit pathway for assessing the potential impact of a proposed development on the conservation requirements of the Giant Gippsland Earthworm.



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## Appendix 1. Incident report for the accidental unearthing of Giant Gippsland Earthworm.

### INCIDENT REPORT FOR THE ACCIDENTAL UNEARTHING OF GIANT GIPPSLAND EARTHWORM

Name of company/organisation:-----

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Name of contact:-----

Contact details:-----

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Date of incident:-----

Location of incident:-----

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Description of incident:-----

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Size of area from which Giant Gippsland Earthworm was unearthed:-----

Estimate of numbers of worms unearthed:-----

Estimate of number injured earthworms:-----

Estimate of number of uninjured earthworms recovered for relocation:-----



## **Appendix 2. Collection and relocation protocols for uninjured Giant Gippsland Earthworm.**

### **INSTRUCTIONS FOR RELOCATING UNEARTHED GIANT GIPPSLAND EARTHWORM**

Implementation of the following relocation instructions will ensure the best possible chance of survival for Giant Gippsland Earthworms (GGE) that have been accidentally unearthed and require placement back into the soil.

1. Collect all uninjured earthworms. GGE is fragile and must be handled with great care. They cannot support their own weight out of their burrows. They must always be carried in a horizontal position. They should never be held vertically and allowed to dangle as this always results in death.
2. If more than one earthworm is unearthed, they can be kept in a plastic container or esky with moist, cool soil with either wet hessian or newspaper positioned over the soil surface. Earthworms can be retained in such conditions for a short period of time (preferably less than one hour) whilst a relocation site is identified and prepared. If the weather is very warm (e.g., summer), earthworms should be relocated as soon as possible.
3. Earthworms should be stored in a shaded location prior to relocation being undertaken.
4. Relocate uninjured earthworms to a nearby site that will not be subject to earthworks. This site should have a moist, predominantly clay soil and must be located within the Environmental Significance Overlay for Giant Gippsland Earthworm and as close to the site from which unearthing occurred.
5. Dig a small trench to a depth of approximately 30 cm and at least as long as the earthworm. The earthworm should be placed within the trench along its length and gently covered with loose, moist soil to a depth of 10-20 cm. The removed pasture clods can then be placed gently on top of the trench.
6. Up to two earthworms can be placed in a single trench.
7. If the soil is dry, wet the trench. Watering may also be required in the following days, particularly during summer, or hot weather.

**Expert Advice on the relocation of Giant Gippsland Earthworm can be obtained from a Biodiversity Officer with the Department of Sustainability and Environment, Traralgon (ph. 03 51722111)**





**Appendix 3. Identification of Giant Gippsland Earthworm and their Habitat (Beverley Van Praagh)**

# **Identification of Giant Gippsland Earthworms and their habitat**

Beverley Van Praagh

May 2010

## Identification of Giant Gippsland Earthworms



**Adult size:** 80-150 cm long x 2 cm diameter

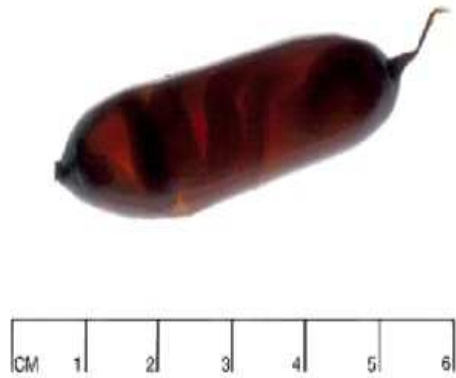
**Colour:** Dark purple head grading into pink-flesh colour

**Distinguishing marks:** 3 bands positioned about 1/3 down the body on the ventral side (underneath) the adult worm



## Identification of Giant Gippsland Earthworms *Cont-*

### Egg Cocoons



#### **Egg Cocoons:**

Large (5-9 cm), amber coloured eggs are deposited within the burrow system at an average depth of around 20 cm. They can be found all year round due to their long incubation period.





## Identification of Giant Gippsland Earthworms *Cont-*

### Cast and Yabby Mounds



#### **Cast:**

GGE leave their waste product (cast) below ground within their burrows.

**Yabbies** excavate large, mounds of soil (chimney) surrounding the entrance to their burrows (see below). They are often mistaken for GGE casts.



## Identification of Giant Gippsland Earthworms *Cont-*

### Burrows & Gurgles



#### **Burrows**

Burrows are usually found within the top 1.5m of soil. They are around 2 cm in diameter. Wet burrows indicate a worm is using the burrow. Note the annuli (rings) imprint on the inside of the burrow.

**Gurgles:** The worms can often be heard moving in their burrows if disturbed by vibration (such as walking over them). The sound is like water draining from a bath.





## Identification of Giant Gippsland Earthworms *Cont-*

### Habitat

#### Habitat

GGEs can be found in a variety of habitats. One of the most important habitats is the clay banks of streams and drainage channels. They are often associated with underground springs and can also be found near soaks and gullies or wet slopes with a southerly or westerly aspect.



## Identification of Giant Gippsland Earthworms *Cont-*

### Habitat & Soils

#### **Habitat continued**

While most GGE are found in cleared pasture, they can sometimes be found in wetter, open areas of native vegetation and also along roadsides.

#### **Soils**

GGE are generally found in the deep blue-grey clay soils and red brown clay loam. GGE are absent from sandy soils and floodplains. Soil depth is usually greater than 1m where GGE are found.