AGENDA APPENDIX

Council Meeting

Wednesday 25 May 2016

AGENDA ITEM FOR SEPARATE DISTRIBUTION TO COUNCILLORS AND EXECUTIVE LEADERSHIP TEAM DUE TO DOCUMENT SIZE.

THE ITEM IS ACCESSIBLE VIA THE COUNCIL WEBSITE OR BY CONTACTING COUNCIL ON 03 5662 9200.

E.7 PLANNING SCHEME AMENDMENT C107 - GIANT GIPPSLAND EARTHWORM ENVIRONMENTAL SIGNIFICANCE OVERLAY - ADOPTION

Appendix 1 – Giant Gippsland Earthworm Environmental Significance Overlay Reference Document (Sept 2015)

GIANT GIPPSLAND EARTHWORM ENVIRONMENTAL SIGNIFICANCE OVERLAY REFERENCE DOCUMENT

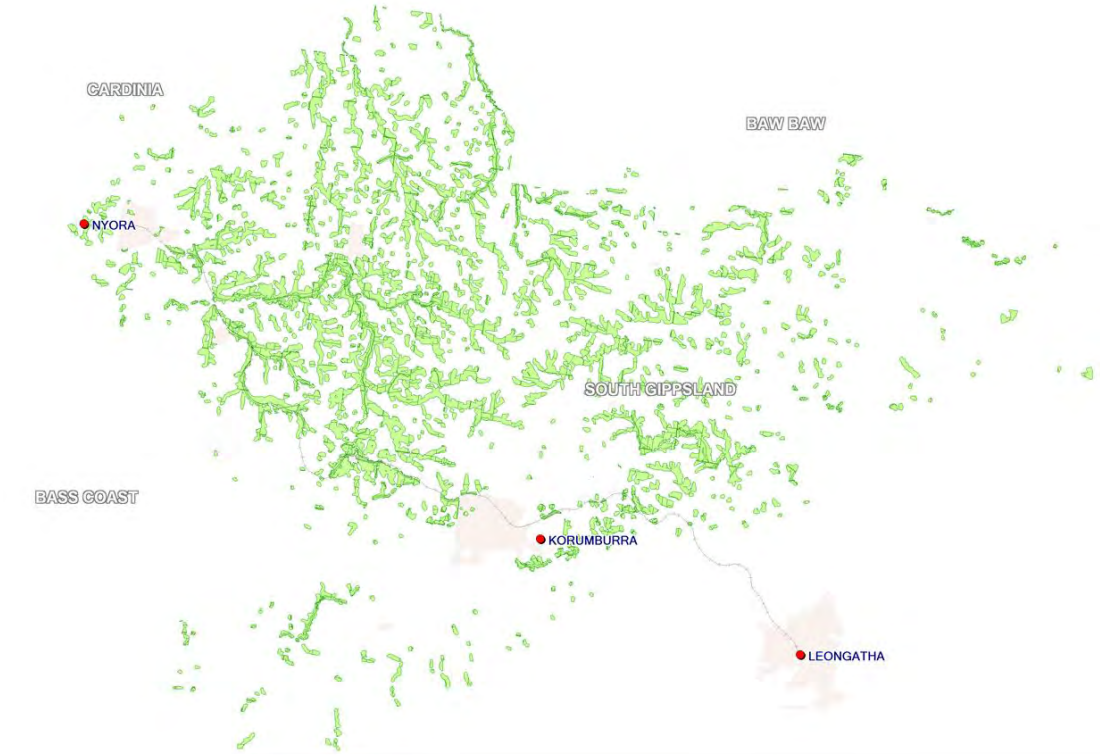


Figure shows Giant Gippsland Earthworm habitat in South Gippsland

September 2015

Acknowledgements

Great thanks to Greg Hollis, Environmental Scientist, Baw Baw Shire Council for preparing the original document which was used as a base for this version. Thanks also to Dr. Beverley Van Praagh and Susan Taylor for their research and assistance in developing the Reference Document. Members of the Giant Gippsland Earthworm Recovery Team and Department of Environment, Land, Water & Planning (DELWP) for providing information and awareness.

Contents

1.0 Introduction

1.1 Objective

This document supports the Environmental Significance Overlay (ESO) provisions to inform Giant Gippsland Earthworm (GGE) planning considerations and conservation requirements. The intent is to ensure that responses to GGE management are consistent. The document contains legislation, planning provisions, ecology/habitat features, threatening activity and what to do on site including a contingency plan for unearthed worms, survey standards for conducting a census for GGE, its habitat and establishing a monitoring program.

The ESO identifies early in the planning process when proposed works might impact on GGE and allow planning responses to be considered during discussions with the applicant or in a permit.

1.2 Conservation Status, Legislation and Planning Provisions

The Giant Gippsland Earthworm (GGE) is listed as threatened under Commonwealth and State legislation and an endangered species on the Department of Sustainability and Environment's *Advisory List of Threatened Invertebrate Fauna in Victoria – 2009*. The species is 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 the framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places of national environmental significance. Actions that have, or are likely to have a significant impact on those listed in the Act require approval from the appropriate Federal Government Minister. The National Recovery Plan for GGE (Van Praagh and Yen 2010a) describes actions to protect the habitat of the species.

In Victoria, the *Flora and Fauna Guarantee Act 1988* (*FFG Act*) is the primary legislation to conserve threatened species and manage potentially threatening processes. A permit may be required under the *FFG Act* for development that could impact GGE and its habitat. Securing GGE populations or habitat from potentially incompatible land uses is an objective within the revised Action Statement for the species (DSE 2011).

Victoria's *Planning and Environment Act* 1987 requires due consideration for the conservation requirements of threatened species such as GGE. A State Planning Policy Framework objective 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 biodiversity* has the following objective:

> "*To assist the protection and conservation of Victoria's biodiversity, including important habitat for Victoria's flora and fauna and other strategically valuable biodiversity sites.*"

This policy for this clause is set out in the Incorporated Document '*Permitted clearing of native vegetation – Biodiversity assessment guidelines'* (Department of Environment and Primary Industries, September 2013), which states that in relation to biodiversity, the SPPF's purpose is to;

"…*ensure that biodiversity is considered in strategic planning processes and that potential impacts from uses and developments on biodiversity are identified and appropriately managed. Strategic planning can include the use of zones and overlays to protect and conserve biodiversity*."

The objective of Local Planning Policy Framework cl21.06-1 *Biodiversity* is;

- To achieve a measurable net gain in the extent and quality of the Shire's biodiversity.

The protection of population and habitat created through the ESO satisfies this requirement. This overlay affects the use or development of land outside of intensive development areas identified as potential habitat. Much of this area is restricted to streams and waterways and steep, south facing slopes. Streamside habitat may or may not include remnant native vegetation. Provisions that aim to conserve riparian vegetation and waterways (clauses 21.07-2 *Land and catchment management*) would also indirectly assist with the protection of habitat for GGE. However, a modified planting scheme where revegetation of creek-banks is undertaken may be required to protect soil moisture around GGE habitat (See Fact Sheet 2 Guidelines for Revegetation and planting projects http://www.giantearthworm.org.au/sitefiles/fact-sheet2.pdf)

2.0 Habitat, Ecology and Biology

The Giant Gippsland Earthworm (*Megascolides australis*) is one of the largest known earthworms in the world. It averages 80 cm in length with a diameter of 2 cm but lengths of up to 2 m have been recorded. The worm is comprised of 300-500 body segments and weighs up to 400 g (DSE 2011, Van Praagh 1992; 1994). Its colour changes from purple for the front third, including the head to pinkish-grey for the remaining two-thirds of the body (DSE 2011) (Fig. 1 and 2). It is endemic to South and West Gippsland, occurring in around 40,000 hectares bounded loosely by Loch and Korumburra areas in the south, Warragul and Drouin in the north 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. Within this distribution range, suitable habitat for GGE is restricted to relatively small areas (10-2500 m^2); generally in moist, blue-grey clay soils on or close to the banks of streams or adjacent to soaks. They can also be found on steep 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 to date indicates that suitable habitat results from a combination of several interrelated factors,

including slope, micro-topography, aspect, soil properties and underground hydrological processes (Van Praagh *et.al.* 2007).

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

GGE is hermaphroditic (having both male and female gender parts) and breeds 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.

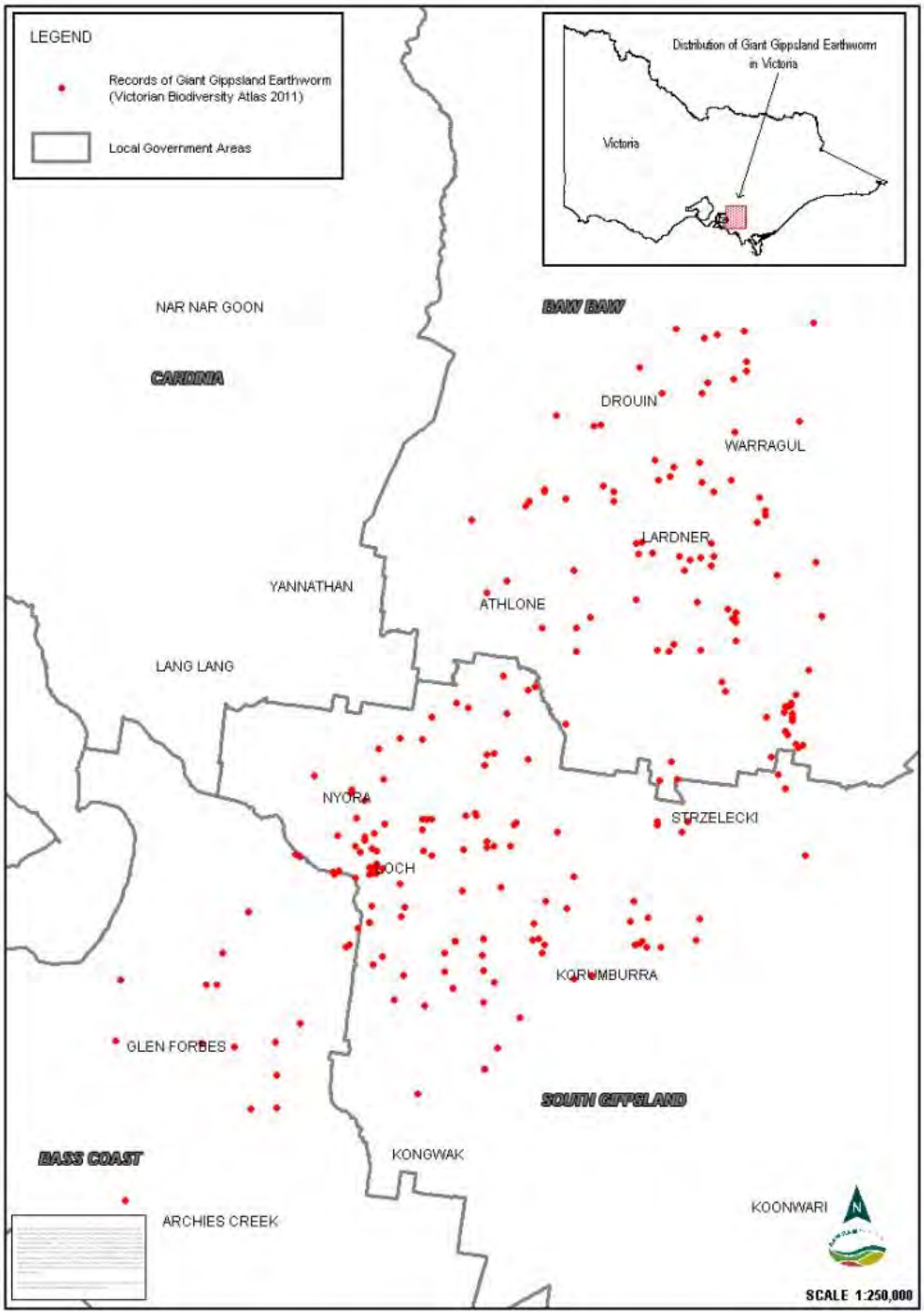
Figure 1: Giant Gippsland Earthworm, showing dark purple head grading into a pink-flesh colour for the rest of the body. (Photo: Greg Hollis)

The number of individuals within a population can vary significantly, primarily limited by the amount of available contiguous habitat. In some instances, only one or two individuals have been observed at a site but where suitable habitat is more extensive, much larger populations have been found. The largest known population of GGE was uncovered at Loch Hill during road construction where over 800 individuals were translocated from an area of approximately 2500 m^2(Van Praagh *et. al*. 2002).

Figure 2: Example of a large Giant Gippsland Earthworm (Photo: Kurt Pitts)

Figure 3: GGE habitat area in Jumbunna, south facing slope with terracettes (Photo: Beverley Van Praagh)

To date, surveys conducted for GGE have detected a high proportion of adults to juveniles, indicating 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).

Figure 4: Location of Giant Gippsland Earthworm records (Victorian Biodiversity Atlas).

3.0 Threats to Giant Gippsland Earthworm

3.1 Pre-European Settlement

No information on GGE populations is known prior to vegetation clearing from the West and South Gippsland region during European settlement, nor are there details relating to the acknowledgment or usage of GGE by the local indigenous people of the area.

3.2 Agricultural Effects

Extensive forest-clearing and establishment of exotic pastures resulted from the arrival of Europeans to the Gippsland area. The fact that GGE have a presence at all within areas cleared for agriculture indicates that the species has some degree of tolerance to disturbance (Van Praagh & Hinkley 1999). Anecdotal reports suggesting many earthworms were killed during clearing and development activities (Barrett 1931, 1935; Smith & Peterson 1982) indicate that broad-scale development for agriculture has impacted the species. Their breeding ecology, dispersal characteristics and fragmented distribution further suggest that unknown longer-term negative impacts and consequences of agricultural land management practices on the species (Van Praagh and Yen 2010a).

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

3.3 Threatening Processes

The distribution of GGE throughout agricultural areas suggests that the species may survive 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). It was noted that not all threatening processes are known or understood, in fact there may be multiple and interacting factors threatening GGE and its habitat (Van Praagh and Yen, 2010a). These threats include:

1. Soil disturbances (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.

3.3.1 Key Threats

Soil Disturbances

Physical damage to individual earthworms and egg cocoons can result from disturbance of the soil profile, 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 soil disturbances can impact on GGE by influencing drainage characteristics (see altered hydrology) and 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 and movement of GGE. Alteration to drainage and the water table is one of the most serious threats to GGE populations. Other disturbances to hydrological conditions adjacent GGE habitat can also have adverse impacts by reducing or increasing water flows within the habitat area. For example, disturbances resulting from inappropriate subdivision and road construction design near GGE habitat.

Establishment of plantations and dense revegetation within or adjacent to GGE habitat can 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 transpirations rates of growing trees.

Chemical Disturbances

There is no direct information on the potential impact of chemicals on GGE or its habitat. However, chemical effects on other earthworm species suggest impacts on GGE should be considered.

Fungicides, fumigants and insecticides are known to be very toxic to earthworms. Herbicides have been noted to have low toxicity to earthworms when used at prescribed rates. Chemical effects on earthworm populations are known to persist after residues are no longer detectable in the soil.

Fertilisers including nitrogen, superphosphate and organics can have a beneficial effect on earthworm populations by increasing plant production and soil organic matter. Positive responses by earthworms to fertilisers are not unconditional however and may vary depending upon the soil pH effects resulting from application. Indicative results have shown that earthworms prefer soils with a pH of 7. Continued use of ammonium-based fertilisers may acidify soils which is detrimental to earthworm populations.

Extreme Weather / 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 development of a GGE distribution model in 2009, South Gippsland Shire Council identified earthworm habitat using the DELWP GGE 'biosite', a spatial layer identifying the distribution range of the species. This layer identified the need for planning permit applications within the distribution range of GGE and required specific planning consideration.

The use of this biosite and associated GGE data records occasionally resulted in inconsistent planning decisions when determining whether or not a planning application occurred within suitable GGE habitat, or whether a site evaluation was required as part of the planning process.

In 2009, DELWP commissioned the development a GGE distribution model (White *et al*. 2011). This distribution model uses presence-only modelling (Maximum Entropy) and examined 80 physiographic, climatic, radiometric and spectral variables to identify localities most likely to contain suitable GGE habitat. Identification of suitable GGE habitat derived from this model is a significant advancement on the DELWP biosite. The distribution model uses a 95% habitat threshold selected by the GGE Recovery Team to best capture the preferred habitat of GGE and inform planning decisions protecting GGE habitat.

4.2 Environmental Significance Overlay (ESO) Preparation

Both Commonwealth and State legislation require planning consideration be given to the protection and management of GGE and its habitat. Prior to the preparation of the GGE distribution model, no statutory planning mechanism existed that identified when works proposed on a planning permit might impact negatively on the conservation requirements of GGE.

The GGE distribution model has been used as the baseline information to prepare the ESO. Alterations to the distribution model were made to reflect existing developed areas and protection buffers applied to development applications in GGE habitat. These alterations included:

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

Potential habitat for GGE as identified by the distribution model was retained within public open space, reserves, urban floodway zones and undeveloped residential and industrial land parcels greater than 8000 m^2. The distribution model for GGE remained unchanged within areas outside urban growth zones. Figure 5 presents the GGE ESO in South Gippsland Shire following the identified alterations made to the GGE distribution model.

4.3 Environmental Significance Overlay Practice Note

All land identified within the ESO will be subject to its provisions. As 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.

The ESO Schedule 9 contains a planning permit exemption for proponents that have prepared a GGE Land Management Plan to the satisfaction of the Department of Environment, Land, Water & Planning (DELWP) 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 Minster for Environment 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 these cases, Council may use its own discretionary powers to request assessment of the impact of a development proposal on GGE conservation. For these case, it is recommended planning advice be sought from Council, DELWP or the Commonwealth Department of the Environment.

4.3.1 Assessing the Impact of Proposed Development on Giant Gippsland Earthworm

When a proposed development is located within the 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 negative development impacts on GGE populations and habitat should consider measures to avoid, minimise and/or offset such impacts. Proposed development should first consider how to avoid impact on locations known to contain suitable habitat for GGE. This might include design adjustments, relocation or re-alignment of works to avoid impact on GGE (e.g. pipelines, cable routes or roads).

If avoidance is not possible, then minimising impacts should be examined. This might include changes to the development design so as to result in negligible impacts to GGE populations or habitat (e.g. minimising soil disturbance, maintaining creek bank integrity, hydrology, direct drilling under GGE populations, low density planting of shrubs and grasses rather than higher density of trees).

The impact of a proposed development will be influenced by the conservation significance of the GGE population present at a site. This significance is decided upon consideration of 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. Providing 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. Funding the increase of land area reserved and managed for conservation of GGE;
3. Provide research funding to improve knowledge on the species conservation requirements and threatening processes; and,
4. ~~Funding experimental research for improving knowledge on translocation of GGE populations.~~

Comment [n1]: Comment from John Brennan DELWP – this is not a priority

Mitigating opportunities through an offsetting mechanism would be influenced by the conservation significance of the GGE population present at a site and any impact by a proposed development. As the responsible authority, South Gippsland Shire Council would seek advice from the DELWP or the Commonwealth on the suitability of any proposed mitigation measures.

4.3.3 Giant Gippsland Earthworm – Protected Wildlife

The ESO identifies localities most likely to contain suitable GGE habitat. This information is public knowledge and expands protection of this species. 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. If permits and approvals for disturbing GGE habitat are required but not sought, substantial penalties may apply.

Both State and Federal approvals may be required to interfere with GGE and or its habitat as it 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).

Appraising the need for planning permits or approvals for activities that may impact negatively on GGE conservation is presented in Figures 5 and 6.

4.3.4 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. To be considered for approval, the Land Management Plan must contain;

- Summary of the conservation status of the specific GGE on site,
- Details on legislation (Commonwealth and State) and planning provisions relating to the management of GGE,
- Purpose for which the subject land is to be used,
- Clear and concise details of buildings and works proposed to be undertaken addressing the 'Key Threats' as described in section 3.3.1 of this document,
- 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
- Results of any surveys undertaken for GGE by an earthworm expert,
- An assessment of impact of proposed land use on GGE. This assessment must be conducted by a suitably qualified person and accord with this document,
- Details on how the proposal attempts to avoid, minimise or offset any negative impact on GGE or its habitat.

5.0 Accidental Unearthing of Giant Gippsland Earthworm

Undetected populations of GGE may still be unearthed during works for permitted development. These incidents could occur both within and outside the ESO. Unearthing incidents may occur because field survey techniques used to sample for populations and habitat of GGE do not have a 100% detection guarantee.

Should a worm or community of worms be unearthed, the following guidelines have been prepared to minimise any further damage to the population. These have been created in consultation between the GGE Recovery Team and DELWP.

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 unearthing site,
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 DELWP 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, DELWP) within 24 hours of the incident.
7. The Site Supervisor must ensure that any uninjured earthworms suitable for relocation must be collected and relocated according to the protocols identified in Appendix 2 of this Reference Document.
8. Works can only recommence within the stop work area once all relevant statutory approvals and permits have been obtained. This may

include the requirement for further expert assessment of the area, upon the advice of both the Victorian Department of Environment, Land, Water and Planning (*Wildlife Act 1975*) and the federal Department of the Environment (*Environment Protection and Biodiversity Conservation Act 1999*).

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

6.0 Survey and Monitoring for Population and Habitat Assessment

6.1 Survey Methodology

Detecting GGE within the landscape is difficult because there are no obvious above-ground signs left behind by the worm. Widespread, non-intrusive surveying methods do not currently exist. Instead, methods to detect GGE primarily rely on the use of direct excavation of soil quadrats and subsequent searching for evidence of their presence (Van Praagh 1994; Van Praagh and Yen 2010b). Excavating soil quadrats can result in disturbance to the worm and its habitat and risks injuring or killing individual worms or egg cocoons.

Detecting GGE populations on the surface of the ground involves walking over a site and listening for a gurgling sound, made when worms move within their wet burrows (Van Praagh 1994; Van Praagh and Yen 2010b). The success of this technique is variable depending upon climatic conditions, density of worms, their activity and the skill of the person conducting the survey. This is a non-destructive method to support the use of soil quadrats (B. Van Praagh p*ers comm*. 2011).

Excavating soil quadrats is the primary technique to detect GGE. Quadrats of approximately 50cm x 50cm x 50cm are excavated by hand to search for signs of earthworm habitation (Van Praagh 1994; Van Praagh and Yen 2010b). Earthworm signs include the presence of burrows, cocoons or castings (waste material produced by the worms).

Soil quadrat intervals can vary depending on local site conditions, evidence of earthworm presence or suitable habitat. Regular soil quadrat sampling can be undertaken at sites which have 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). Burrows can usually be located within the top 20 cm of soil.

An assessment of GGE activity at a site can be undertaken by an individual trained in appropriate census techniques. These techniques broadly listed below, are ranked in order of increasing probability of injury or damage to GGE or its habitat (Beverley Van Praagh *pers comm*. 2011):

- Walking over the a site and listening for gurgles;
- Hand excavation of shallow soil quadrats (depending on size of site). Burrow density and moisture levels within burrows should be noted as they can remain in the soil for long periods of time, even after an individual has died. Active burrows are wet but disused burrows are dry

and often infiltrated with plant roots. Similarly, old cast material will have plant roots growing through and around it.

- 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 is continually being developed. This includes the potential use of a geophone (an acoustic listening apparatus) for detecting the presence of GGE without the requirement for excavation.

6.2 Population and Habitat Monitoring

Council may require monitoring of a GGE population at its discretion, typically for proposed large-scale developments (e.g., subdivisions, establishment of timber plantations). Measures to avoid or mitigate for potential negative impacts to GGE will typically be required by planning permits for such developments. Council considers it important to evaluate the success of these measures to refine management policies.

The use of soil quadrats and listening for 'gurgles' are suited for detecting the presence or absence of GGE rather than establishing population numbers in a community. Adapting these census techniques into a grid format would enable systematic sampling of earthworm relative abundance over time. This sampling over time could be used monitor the health of an earthworm population, indicating population persistence, movement and distribution. The risk of this approach is that considerable disturbance to earthworms or habitat could result from repeated excavation of soil quadrats. Careful consideration is to be given about the impact of this approach, including proposed sampling density, before implementation.

Any population monitoring program is to consider the conservation significance, extent and density of a GGE population before design and implementation. Smaller sites or small populations would necessitate a confined monitoring approach whereas larger populations and/or those spread over larger areas may withstand more frequent or invasive survey techniques. Should a need arise to examine the breeding activity of earthworms at a site, the design of the monitoring program would involve searches for breeding adults during the breeding season of the species (September-December) or egg cocoons.

Based on the census techniques and monitoring considerations, a monitoring program should generally occur at least once a year and usually during winter or spring when GGE is most active.

6.2.1 Population Monitoring Surrogate

An alternative, low impact approach to population monitoring is to use a population surrogate such as habitat. Monitoring of habitat conditions can provide an indirect measure of population health and persistence. For GGE populations, monitoring soil conditions (moisture and drainage characteristics) should be considered prior to opting for disturbance-based sampling techniques described above.

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

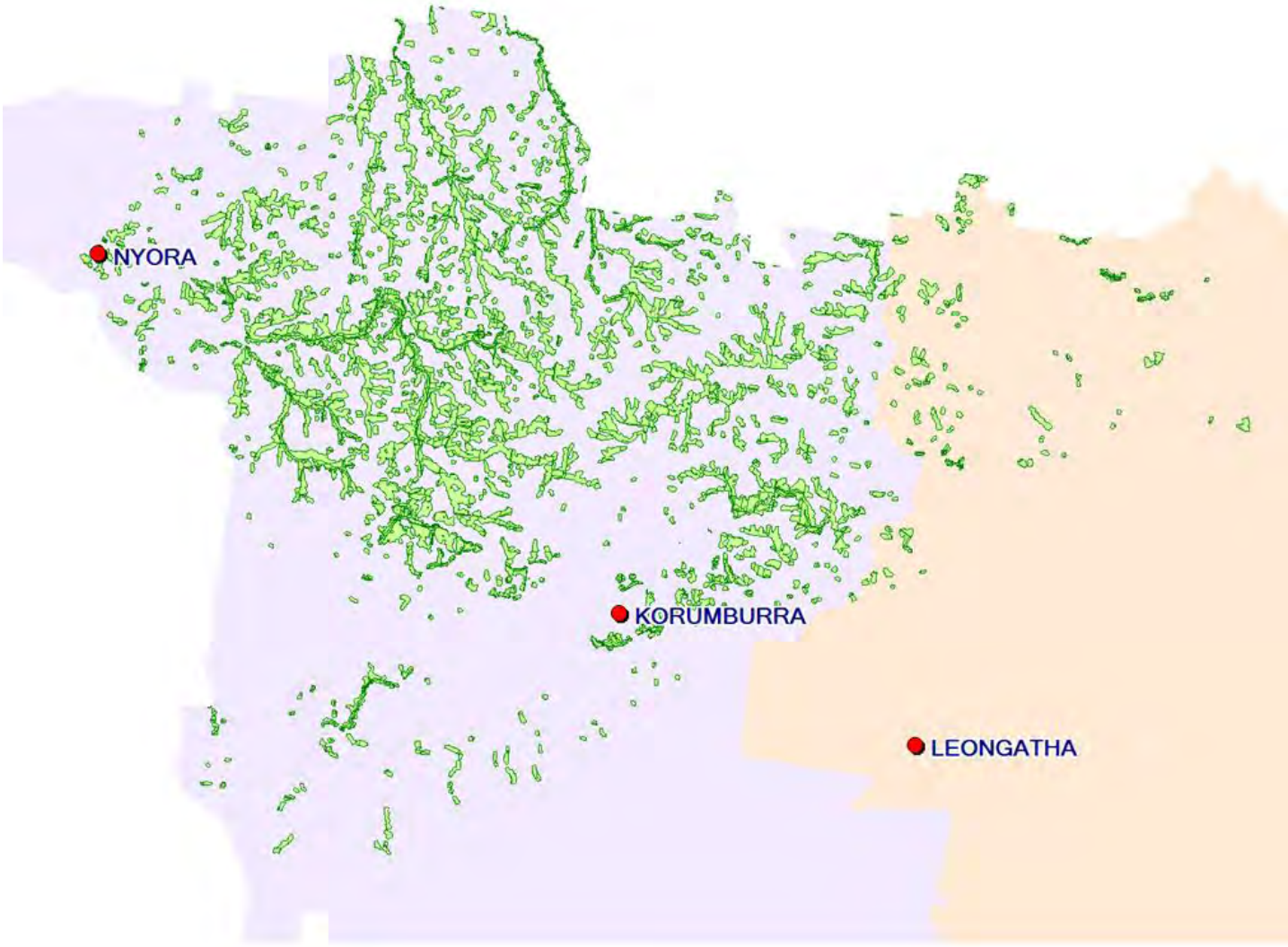

Figure 5: Giant Gippsland Earthworm Environmental Significance Overlay in South Gippsland Shire. Depicted overlying Ward Bou

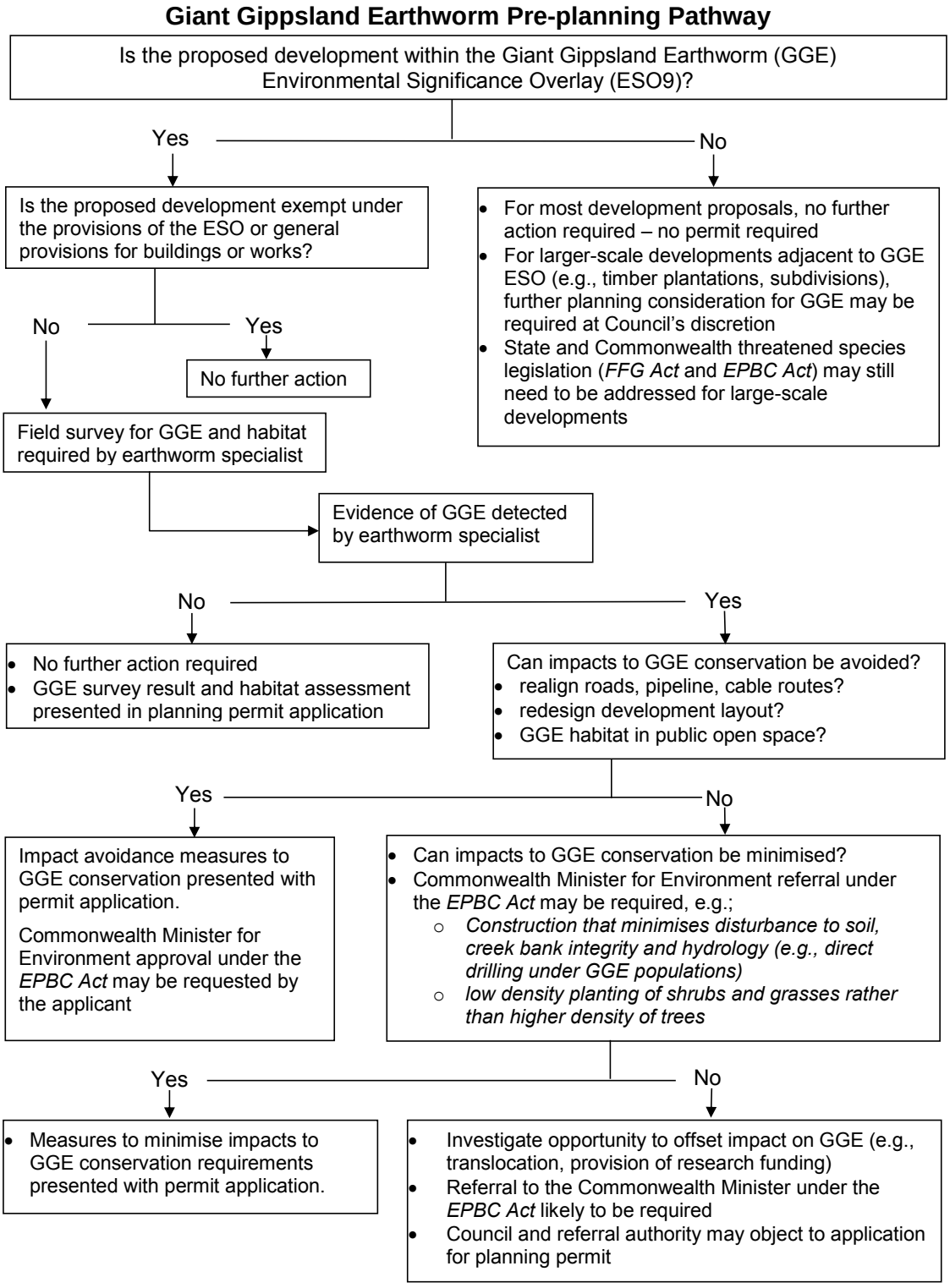

Figure 6: Pre-planning pathway for assessing the impact of development on conservation requirements of the Giant Gippsland Earthworm.

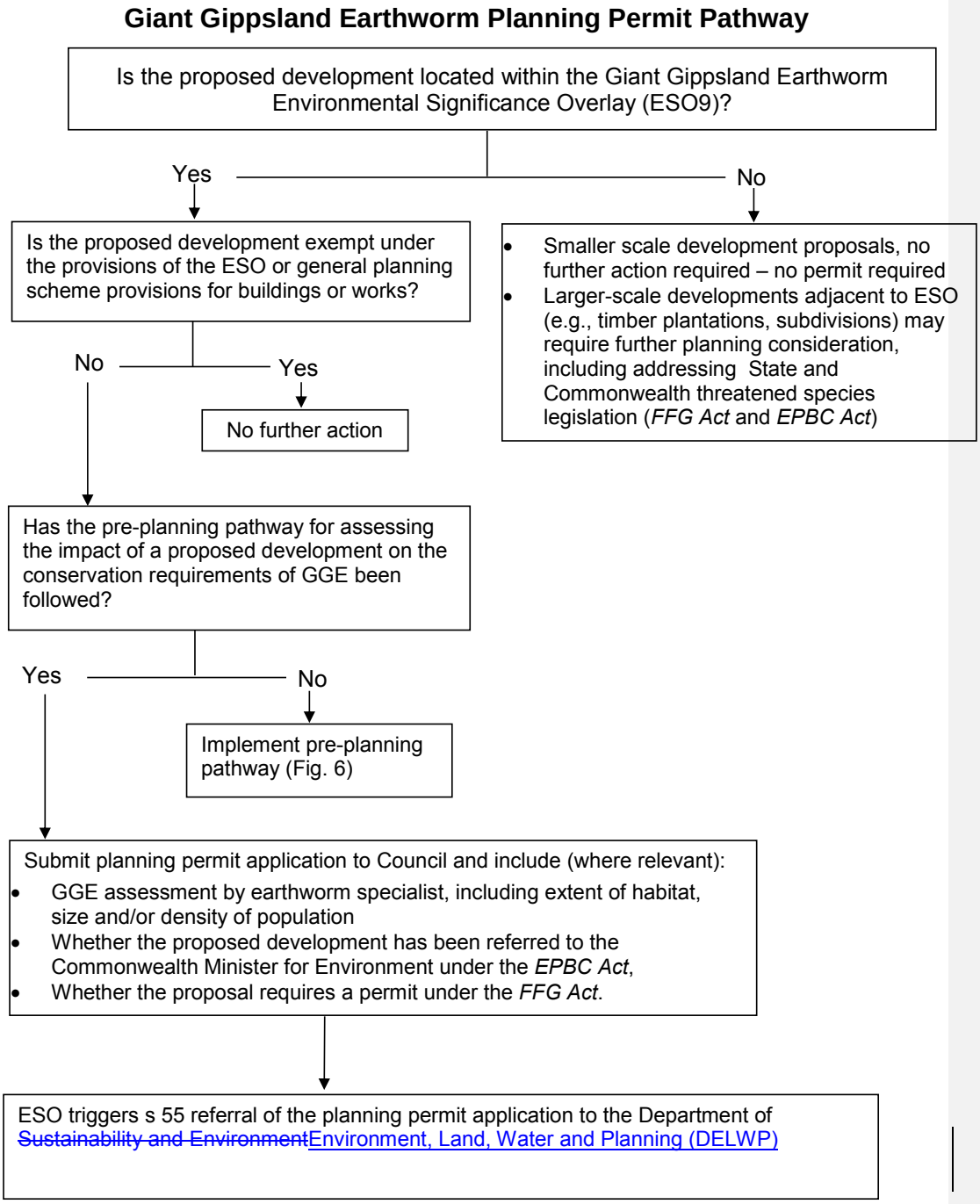

Figure 7: Planning permit pathway for assessing the potential impact of a proposed development on the conservation requirements of the Giant Gippsland Earthworm.

References

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Appendix 1:

Unearthing Giant Gippsland Earthworm Incident Report

Company/organisation name _____

Contact name _____

Contact details _____

Date of incident _____

Location of incident _____

Description of incident _____

Size of area from which Giant Gippsland Earthworm was unearthed _____

Estimate number of worms unearthed _____

Estimate number of injured earthworms _____

Estimate number of uninjured earthworms recovered for relocation

Notes:

Appendix 2.

Giant Gippsland Earthworm Collection & Relocation Protocols.

If Giant Gippsland Earthworms have been unearthed and require placement back into the soil - following these instructions will give them the best chance of survival.

1. Collect all uninjured worms **CAREFULLY!** The GGE is fragile and must be handled with great care. They must always be carried in a horizontal position - NEVER hold them vertically or dangle them as this always results in death. They cannot support their own weight.

2. Keep any unearthed worm in a plastic container or esky with moist, cool soil, covering the surface with either wet hessian or newspaper to reduce evaporation. 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), relocated the worms as soon as possible.

3. Earthworms should be placed in a shaded location prior to relocation.

4. Relocate earthworms to a nearby site that is not subject to earthworks. This should have a moist, predominantly clay soil and be located within the Environmental Significance Overlay, as close to the site from which unearthing occurred.

5. Dig a small trench approximately 30cm deep and at least as long as the earthworm. Place the worm lengthwise within the trench and gently covered with loose, moist soil to a depth of 10-20 cm. Any removed pasture clods can then be place 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 is required particularly during summer or hot weather.

Expert advice on the relocation of Giant Gippsland Earthworm can be obtained from a Biodiversity Officer with;

- the Dept of Environment, Land, Water & Planning, Traralgon (ph 5172 2111) or
- South Gippsland Shire Council, Leongatha (ph 5662 9200)

More information is available at www.giantearthworm.org.au

Appendix 3:

Identification of Giant Gippsland Earthworm and their habitat

More information at: www.giantearthworm.org.au

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

Egg Cocoons

Egg Cocoons: are large (5-9 cm), amber coloured eggs 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.

Cast and Yabby Mounds

Yabbies and GGEs are often found together because they both prefer wetter habitats.

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.

Gurgles & Burrows

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.

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

Habitat

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

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