SINCLAIR KNIGHT MERZ

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Western Sydney Recycled Water Initiative – Replacement Flows Project

ADDENDUM: FLORA AND FAUNA ASSESSMENT FOR PROPOSED MODIFICATION TO PIPELINE ROUTE

- Final
- 3 April 2008

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1. Introduction

1.1 Background

The Western Sydney Recycled Water Initiative (Replacement Flows Project) will connect the Penrith, St Marys and Quakers Hill sewage treatment plants (STP's) by pipes to allow treated wastewater from the three plants to be further treated at a new advanced water treatment plant (AWTP) at the St Marys STP. The highly treated recycled water will be released into the Hawkesbury-Nepean River below Penrith Weir.

An Environmental Assessment (EA) for the project was submitted to the NSW Department of Planning and approved by the Minister on the 20th June 2007, subject to Conditions of Approval (CoA). A specific CoA was issued for the Project in relation to ensuring that the Project does not directly impact on threatened species and endangered ecological communities, such as Cumberland Plain Woodland.

During detailed design investigations it was determined that the original EA alignment which involved open trenching along an existing sealed pathway through the Cumberland Plain Woodland at this location might not be feasible and hence an alternative route was investigated. This alternative route positions the pipeline heading northwest from Penrith STP towards Andrews Road, Penrith, through an area currently occupied by Cumberland Plain Woodland, a listed Endangered Ecological Community.

1.2 Objectives of the Addendum

This report has been prepared as an addendum to original Replacement Flows Terrestrial Ecology Report (October 2006), which was contained in Appendix D of the EA.

An alternate option was investigated which would involve open trenching along an existing disused sewer easement which runs through the Cumberland Plain Woodland area. An arborist was engaged to address potential impacts on remnant trees (Tree Wise Men 2008) for the alternate pipeline option. The original EA alignment and the proposed alternate route are shown in Figure 1. The alternate route is subject to this flora and fauna impact assessment.

This addendum reports on an inspection of the proposed alternate route and provides an assessment of the potential ecological impacts and their significance on Cumberland Plain Woodland under Part 3A of the NSW *Threatened Species Conservation Act*, 1995 (TSC Act) and assessment guidelines applicable to the *Environment Protection and Biodiversity Conservation Act*, 1999 (EPBC Act). The information presented in the report is based on a review of available data, including the EA and arborists report, and follow-up site investigations.

This report also provides a comparison assessment of the flora and fauna impacts associated with the original EA alignment and the proposed alternate alignment, as requested by the Director-General (letter dated 17/3/08).

Figure 1 Original EA and Proposed Alternate route location

Figure 1 - Replacement Flows Project, Potential Modification Cumberland Plain Woodland, near Penrith STP

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2. Background Review

2.1 Project Ecology Assessment

A Flora and Fauna Assessment was undertaken as a component of the EA for the entire pipeline route (SKM 2006). Prior to the site inspection for this addendum a review of this report was undertaken to gather available information in relation to the vegetation community types and flora species previously recorded in the vicinity of the proposed alternate route.

The report provided details on the following:

- A description of the type, condition and distribution of flora and fauna species, ecological communities and habitats in the area directly and indirectly affected by the proposal;
- Identified and provided a qualitative evaluation and description of the conservation significance of species, populations and communities in the study area including identification of potential impacts from proposed construction activities;
- Assessed the significance of impacts from the proposal on species, populations and communities known or expected to occur in accordance with the TSC Act and EPBC Act; and
- Provided ameliorative and management recommendations to minimise the identified direct and indirect impacts of the proposal on flora and fauna of conservation significance, which were incorporated into the EA.

The report provided a description of the site in the vicinity of the proposed alternate route (Penrith STP to Andrews Road) and described the vegetation as characteristic of Shale Hills Woodland (Map Unit 9: NPWS 2000) which is listed under the *EPBC Act* and *TSC Act* as the endangered ecological community 'Cumberland Plain Woodland'. No threatened flora or fauna species were identified in the proposal area. The site was considered potential habitat for the Cumberland Plain Snail, however no individuals were recorded. No other threatened flora or fauna were expected in this area (SKM 2006).

The proposed construction activities addressed in the flora and fauna assessment for the Penrith STP to Andrews Road section were based on open trenching along an existing sealed pathway through the Cumberland Plain Woodland area. It was concluded that the proposal would have minimal impact on the Cumberland Plain Woodland at this location provided soil stockpile areas and vehicle movements were restricted to cleared and disturbed areas along the edge of the path.

2.2 Arborist Report

An inspection of the alternate route through the Cumberland Plain Woodland was undertaken by an arborist in January 2008 (Tree Wise Men Australia 29/01/08). The purpose of the inspection was to review the alternate alignment in terms of monitoring tree health and stability. The findings of the

inspection identified the route along the existing sewer easement as the most appropriate in terms of completely avoiding the need for tree removal (except for 2 juvenile trees <1m in height) and also minimising harm to tree roots. Further mitigation advice from Tree Wise Men (29/01/2008) is discussed in Section 5 of this report.

3. Site Assessment

3.1 Methods

An inspection of the proposed alternative route (Penrith STP to Andrews Road section) was conducted on 10 January 2008, and focussed on the area to be directly impacted through the Cumberland Plain Woodland area only (i.e. a 300 m x 6 m wide disturbance corridor). The alternate route is to be located within a disused sewer easement which has been previously cleared during installation of the sewer in the late 1970s. Although the sewer was installed approximately 30 years ago, very little native regrowth has occurred during that time due to competition from invasive grasses. The remainder of the route traverses disturbed cleared land and parkland which was not inspected in detail due to the absence of natural vegetation.

The inspection aimed to confirm the vegetation community types and flora and fauna species and habitat types present and assess the potential direct and indirect impacts on these from the proposed mechanical trenching and installation of the pipeline along the alternate route.

3.2 Results

The results of the site inspection confirmed that the proposed location of the alternate pipeline will indeed traverse a section of vegetation characteristic of 'Shale Hills Woodland' and consistent with the listed Endangered Ecological Community 'Cumberland Plain Woodland' under both EPBC Act and TSC Act.

The vegetation is remnant, although highly modified from its original condition, and consists of a mixed age canopy dominated by Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E.tereticornis*), Cabbage Gum (*E.amplifolia*) and Thin-leaved Ironbark (*E.crebra*). The existing sewer pipe is inactive and the easement is currently occupied by regrowth groundcover species, predominantly exotic grasses and scattered native shrubs and herbs at low density and two juvenile Grey Box (*Eucalyptus molucanna*) <1 m in height. Several large Grey Box are located on the edge of the old easement outside of the direct impact zone (Refer to Appendix A for site photographs).

A sparse shrub layer is present consisting of a low diversity and abundance of native woodland species dominated by Blackthorn (*Bursaria spinosa)* and Sydney Green Wattle (*Acacia parramattensis)*. The groundcover is highly disturbed, being dominated by African Lovegrass (*Eragrostis curvula),* a noxious weed in the local area, as well as Rhodes Grass (*Chloris gayana*). These species are strongly competing with native grasses and herb species at the site such that native species are present in only very low densities. Native species include Kangaroo Grass (*Themeda australis*), Wallaby Grass (*Austrodanthonia fluva*), Redleg Grass (*Botricholoa macra*), and Barbed Wire Grass (*Cymbopogon refractus*).

It is evident that the relict sewer easement and surrounding vegetated site represents a disturbed remnant with a highly disturbed understorey dominated by exotic grasses, although there is a scattered low density of native plants present in the understorey which would be directly impacted by the proposal. Two juvenile Grey Box (<1 m in height) are present within the alignment (refer Plate 5 Appendix A) in addition to a number of mature trees in close proximity to the route suggesting that some damage to tree roots can be reasonably expected as a result of any excavation, though these impacts can be minimised in accordance with the arborist's advice to assist in long-term tree stability and health. The native species identified at the site are a characteristic component of ecological communities representing Cumberland Plain Woodland.

Habitat for fauna is distinctly absent from the proposed works corridor. In this regard, there is a lack of food and shelter or cover resources and refuge or movement opportunities. This is the result of the small size of the work area and the effect of previous clearing and excavation for the existing sewer pipe which has removed all trees, logs, fallen timber or debris from the works area. Some habitat use could be expected by a small number of bird and reptile species which are common inhabitants of urban landscapes. During the site inspection in January 2008, there was no evidence of Cumberland Plain Snails within the worksite area which would be directly impacted by the proposal.

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4. Impact Assessment

4.1 Potential impacts from alternate route

The proposed pipeline construction involves excavation and backfilling a trench for a distance of approximately 300 m through the Cumberland Plain Woodland. The remainder of the pipeline will traverse open or cleared disturbed land. The width of trench required to install the two (2) pipes in this area is 2.5m wide by approximately 2m deep. Excavation of the trench will be by machine and restricted to a 6 metre wide disturbance corridor with all soil material to be transported away from the construction corridor to two stockpile areas to be located in cleared land outside the Cumberland Plain Woodland area. The trench and pipe installation will be staged such that the trench does not remain open overnight or would be fenced off at the end of the day to prevent access. Sediment and erosion control fencing will be used on sloping areas to minimise indirect impacts to the adjacent Cumberland Plain Woodland area.

No hollow-bearing trees, logs, natural and artificial cover were identified in the proposed construction corridor. Thereby fauna sheltering opportunities are absent and habitat is restricted to low groundcovers of exotic grasses and herbs.

As noxious and invasive weeds are currently abundant at the site there is potential to inadvertently spread weeds through machinery and vehicles entering and leaving the work site. Top soil is expected to be infested with weed seed and not suitable for specific partitioning for regeneration purposes.

Remnant and regrowth woodland from the site and surrounding areas is consistent with the endangered ecological community (EEC) referred to as Cumberland Plain Woodland scheduled in NSW under the *TSC Act* and under the Commonwealth *EPBC Act*. As there will be some direct and potential indirect impacts to Cumberland Plain Woodland as a result of the proposed works, an assessment of significance under Part 3A of the *EP&A Act* has been conducted in accordance with guidelines for threatened species assessment (DECC and DPI 2005) in addition to address of the significant impact guidelines under the *EPBC Act* (DEH 2006).

The proposed works area does not contain any significant or critical habitat for threatened or significant fauna species and provided suitable construction mitigation measures are employed as is proposed in the recommendations of this report, the proposal is unlikely to impact on native fauna species and habitat in the locality. As a precautionary measure, the vulnerable Cumberland Plain Snail (*Meridolum corneovirens*) is considered to potentially occur in the area surrounding the site and the potential impacts of the proposal on this species have been addressed below.

The removal of vegetation along the proposed pipeline route is limited to disturbed groundcover and two juvenile trees less than 1m in height within the 6m wide construction corridor. The

proposed removal of this vegetation would not result in the isolation of interconnecting areas of habitat or threatened species. The degraded nature of the disturbance area indicates that it is unlikely to provide important habitat for threatened fauna species and it is considered unlikely that this proposal would reduce the long-term viability of a native fauna within the local or regional area. The worksite corridor would be rehabilitated post construction with native grasses and shrubs, including a weeding program.

4.2 Environmental Planning and Assessment Act

An assessment of the impacts of the proposed alternate route on threatened species and endangered ecological communities listed under Schedules 1, 1A and 2 of the TSC Act has been undertaken. The proposal is to be assessed under Part 3A of the *EP&A Act* and consequently this impact assessment was undertaken in accordance with the Draft Guidelines for Threatened Species Assessment (DEC and DPI 2005).

4.2.1 Cumberland Plain Woodland

The presence and high conservation value of Cumberland Plain Woodland near the Penrith STP has been noted from the previous EA and subsequently the proposed alternate route has been deliberately placed within an old sewer easement to minimise the impact on vegetation as much as possible. This proposal will result in impacts in groundcover vegetation and two juvenile trees only and no mature trees are located along the easement. Further assessment and planning conducted on site to address construction impacts include:

- Identification of appropriate locations for temporary stockpile of soil during the excavation and filling of the trench; and
- Specific techniques to minimise the impacts on the roots of mature trees located close to the construction corridor.

Assessment of Significance (Part 3A EP&A Act)

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Cumberland Plain Woodland is not a threatened species or population.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Direct impacts on exotic and native groundcover vegetation representative of Cumberland Plain Woodland will result from the proposed clearing and excavation for trenching works. No mature trees are required to be removed. The disturbance zone is expected to be restricted to a 6 m wide corridor and soil removed from the trench will be stockpiled in cleared areas outside the

Cumberland Plain Woodland area before backfilling. The disturbance will be temporary for excavation of the trench and backfilling once the pipes have been installed. An arborist report has been prepared which indicates that there will be no significant impact on remnant trees (Tree Wise Men 2008) provided management measures are implemented on-site. The report details specific measures required to minimise impacts on the roots of proximal remnant trees. Strict adherence to these protective measures is essential for consistency with the conclusions of this assessment.

The protective measures put forward are designed to ensure that any impacts on Cumberland Plain Woodland would be very minimal and that no areas of remnant or intact woodland would be disturbed, thereby ensuring there is no reduction in the extent of this community.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

Cumberland Plain Woodland is not a threatened species or population.

How is the proposal likely to affect current disturbance regimes?

A number of current disturbance activities are evident in the study area. The most extensive of these is weed invasion while other lesser impacts have resulted from litter and edge effects along the sealed pathway. The proposed excavation and disturbance of topsoil has potential to exacerbate the issue of weed invasion. Measures to ameliorate this impact during the construction are required and have been identified in this report. Adherence to these measures will provide adequate provisions to protect native flora and may improve the overall condition of the site.

How is the proposal likely to affect habitat connectivity?

The proposal will not result in the further fragmentation of any habitats as the works will be restricted to an existing cleared and disturbed easement and not within a recognised habitat corridor. Rehabilitation of the site and regrowth of vegetation will ensure that surface disturbances associated with the trench corridor will be concealed in the future.

How is the proposal likely to affect critical habitat?

No critical habitat has been identified for this community within the study area.

4.2.2 Cumberland Land Snail

How is the proposal likely to affect the lifecycle of a threatened species and/or population?

At present there is limited information about the biology and life history of the Cumberland Land Snail. It is hermaphroditic and eggs are laid in moist and dark areas such as under logs, fallen trees and artificial ground cover such as building refuse and car bodies (NSW Scientific Committee

1997). The species appears to persist in degraded environments provided that this critical ground cover of logs or rubbish is available (NSW Scientific Committee 1997). However nothing is currently known about rates of fecundity of the species, length of life span, dispersal patterns and over what distances individuals can move.

No evidence of the Cumberland Land Snail was recorded in the vicinity of the alternate route. An inspection of the entire trenching works site identified an absence of any cover for snails either natural or artificial. This is likely to be a result of the presence of the existing sewer pipeline easement and previous removal of debris from the site to accommodate this.

On the basis of records of this species which account for its distribution throughout the wider area (DECC Atlas of NSW Wildlife 2008) it is evident that there are larger expanses of Cumberland Plain Woodland that provide suitable and indeed better quality habitat than the assessed works area.

Given the absence of sheltering microhabitat structures for this species from the works area there are no specific mitigation measures required.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

No evidence of the Cumberland Land Snail was recorded in the vicinity of the alternate route proposed during inspections in December 2007 and March 2008. An inspection of the entire trenching works site identified an absence of any cover for snails either natural or artificial. This is likely to be a result of the presence of the existing sewer pipeline easement and previous removal of debris from the site to accommodate this.

Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

There are over 100 records of this species throughout its small and restricted distribution and approximately 70 locations recorded within a 40 square kilometre radius centred on the Cumberland Plain and Castlereagh Woodlands. Therefore this species would be at the limit of its known distribution although will not be impacted by the proposal.

How is the proposal likely to affect current disturbance regimes?

A number of current disturbance activities are evident in the study area; the most extensive of these is weed invasion while other lesser impacts have resulted from litter and edge effects along the sealed pathway. The proposed excavation and disturbance of topsoil has potential to exacerbate the issue of weed invasion. Measures to ameliorate this impact during the construction are required and

have been identified in this report. Adherence to these measures will provide adequate provisions to protect future habitat for this species and improve the overall condition of the site.

How is the proposal likely to affect habitat connectivity?

The Project would have no significant long term impact on habitat connectivity or movement corridors for this species. The proposal will not result in the further fragmentation of any habitats as the works will be restricted to an existing cleared and disturbed easement and not within a recognised habitat corridor. Rehabilitation of the site and regrowth of vegetation will ensure that surface disturbances associated with the trench corridor will be concealed in the future.

How is the proposal likely to affect critical habitat?

No evidence of the Cumberland Land Snail was recorded in the vicinity of the alternate route proposed. An inspection of the entire trenching works site identified an absence of any cover for snails either natural or artificial. On this basis the site is not considered critical for this species.

4.3 Environment Protection and Biodiversity Conservation Act

The assessment of nationally endangered communities and threatened species present within or known to utilise the study area has been undertaken in accordance with the significant impact criteria for endangered and vulnerable species as outlined in the Significant Impact Guidelines relating to matters of national environmental significance (DEH 2006). This assessment is provided below.

Listed endangered ecological community: *Cumberland Plain Woodland*

This assessment deals specifically with the significance of impacts from the proposal on the nationally endangered Cumberland Plain Woodland ecological community.

1. Will the action reduce the extent of an ecological community?

The works will not physically reduce the extent of Cumberland Plain Woodland. Direct impacts on exotic and native groundcover vegetation and two juvenile trees representative of Cumberland Plain Woodland will result from the proposed clearing and excavation for trenching works. The disturbance will be temporary for excavation of the trench and backfilling once the pipes have been installed. No removal of mature trees will result and potential disturbance to tree roots will be managed in accordance with advice from the arborists report.

2. Will the action fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

There will be no increased fragmentation of Cumberland Plain Woodland. The disturbance will be temporary for the purpose of excavating a trench and backfilling once the pipes have been installed. No tree removal or disturbance to tree roots will result.

3. Will the action adversely affect habitat critical to the survival of an ecological community

The proposed development would not reduce the area of land currently occupied by Cumberland Plain Woodland in the Western Sydney region, and hence not affect habitat critical to its survival. The high conservation value of the assessed remnant has been recognised and the proposed infrastructure located along an existing sewer easement to minimise impacts on native vegetation. Measures to ameliorate impacts during construction are required and have been documented in this Section 5 of this report.

4. Will the action modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

The proposed laying of the pipes would involve shallow excavation and backfilling of the trench. This activity would not cause any alteration to groundwater drainage patterns. Sediment and erosion control measures should be implemented to limit sediment and nutrients entering surrounding areas of remnant vegetation during the construction phase.

The works would involve disturbance to topsoil and sub-surface soils along the trench location only. Measures to preserve the native seed stock stored within the topsoil will be included in the construction methods. All soil excavated from the trench would be reused to backfill and remediate the site.

5. Will the action cause a substantial change in species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;

The proposed construction footprint is dominated by two invasive weed species African Lovegrass (*Eragrostis curvula)* and Rhodes Grass (*Chloris gayana*). In comparison native groundcover species richness is very low. There are no mature trees within the corridor, with the exception of two juvenile trees. Rehabilitation of the site is essential post-construction to ensure that the invasive grass species do not outcompete any native regeneration and hence dominate the site again. In this event the proposal has the opportunity to improve the proportion of native species in the understorey.

6. Will the action cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- *assisting invasive species that are harmful to the listed ecological community, to become established; or*
- *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*

The proposed construction footprint is dominated by two invasive weed species African Lovegrass (*Eragrostis curvula)* and Rhodes Grass (*Chloris gayana*). Rehabilitation of the site is essential post-construction to ensure that the invasive grass species do not outcompete any native regeneration and hence dominate the site again.

There will be no influx of chemicals as a result of the proposed activity.

7. Will the action interfere with the recovery of an ecological community?

The proposed development would not reduce the area of land currently occupied by Cumberland Plain Woodland in the Western Sydney region. The implementation of mitigation measures would further ensure that longer term residual impacts are not imposed on vegetation within the works area.

4.4 Comparative Assessment of Original and Alternate Pipeline Routes

The location for the original EA alignment, through the subject area of Cumberland Plain Woodland, was reviewed at the detailed design stage with the conclusion that this alignment was unlikely to be constructed to the degree of sensitivity that was originally envisaged and assessed in EA. This is the result of the meandering nature of the alignment meaning there would be a need to widen the trench at several locations to accommodate thrust blocks and bends. To allow this widening would require the removal of mature trees or incur damage to the roots of trees situated along the edge of the footpath.

The new alignment was investigated on the basis that it was shorter and straighter and therefore can be constructed with a continuous and narrower trench. Further investigation of this option by an arborist also identified that significant impacts to tree roots could be avoided due to the absence of trees along the old easement. As a result there will be no impacts on large mature trees. This was seen as a favourable option to protect existing tree cover in the reserve. Further inspection revealed that the new alignment route would in fact also have minimal disturbance to native shrubs and groundcover plant species given the dominance of exotic species at this location.

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5. Recommendations

The following mitigation measures are recommended to protect the integrity of the Cumberland Plain Woodland endangered ecological community during the construction and operation of the pipeline.

5.1 Pre-construction measures

- All mature trees adjacent to the works corridor should be regarded as significant and retained in their present condition wherever possible.
- All vegetation from land surrounding and in proximity to the works corridor is classified as an endangered ecological community and is to be treated accordingly (i.e. fenced off to prevent accidental damage during construction works).
- To avoid impacts on native vegetation, plant and equipment required for the excavation works should be restricted to the designated works corridor (6 m wide) and stockpile sites clearly identified outside the Cumberland Plain Woodland area.

5.2 Construction measures

- There should be no stockpiling of excavated soil or construction plant outside of the designated works corridor or the identified stockpile sites where impacts to native trees could occur.
- Appropriate sediment and soil erosion quality controls should be utilised, particularly in regard to potential run-off in the event of heavy rain event during excavation.
- Avoid vehicle entry into adjacent woodland areas or edge areas where weed seed could be transported and deposited by vehicles used in the construction.
- The protective measures outlined in the Tree Wise Men (2008) report regarding the protection of tree roots for proximal trees are to be strictly adhered to.
- Any scour values or air values are to be located to the north or south of the Cumberland Plain Woodland and not within the woodland itself. Following completion of construction there is to be no vehicle access to the pipeline with the tree area for scouring purposes.

5.3 Post-construction measures

- The worksite corridor would be rehabilitated and planted with native grasses and advanced tube stock of local shrubs from the list provided in Appendix B or other species representative of the Cumberland Plain Woodland.
- Maintenance of the rehabilitated area, including a weeding program, would occur for a period of at least six (6) months as per Condition of Approval 2.15.

- Planting of juvenile Grey Box trees could occur elsewhere in the Cumberland Plain Woodland area to compensate for the removal of the two juvenile trees within the worksite corridor. This should only be done using locally collected seed.

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6. Conclusions

The works to be undertaken as part of the proposed alternate pipeline route for the Western Sydney Recycled Water project have been assessed in regard to the presence of Cumberland Plain Woodland (Endangered Ecological Community: *EPBC Act* and *TSC Act*) and threatened species. The assessment concludes that:

- The proposed alternate route is located within a highly modified and previously cleared section of remnant Cumberland Plain Woodland comprising an understorey dominated by exotic grasses. The route follows an existing sewer easement where it is evident that trees have been removed such that there is a clear line of site through the woodland. Vegetation within the easement comprises mostly exotic groundcover species and two small juvenile Grey Box (<1 m in height).
- The works required would not result in a significant adverse impact on the overall distribution, condition and future viability of Cumberland Plain Woodland in western Sydney. This is further reinforced by the inclusion of appropriate protective measures to be implemented during the pre-construction, construction and post-construction phases of the project.
- Furthermore, the proposal does not involve significant impacts to individual threatened flora and fauna species or critical habitats as listed in the *TSC Act* and would not significantly impact on a matter of national environmental significance as scheduled in the *EPBC Act*.

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7. References

DEC and DPI (2005). Draft Guidelines for Threatened Species Assessment. Department of Environment and Conservation and Department of Primary Industries, July 2005.

DEH (2006). *EPBC Act Policy Statement 1.2 Significant Impact Guidelines*. Commonwealth Department of Environment and Heritage.

NSW Scientific Committee (1997) Cumberland Plain land snail - Endangered species determination - final. DEC (NSW), Sydney

SKM (2006). Replacement Flows Project Environmental Assessment. Appendix D: Terrestrial Ecology Assessment. Sinclair Knight Merz, Sydney.

Tree Wise Men Australia (2008). Statement of site inspection findings relating to tree protection measures required to enable installation of recycled water pipeline: Hickeys Lane, Penrith.

Appendix A Photographs of the works corridor

Plate 1: Photograph looking north along sewer easement (shows gap in trees selected for pipeline).

Plate 2: section of cleared path retained over existing sewer easement

Plate 3. Photograph looking south along sewer easement (shows gap in trees selected for pipeline)

Plate 4: section of cleared path retained over existing sewer easement. Tree root protection measures are required for excavation in this area.

Plate 5. Two juvenile Grey Box saplings <1 m to be removed

Appendix B Plant species identified along the works corridor

Classification/ Scientific name	Common Name
Vascular Plants	
Seed Plants	
CLASS ROSOPSIDA	Eudicotyledons
SUBCLASS DILLENIIDAE	
Order Caryophyllales	
POLYGONACEAE	
Rumex crispus *	Curled Dock
SUBCLASS ROSIDAE	
Order Myrtales	
MYRTACEAE	
EUCALYPTS	
Eucalyptus amplifolia	Cabbage Gum
Eucalyptus crebra	Thin-leaved Ironbark
Eucalyptus molucanna	Grey Box
Eucalyptus tereticornis	Forest Red Gum
Order Fabales	
FABACEAE	
FABOIDEAE	
Trifolium repens *	White Clover
MIMOSOIDEAE	
Acacia parramattensis	Sydney Green Wattle
SUBCLASS ASTERIDAE	
Order Apiales	
PITTOSPORACEAE	
Bursaria spinosa	Blackthorn
Order Asterales	
ASTERACEAE	
Ageratina adenophora *	Crofton Weed
Bidens pilosa *	Cobblers Peg
Sonchus oleraceüs *	Common Sow-thistle
Tagetes minuta *	Stinking Roger
Taraxacum officinale *	Dandelion
CLASS LILIOPSIDA	Monocotyledons
SUBCLASS COMMELINIDAE	
Order Poales	
POACEAE	
Austrodanthonia fluva	Wallaby Grass
Aristida vagrans	Three awn speargrass
Bothriochloa macra	Red Leg Grass

Classification/ Scientific name	Common Name
Chloris gayana *	Rhodes Grass
Cynodon dactylon *	Common Couch
Cymbopogon refractus	Barbed Wire Grass
Eragrostis curvula *	African Lovegrass
Pennisetum clandestinum *	Kikuyu
Themeda australis	Kangaroo Grass

* denotes exotic or naturalised species

Appendix B – Indicative Construction Layout

EXCAVATION THROUGH CUMBERLAND PLAINS WOODLAND