

# ALKIMOS WATER ALLIANCE

## ALKIMOS WASTEWATER TREATMENT SCHEME

### TERRESTRIAL CONSTRUCTION MANAGEMENT PLAN

#### MANP016

18 April 2008	5	Changes to address DEC requirements	JDH	GN	
December 2007	4	Structural changes to address DPI comments	JDH	GN	
November 2007	3	Revised after release of Ministerial Statement	JDH	GN	
17 September 2007	2	Release to Water Corporation review	JDH	GN	
May 2007	1	First draft for review	DC	JDH	
Date	Revision	Description of Revision	Originator	Review	Project Approval

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## EXECUTIVE SUMMARY

In December 2006, the Water Corporation announced the Alkimos Water Alliance (AWA) as the successful Alliance partner to undertake design and construction works associated with the Alkimos Wastewater Scheme. The team comprises Alliance partners Multiplex, Züblin and Macmahon and sub-contract partners Worley Parsons, Connell Wagner, Land and Marine and Cardno BSD.

The AWA was formed specifically to progress the design and construction of:

- Earthworks for the wastewater treatment plant (WWTP) to be located at Site B;
- The ocean outfall including the launch site at Site 1B;
- A land based connection between the WWTP site and the launch site/ocean outfall; and
- The remaining section of the Quinns Main Sewer to connect established residential areas to the WWTP site.

This Terrestrial Construction Management Plan (TCMP) has been prepared by the AWA for terrestrial (onshore) works associated with the Alkimos Wastewater Scheme. This TCMP details how the AWA will manage the environmental aspects of construction activities associated with the Alkimos Wastewater Scheme. It has been prepared to address Ministerial Condition 6-2 associated with Ministerial Statement 755, which was issued in accordance with the provisions of Part IV of the Environmental Protection Act 1986 (See **Appendix A**).

Since the time of the submission of the Public Environmental Review (PER) (Water Corporation, 2005), AWA has developed a refined detailed design for the launch site at both Site 1B and Site 1A, Site 1B is outlined in **Section 11**. A key facet of this has been finalising the design based on the Launch Site 1B option that was one of three launch site options outlined in the PER. Any reference to the “launch site” within this document refers to the Launch Site 1B option, and this option was specifically selected to minimise impacts on flora and vegetation following the Environmental Protection Authority’s (EPA) assessment of the proposal.

The PER assessed two locations for the WWTP site, referred to as Site A and Site B. Site B was selected as the preferred option and has become the focus for detailed design. Approximately 2 million cubic metres of excavated material will need to be removed from the WWTP site and will be placed on land owned by LandCorp (Lot 102) to the south of the WWTP site. Haul roads have been designed to achieve safe transportation of the spoil to the fill site and access roads have been designed to provide safe access for staff and to minimise/avoid impacts to environmentally significant areas.

The design and construction approach for the Alkimos Wastewater Scheme, developed by the AWA on behalf of the Water Corporation, reflects with the guiding overall principle of minimising impact on the existing environment. The management measures detailed in this TCMP are considered to be the most appropriate to achieve the objectives stated, given the environment in which construction is to occur.

The TCMP document is separated into two main components, the first contained in **Section 4** which specifies project wide environmental management principles, including:

- Section 4.1 Construction Management;
- Section 4.2 Dieback Management;
- Section 4.3 Weed Management;
- Section 4.4 Fire Management;
- Section 4.5 Hydrology Management;
- Section 4.6 Landform Management ; and

- Section 4.7 Rehabilitation Management.

The second component deals with the detailed implementation of these environmental management principles. The management controls and responsibilities associated with the terrestrial construction works for each element of the project are contained separately within **Section 5** to **Section 12**. These have been developed by AWA in order to minimise environmental impacts and meet the objectives specified within this document the Water Corporations PER and the Ministerial Conditions. These sections are as follows:

- Section 5 Access roads;
- Section 6 Site offices/compound areas;
- Section 7 Haul roads;
- Section 8 Quinns main sewer;
- Section 9 WWTP site excavation;
- Section 10 Land based connection from WWTP to the launch site;
- Section 11 Launch site; and
- Section 12 Launch site dune crossing (through Bush Forever) and beach access corridor.

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- Appendix B: Clearing Permit CPS 1064/2
- Appendix C: Department of Environment and Heritage Statement 2007/3259
- Appendix D: Roles and Responsibilities Table
- Appendix E: Ground Disturbing Works Permit
- Appendix F: AWA Environmental Incident Form
- Appendix G: Contact Details for Site Based Staff
- Appendix H: Vehicle Hygiene Declaration Form
- Appendix I: Dieback Management Plan
- Appendix J: Licence to Take Water
- Appendix K: Vegetation Community Index

## ABBREVIATIONS

AHD	Australian Height Datum
AWA	Alkimos Water Alliance
DEC	Department of Environment and Conservation
DEH	Department of Environment and Heritage
DPI	Department of Planning and Infrastructure
DRF	Declared Rare Flora
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (commonwealth)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
FMP	Fauna Management Plan
MRS	Metropolitan Regional Scheme
OOPCMP	Ocean Outlet Pipeline Construction Management Plan
PER	Public Environmental Review
PF	Priority Flora
RL	Reduced Level
TBM	Tunnel Boring Machine
TCMP	Terrestrial Construction Management Plan
TEC	Threatened Ecological Community
WA	Western Australia
WWTP	Wastewater Treatment Plant

## 1 INTRODUCTION

### 1.1 BACKGROUND

The Alkimos Wastewater Scheme is to be implemented approximately 40km north-west of Perth's CBD, within the future suburb of Alkimos as shown in **Figure 1**.

The Water Corporation commenced planning for the Alkimos Wastewater Scheme in the 1970s to provide for the planned continued residential growth in the Perth metropolitan north-west corridor. The Water Corporation is the proponent for the Alkimos Wastewater Scheme and the project/proposal has been subject to the Western Australian (WA) Environment Impact Assessment (EIA) process and was assessed at the level of Public Environmental Review. (Alkimos Wastewater Treatment Plant – Public Environmental Review. Water Corporation, 2005).

In December 2006, the Water Corporation announced the Alkimos Water Alliance (AWA) as the successful Alliance partner to undertake design and construction works associated with the Alkimos Wastewater Scheme on behalf of the Water Corporation. It comprises Alliance partners Multiplex, Züblin and Macmahon and sub-contract partners Worley Parsons, Connell Wagner, Land and Marine and Cardno BSD.

The AWA was formed specifically to progress the design and construction of:

- Earthworks for the wastewater treatment plant (WWTP) to be located at Site B;
- The 3.7 km ocean outfall including the launch site at Launch Site 1B;
- A land based connection between the WWTP site and the launch site/ocean outfall; and
- The remaining section of the Quinns Main Sewer to connect established residential areas to the WWTP site.

It is also envisaged that the AWA may be contracted to integrate the design and construction of the WWTP itself once the earthworks have been completed, however it will not be responsible for the ongoing operation of the scheme.

The Alkimos Wastewater Scheme components, listed above (except for the Quinns Main Sewer), received Ministerial approval on 12 November 2007 (see **Appendix A**) pursuant to Part IV of the Environmental Protection Act 1986 (EP Act). The Quinns Main Sewer section of the scheme from the suburb of Butler to the edge of the buffer boundary falls under the jurisdiction of the Water Agencies (Powers) Act 1984 as general works and received Clearing Permit (CPS 1064/2) pursuant to Part V of the of the Environmental Protection Act 1986 on 9 August 2007, and hence was not assessed under Part IV (see **Appendix B**).

The Construction and Operation of the Alkimos Wastewater Treatment Plant has been considered pursuant to Section 75 of the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act). On the 26 February 2007 it was deemed 'not a controlled action' and, as such, did not require further assessment by the Australian Government (EPBC 2007/3259) (refer to **Appendix C**).

Since the formation of the AWA, the project design has progressed and has been refined from the design presented in the PER and as shown in **Figure 2**. Based on discussions held between the Water Corporation and the EPA Service Unit, it has been agreed that a number of changes to the scope of the original proposal will be progressed through a Section 45c process, and that the proposed changes are considered "non substantial".

This primarily relates to the original proposal requiring 29Ha of clearing and the revised proposal will necessitate the clearing of approximately 50Ha in total.

The Alkimos – Eglington Metropolitan Regional Scheme Amendment No. 1029/33 was formally reviewed by the EPA and through this process, Area 9 to the north of the WWTP was identified as having high east-west ecological linkage values. To assist in the finalisation of the MRS assessment, the Water Corporation proposed two areas within the buffer zone to be protected and managed for conservation purposes, as an offset to taking a portion of Area 9 for the location of the WWTP Site B. These are referred to as Area 10b which is located to the south of the WWTP site and Area 10a which is the portion of land north of Area 9 as shown in **Figure 3**. A key aspect of the design process and this management plan has been avoiding and managing impacts to Area 9, Area 10a and Area 10b.

## 1.2 PURPOSE OF THIS DOCUMENT

This Terrestrial Construction Management Plan (TCMP) has been prepared by the AWA for construction works associated with the Alkimos Wastewater Scheme. It details how the AWA will manage the environmental aspects associated with the construction of the Alkimos Wastewater Scheme, primarily potential impacts to flora/vegetation and landforms.

The primary objective of the TCMP is:

To protect native vegetation and landforms on the site outside the authorised area of permanent disturbance as defined in Figure 3 in Schedule 2 and Figure 4 in Schedule 3 of Ministerial Statement 755.

The TCMP has been prepared to satisfy Condition 6 as specified in Ministerial Statement 755 (November, 2007).

Specific requirements for the TCMP have been recommended by the EPA (2007) and within Ministerial Statement 755, and these recommendations have been addressed within various sections of this document. For ease of reference, the issues identified by the EPA and the Ministerial Conditions and corresponding section references for this document are provided below in **Table 1.2**.

**Table 1.2 Terrestrial construction issues and relevant section references**

Issue	References
Modification and configuration (dimension and gradient) of the launch site as far as practicable, to minimise the impact on the terrestrial vegetation and formation of the launch site dimensions	Section 11
Access roads	Section 5
Sheds, amenities and other facilities to be installed	Section 6
Management of activities in areas outside the area of disturbance (as defined in Figure 3 in Schedule 2 and Figure 4 in Schedule 3)	Section 4
Depth of pipe burial sufficient to withstand a one-in-one hundred year storm	Section 2.1.3
Impacts on the beach profile	Section 2.1.3
Bush forever site, including <i>Frankenia pauciflora</i>	Section 12

Threatened Ecological Communities	Section 2.2.3
Rehabilitation of the launch site/s	Section 11.2.7, Section 12.2.7

### 1.3 DOCUMENT FORMAT

The remainder of this report is comprised of the following components:

- Section 2 – Existing environment;
- Section 3 – Management standards and objectives ;
- Section 4 – Project wide terrestrial management principles;
- Section 5 – Access roads;
- Section 6 – Site offices and compounds;
- Section 7 – Haul roads;
- Section 8 – Quinns main sewer;
- Section 9 – WWTP site excavation;
- Section 10 – Land based connection from the WWTP to the launch site;
- Section 11 – Launch site;
- Section 12 – Launch site dune crossing through Bush Forever;
- Section 13 – Operational monitoring;
- Section 14 – Reporting;
- Section 15 – Summary; and
- Section 16 – References.

## 2 EXISTING ENVIRONMENT

The existing terrestrial environment of the project area is summarised in the following sections.

### 2.1 SOILS AND LANDFORMS

Geomorphically, the dunes at the Alkimos site represent the Holocene Safety Bay Sand portion of the Quindalup and Spearwood Dune Systems. These dune systems belong to a larger system of former coastal dunes that are a prominent feature over much of the coastal plain of the Perth Metropolitan area.

The dunes on site are predominantly linear systems following the coastline with flat to gently sloping sandy beaches. The large dunes have steep slopes extending to the beach, which grade to a lower undulating beach ridge characterised by inter-dune depressions and karstic features (GHD, 2005).

#### 2.1.1 Soils

As indicated the landforms and soils within the project area are part of the Quindalup Dune and Spearwood Dune Systems. The Quindalup Dunes are parabolic and coastal calcareous sand dunes and associated undulating landscapes, of differing ages and with minimal soil profile development (McArthur and Bartle, 1980).

There are six Quindalup dune system units in the study area: Q1, Q2, Q3, Q4, Qp and Qs (see **Figure 4**). The launch site is situated within an inter-dune depression of Q1 (the oldest phase of Quindalup dune system) directly behind the foredune, which is a thin section of Q4 (the youngest phase) (Weston, 2005).

The oldest phase (Q1) is known to comprise dunes or remnants with low relief, organic staining down to about 30cm and definite cementation below one metre. The Q1 phase has a flattened profile and is largely covered by vegetation and soil organic matter to depths of 30 to 50cm. These dunes are completely stable and are of the order of 6000 years old (Lemmon, T.C, Gee, R.D, Morgan, WR and Elkington, C.R.1979).

The WWTP site predominantly falls within the inter-dune depression of Q3 phase with a small section through Q2. The WWTP excavation site is located within the swale surrounded by dune systems. Quindalup dune systems consist of Safety Bay Sand, which consists of fine to medium grained quartz sand and shell fragments and overlies calcareous sand and limestone of the Tamala Limestone, which is Karstic in nature and has a naturally high permeability. The majority of the haul roads traverse through Q3, and the QMS section passes through a mixture of landforms.

#### 2.1.2 Landforms of the Alkimos area

Geoheritage is known as a complex expression of the geological and geographical landforms and the historical development of all ecological systems upon them. The parabolic dune feature at Alkimos is 2km wide, extending inland for 4km. Three individual dune types occur within this feature including parallel dunes, nested parabolic dunes and blow-outs. The landforms underlying the study area are shown in **Figure 4**.

The Semeniuk Research Group (2004) describes the Quindalup Dunes encompassing the footprint areas as nested parabolic dunes perched on coastal limestone. They recognise the entire Alkimos nested dune system as unusual, being perched on a limestone plateau and having arms with fretted margins. In 1979, the coastal dune formations in the Alkimos area were identified as having national and world geoheritage significance.

Blow outs form when the parallel dunes along the beach front are breached during heavy storms, with the resultant gap creating a wind tunnel through which the sand is transported. These blow outs are usually highly degraded and generally continue to erode over time. A blow out occurs through the foredune within the launch site foot print as shown in **Plate 1** and **Plate 2**.

### 2.1.3 Beach profile and processes

Littoral drift (also referred to as longshore drift) occurs at the Alkimos site and is the process by which sediments move along a beach shore. The process occurs as a result of waves approaching the shore obliquely, which is in turn driven by factors such as the direction and fetch of the prevailing winds. Waves striking the shore at an angle cause the waves to 'swash' up the beach at an angle. The swash moves sediment particles up the beach at this angle, while the backwash returns them (solely under the influence of gravity) directly down the beach. This has the net effect of gradual movement of the sand particles along the shore. The water molecules are among the particles moved in the process, so there is a net movement of water in the same direction, referred to as longshore current (Beer, 1997).

Natural coastline movements in the area adjacent to Lot 101 over the last half century have ranged from receding (45m to 55m) to mostly stable or accreting. Some areas of erosion have occurred, particularly where dune vegetation has become degraded or damaged (Oceanica, 2006). The shoreline, for approximately 1km south of the proposed launch site, was characterised as eroding at an estimated 7,300m<sup>3</sup>/yr with the sediment moving predominately to the North. The shoreline for 1.5km to the north of the launch site was estimated to be accumulating sediment at 15,000m<sup>3</sup>/yr (Oceanica, 2006).

In 2007, Worley Parsons conducted a metocean and coastal study along the ocean outfall alignment. The investigation concluded that the pipeline is likely to be lying under rock for the majority of the progression to 5m below sea level. It was concluded that of predicted patterns of storm induced erosion around the Alkimos pipeline shore crossing above 0m AHD (landward of Ch 100), the risk of the pipeline becoming exposed is low and armouring is not required. From -4m AHD (seaward of Ch 180), the trend is for deposition rather than erosion and consequently the risk of the pipeline becoming exposed is low and armouring is not required.

Between Ch 100 and Ch 180 the rock profile undulates, refer to **Section 11**. As the modelling has predicted, it is likely the sandy bottom would erode back to the rock profile and probably beyond, armouring should be provided where the rock profile is less than 0.5m above the top of the pipeline; that is approximately Ch 110 to 140 and Ch 150 to Ch 175. Armouring or coarse backfill should also be used in this zone (Ch100 to Ch180) where the total depth of cover to the top of the pipeline will be less than 2 metres (Worley Parsons, 2007).

During modelled 100 year storm events, there was no erosion of the profile predicted at the -5m level. There was some accretion due to the erosion of the upper profile. At the shoreline, a limestone platform is present and this will limit the shoreline recession to where the rock intersects the mean sea level. The pipeline will be trenched through rock in this section.

Based on the available information, the vertical alignment of the pipeline should not be undermined (Worley Parsons, 2007). The pipeline will be exposed in the trench, therefore the use of backfilling will be required with a suitably designed fill and armouring in order to stabilise the foredune, for all areas to -5m where the cover to natural seabed is less than 1.5m will be required.

## 2.2 FLORA AND VEGETATION

A number of previous floristic surveys have targeted the Alkimos and/or the neighbouring Eglinton areas. These surveys include:

- In 1990, Trudgen and Keighery (1990) surveyed the Alkimos area and mapped the vegetation units associated with variously aged dunes in the Quindalup System as well as limestone areas and sand surface areas of the Spearwood System.
- ATA Environmental surveyed and mapped the vegetation of selected areas of the Alkimos and Eglinton district in 2002, which was followed by in-fill surveys by Bennett in 2004 (ATA Environmental, 2004). The information attained during these surveys was used to produce more detailed mapping of the vegetation units and condition in the Alkimos area.
- The ATA mapping was used by Dr Arthur Weston on behalf of Syrinx (2005) when they conducted a targeted survey of the two proposed WWTP sites, their buffer zones and the proposed ocean outfall sites.
- In June 2007 AWA undertook further detailed survey. The survey was organised to further clarify vegetation specific to the launch site area and to establish reference sites outside the launch site and record plant densities within the launch site.

These reports provide the basis for the detailed description of the existing site flora and vegetation provided in the following sections.

### 2.2.1 General site flora

Generally, the vegetation of the Alkimos area was described by Dr Arthur Weston to be representative of two vegetation complex systems known as the Cottesloe Complex Central and South system and the Quindalup Complex System.

The Cottesloe system is the part of the study area north (and east) of the parabolic dunes, and the Quindalup System represents the remainder of the study area. The Cottesloe System supports Spearwood scrubs and heaths dominated by species of *Dryandra*, *Melaleuca* and *Acacia* on shallow sand, and limestone and low woodlands dominated by species of *Banksia* and *Eucalyptus* on deeper sands.

The Quindalup System supports grasslands, herblands and shrublands dominated by species of *Cakile*, *Spinifex*, *Tetragonia*, *Scaevola*, *Acacia*, *Myoporum* and *Spyridium* on the strand, fore dunes and adjacent mobile dunes, shrublands and heaths dominated by *Melaleuca systema* and species of *Acacia*, over *Lomandra maritima* herblands. On crests and middle to upper slopes of stable dunes; heaths of *Acacia rostellifera* and *Acacia saligna* and weedy grasslands and herblands on flats, swales and gentle slopes; and enclaves of Cottesloe vegetation and, in some places, Tuart trees on Spearwood sands and limestone (Weston 2005) as shown in **Figure 5** and **Figure 6**.

The Cottesloe System vegetation is in the best condition (“Very Good” to “Good” and “Very Good” to “Excellent”), while the vegetation of the dunes in the Quindalup system is in “Good” to “Very Good” condition. Most of the other Quindalup vegetation is in a more degraded condition, with much of the vegetation on flats and gentle slopes being weedy and “Degraded” or “Completely Degraded”.

The WWTP excavation site has a combination of flats, broad swales and valleys with weedy vegetation and weed infested native vegetation, as shown in **Plate 3**. The vegetation condition ranges from “Very Good” to “Completely Degraded” as shown in **Figure 7** and **Figure 8**. *Melaleuca systema* Open Low Heath over

*Lomandra maritime* Herbland (MsLm) is present on over 50% of the dunes around the flats (Weston, 2005). *Melaleuca systema* Low Shrubland to Shrubland (Ms) is also prevalent through the western portion of the site footprint. Haul roads and access roads traverse through a variety of vegetation units, predominantly through MsLm, Ms and AsMs *Acacia saligna* – *Melaleuca systema* shrubland.

The WWTP buffer zone supports Spearwood *Dryandra sessilis* Open to Closed Heath to Scrubs (Ds) and *Banksia* woodlands (Bam and BamET), which provides a feeding and foraging habitat for Carnaby's Cockatoos.

Weston (2005) found about 60% of the vegetation of the launch site to be previously cleared areas, with the vegetation condition ranging from "Good" to "Completely Degraded" with the majority of the area being "Completely Degraded" (shown in **Plate 4** and **Plate 5**). The most significant remnant vegetation was a *Melaleuca systema* open low heath over *Lomandra maritima* herbland on the older dunes. The vegetation of the younger foredunes consisted mostly of a *Spyridium globulosum* – *Scaevola crassifolia* closed low heath to shrubland (SgSc). An area of exposed limestone also occurs in the launch site and this contains a *Dryandra sessilis* (Ds) open to closed heath and *Melaleuca huegelii* – *Melaleuca systema* low shrubland to open low heath, with *Acacia truncate* (MhMs). The remainder of the older Quindalup Dune sands have been historically cleared of their native vegetation but most likely supported MsLm. The foredunes are largely vegetated with a *Spyridium globulosum* – *Scaevola crassifolia* shrubland (SgSc) with a small area of *Frankenia pauciflora* low shrubland (Fpls) near the foredune. **Figure 9** and **Figure 10** show the vegetation communities and vegetation condition respectively for the launch site area that was generated from the Weston (2005) survey.

### 2.2.2 Declared Rare Flora and Priority Listed Flora

Weston (2005) reported that there were no species of Declared Rare Flora (DRF) identified in the study area, and that none were likely to be found in the area.

The previous surveys of the Alkimos area identified a number of Priority Flora (PF) as well as Locally Significant Flora that occur within the project area. *Conostylis pauciflora* subsp. *euryrhipis* (P3) occurs between Alkimos and Cervantes on Quindalup dunes and is common in the *Melaleuca systema* open low heath over *Lomandra maritima* herbland.

*Sarcozona bicarinata* (P3) is a succulent herb of coastal dunes and limestone and has been recorded as common in limestone outcrops within the launch site (Weston 2005). *Stylidium maritimum* (P3) is a tufted herb of sand over limestone in coastal heath and shrublands or woodlands of the Swan Coastal Plain. This species was recorded in *Melaleuca huegelii* – *Melaleuca systema* heath at one site by Weston (2005) and may occur in similar vegetation at the launch site however circumstances of this vegetation unit is unlikely to occur so close to the coast.

*Hibbertia spicata* subsp. *leptotheca* (P3) is a small shrub of near coastal limestone between Yalgorup National Park and Lancelin. Weston (2005) recorded this taxon within the *Melaleuca huegelii* – *Melaleuca systema* – *Acacia truncate* Open Low Heath and *Melaleuca huegelii* – *Melaleuca systema* Closed Heath, with the largest population recorded north of the launch site. *Astroloma microcalyx* is no longer a priority taxon.

The locally significant flora *Frankenia pauciflora*, *Leucophyta brownii* and *Olax benthamiana* were recorded by Weston (2005) on the limestone cliffs to the west of the launch site. The vegetation within the Bush Forever area was surveyed in March 2007, and of the DRF and PF previously identified, only *Frankenia pauciflora* was

recorded on the limestone outcropping on the edge of the pegged launch site area. A total of 12 plants of *Frankenia pauciflora* were recorded in this section.

*Frankenia pauciflora* is often associated with coastal limestone but is uncommon in the Alkimos area and can therefore be considered locally significant. The proposed outlet construction is only likely to impact up to 12 plants and therefore the impact on this species is considered to be minor.

### 2.2.3 Threatened Ecological Communities

The area was originally surveyed by E.M. Bennett for ATA Environmental in 2004 but the area had been burnt less than a year before the survey was conducted. Dr Arthur Weston also visited the Alkimos area in 2004 and 2005. It was observed that one TEC, FCT 26a listed as “Endangered” by the Department of Environment and Conservation is probably represented within the study area north of Lot 101 within the Site A buffer boundary (Weston, 2005).

In March 2007 it was observed that the limestone vegetation within the launch site was very similar in dominant species and structure to that of the limestone ridge north of the buffer zones, which has been classified as FCT 26a ‘*Melaleuca huegelii* – *Melaleuca systema* shrublands of limestone ridges’. The degree of uncertainty remains regarding the conservation significance of the *Melaleuca huegelii* – *Melaleuca systema* low shrubland to open low heath with *Acacia truncata* on the limestone areas of the launch site. It was concluded that the representation of FCT 26a so close to the coast would be unusual (Weston, 2005).

The work of Bennett for ATA Environmental (2004) covered the launch site area. Two sampling points were located and studied within the launch site. These sites were originally inferred to be Floristic Community Type 26a (FCT 26a), *Melaleuca huegelii* – *Melaleuca systema* shrublands of limestone ridges, a Threatened Ecological Community (TEC). However, the site had been burnt in late 2003 and the vegetation sampled less than a year later. Therefore, the vegetation had not yet recovered to its pre-fire condition. The analysis of the ATA data by Weston (2005) indicated these sites were probably not FCT 26a, but were closer to either FCT 29 or FCT 24.

**Plate 4** and **Plate 5** show the general vegetation types and condition at the launch site, and in particular the contrast between the cleared areas and the vegetated limestone outcrop.

### 2.2.4 Bush Forever

The area proposed for the ocean outfall trench, comprises the dune between the beach and to the larger launch site area, has been survey pegged across the coastal dunes and through Bush Forever Site 397 (which connects to Bush Forever Site 130).

Bush Forever Site 397 is described by Bush Forever Volume 2 (Government of WA, 2000) as having vegetation ranging from near “Pristine” to “Degraded”, with areas of severe localised disturbance. Significant flora includes *Conostylis pauciflora* subsp. *euryrhipis*, *Stylidium maritimum*, *Melaleuca cardiophylla*, *Lechnaultia linarioides*, *Grevillea preissii*, *Diplopeltis huegelii* subsp. *huegelii*, *Trymalium ledifolium* subsp. *ledifolium*.

The corridor required though the Bush Forever site encompasses the foredune, which is an area of severe localised disturbance, as seen in **Plate 1** and **Plate 2**. The foredune will need to be excavated but then will be restored to a better condition once construction is complete. The foredune area within the Bush Forever site consists of both Q1 and Q4 representatives of the Quindalup dune system, both the youngest and oldest phases, refer to **Figure 4**.

## 2.3 HYDROLOGY

A number of geotechnical and hydrological surveys have previously targeted the Alkimos site area, including;

- A Hydro-geological assessment of the proposed Alkimos WWTP site in October 2004, conducted by Rockwater Pty Ltd; and
- Geotechnical drilling in the Alkimos onshore ocean outfall area and preparation of a brief factual report, undertaken in November 2005 by GHD Pty Ltd.

Golder Associates Pty Ltd has conducted further drilling and geophysics data within the project area in 2007.

### 2.3.1 Groundwater

The Safety Bay Sand and Tamala Limestone found at Alkimos make up part of a surficial aquifer complex in the Perth area. This is a complex, unconfined and multilayered aquifer (Davidson, 1995). The surficial aquifer has a maximum thickness of about 70m but an average thickness of approximately 45m in the northern Perth region. The upper surface of the unconfined aquifer is the watertable whose variations in depth depend mainly on topography but also permeability of the sediments. Groundwater levels fluctuate seasonally by about 0.5m in the limestone along the coast (Davidson, 1995).

The groundwater table configuration is dominated by the presence of a major groundwater mound, the Gnangara Mound (South). Groundwater flow radiates from the Gnangara Mound South (in the east) at approximately 70mAHD west towards the ocean to around 1mAHD at the coastline.

The Alkimos area is made up of Tamala Limestone, which is karstic in nature and has a high permeability. Groundwater in the Tamala Limestone is recharged by rainfall infiltration, and flows westward to discharge to the ocean. Variations in rainfall, tides, temperature and other factors affect the groundwater level in the area.

### 2.3.2 Surface water

Due to the highly permeable surface strata within the site there are no surface water features within the project area.

## 2.4 THREATENED FAUNA AND FAUNA HABITAT

The environment and fauna habitats within the project area are strongly influenced by dunal systems. The vegetation of the project area can broadly be described as coastal heathlands and woodlands overlying Quindalup and Spearwood dune systems.

*Dryandra sessilis* thickets and exposed limestone may support species with locally restricted distributions on the coastal plain, including *D. polyopthalmus* (a gecko) and the Barking Gecko. The Carpet Python also seems to favour rocky areas. Grass Trees almost certainly provide shelter for reptiles and some mammals. The foredune area in particular is home to a moderately rich reptile habitat such as the Bobtail, Dugite, Gould's Goanna and species specialised for existence in loose sand.

A fauna assessment in accordance with EPA Guidance Statement No. 56 (EPA 2004) was carried out for the area as part of the preparation of the PER. The assessment consisted of a site inspection (conducted in January 2005 by Dr Mike Bamford and Dr Robert Davis of Bamford Consulting Ecologist), and a desktop review of available data, including publications and databases (CALM, EPBC, WA museum, Birds Australia).

The Alkimos site possibly supports up to 51 reptile species, 102 bird species, 22 species of mammals and 5 species of amphibian (Bamford, 2004). A separate Fauna Management Plan (FMP) has been developed to satisfy Condition 10-1 of the Ministerial Statement 755, and details how the AWA will manage the impacts on terrestrial fauna during construction activities associated with the Alkimos Wastewater Scheme. Consequently, fauna management has not been assessed in this TCMP.

### 3 MANAGEMENT OBJECTIVES AND STANDARDS

#### 3.1 MANAGEMENT OBJECTIVES

As indicated in **Section 1.2**, the primary aim of preparing and implementing this TCMP is to protect native vegetation and landforms on the site outside of the authorised area of permanent disturbance.

There are a number of specific objectives for this TCMP, which are as follows:

- To provide additional information and detail to that contained within the PER, specifically pertaining to the relevant impacts on native vegetation and landforms;
- To provide detail as to how impacts on native vegetation and landforms will be managed consistent with the key objectives outlined in the PER, which include:
  - Minimising the impacts on the abundance, species diversity, geographic distribution and productivity of vegetation units;
  - Protecting Declared Rare Flora (DRF) taxa consistent with the provisions of the Wildlife Conservation Act;
  - Protecting flora listed under the Schedules of the EPBC Act; if any are subsequently found in the Project area; and
  - Protecting flora of other conservation significance.
- To provide a framework for the TCMP that is consistent with the recommendations provided by the EPA contained within EPA Bulletin 1239, and to satisfy Condition 6 of Ministerial Statement 755.

#### 3.2 RELEVANT LEGISLATION, POLICIES AND STANDARDS

The relevant legislation, policies and standards in relation to managing the impacts associated with terrestrial construction are outlined below in **Table 2**.

**Table 2: Relevant Legislation/Policies/Standards in relation to managing the impacts on the terrestrial environment**

LEGISLATION / POLICY / STANDARD	PURPOSE	KEY AGENCY / DMA
Environmental Protection Act 1986 Environmental Protection Regulations 1987	Provides the statutory framework for environmental impact assessment and the placement of statutory conditions on approvals.	EPA, DEC
Wildlife Conservation Act 1950 Wildlife Conservation Regulations 1970	Provides protection for fauna and identifies fauna with conservation significance.	DEC
Environment Protection and Biodiversity Conservation Act 1999	Provides protection for matters of National Environmental Significance.	DEH
EPA Position Statement No. 3 (Terrestrial Biological Surveys as an Element of Biodiversity Protection in Western Australia, 2002)	Discusses the principles which the EPA will use when assessing proposals, which may impact on biodiversity values.	EPA
EPA Position Statement No. 2	Discusses the principles which the EPA will	EPA

(Environmental Protection of Native Vegetation in Western Australia 2000)	use when assessing proposals, which affect environmental processes at the landscape level and in its biodiversity.	
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## 4 PROJECT WIDE TERRESTRIAL MANAGEMENT PRINCIPLES

This section outlines key issues to be managed for various elements relating to terrestrial construction. These details are then adopted for each aspect of the project to enable the AWA to meet the objectives specified in Section 3.1.

Specific management procedures (based on the general issues and management principles) for each element of the project are contained in Section 5 to Section 12 as follows:

- Section 5 Access roads;
- Section 6 Site offices/compound areas;
- Section 7 Haul roads;
- Section 8 Quinns main sewer;
- Section 9 WWTP site excavation;
- Section 10 Land based connection from WWTP to the launch site;
- Section 11 Launch site; and
- Section 12 Launch site dune crossing (through Bush Forever) and beach access corridor.

### 4.1 CONSTRUCTION MANAGEMENT

#### 4.1.1 Background

Construction activities will be undertaken throughout the project area. At any one time there may be up to one hundred people on site working simultaneously. It is important that construction management procedures are in place to ensure that staff are conscious of the environmental constraints and that the necessary environmental management outcomes are achieved.

It will not be possible to protect the vegetation within areas of disturbance specified in Figure 3, as the use of the site necessitates clearing of all vegetation within the footprints outlined. However, the Alliance has sought to adopt designs that minimise clearing and will seek similar opportunities during construction to do the same. The entire site will be managed to ensure areas of disturbance remain within designated footprints so that the surrounding environment is kept in a condition which is representative of its pre-project condition.

#### 4.1.2 Objectives

The objectives for construction management are;

- Implement management measures within areas of disturbance to avoid impacts to the surrounding environment;
- to ensure that all construction activities remain within the specified footprints.

#### 4.1.3 Management framework

##### 4.1.3.1 Management roles and responsibilities

The management roles and responsibilities are specified within Appendix D. The table outlines the management responsibilities and expectations of all key staff involved in carrying out the management procedures specified in the TCMP.

#### 4.1.3.2 Staff inductions and training

Prior to works commencing, Package Managers and Site Supervisors will undertake an intensive site environmental induction program which will outline all the commitments and management measures contained in the following:

- Terrestrial Construction Management Plan;
- Fauna Management Plan;
- Seabed and Benthic Habitat Management and Monitoring Plan;
- Ocean Outfall Pipeline Construction Management Plan; and
- AWA Environmental Management Plan.

The Site Supervisors and Package Managers will be responsible for ensuring all site personnel have undertaken a general environmental induction and that they adhere to the conditions and commitments made in the above management plans.

The Site Environmental Coordinator will be on site to continuously offer environmental assistance and to interpret any commitments contained in management plans and guidelines, attend prestart meetings, complete regular internal audits to ensure that operational requirements are being undertaken and to alert management and implement management responses if audits indicate non-compliance. More information on the audit framework to be adopted during the project is contained in **Section 14**.

#### 4.1.3.3 Boundary mark-out and fencing

Prior to ground disturbing activity the entire project area will be surveyed and pegged so that the extents of the project are clearly delineated. It is a requirement that all vehicles operate within the project boundaries and within fencing. All vehicles are to remain on designated access and haul roads when traversing to the various areas of operation.

Site fencing will be erected around the site to prevent recreational vehicles entering the site and driving through the project area, and the alignment for site fencing is shown in **Figure 11**. Fencing will be maintained to restrict recreational vehicles from entering the project area.

#### 4.1.3.4 Ground disturbing works permit procedure

The Alkimos Wastewater Scheme will involve the progression of a number of working areas, often concurrently. Given these will be coordinated by separate supervisors it will be important to ensure that clearing is undertaken in a manner that complies with the various statutory approvals, detailed design and management plans.

A formal internal Ground Disturbing Works Permit (GDWP) procedure has been established and will be relevant for all aspects of the project. Within the GDWP form the Environment and Community Relations Manager and the Alliance Manager have the opportunity to apply conditions to the works. For example, the GDWP may stipulate the requirement for supervision during clearing or for clearing to be conducted using a particular method. These conditions must be adhered to when undertaking the ground disturbing activity.

Any works involving clearing of vegetation or excavation will always constitute ground disturbing works and the following procedure will be adopted.

- Prior to any ground disturbing works being undertaken a GDWP is to be approved. A copy of the GDWP form is contained in **Appendix E**. The GDWP form will be completed by the Works Supervisor representing the AWA or the contractor/subcontractor undertaking works on behalf of the AWA.
- GDWP form is to be submitted to the Environment and Community Relations Manager for review and approval/refusal (with or without specific conditions).
- GDWP form to be forwarded by Environment and Community Relations Manager to Alliance Manager for approval/refusal (with or without specific conditions).
- Approved GDWPs to be provided a unique GDWP number (for future reference and records purposes). The GDWP is to be uploaded onto the GDWP register and a copy is to be retained and filed by the Environment and Community Relations Manager.
- A copy of the signed GDWP is to be supplied to all relevant parties undertaking ground disturbing works (including sub contractors) and the conditions specific to the GDWP must be adhered to during the ground disturbing activities.
- Any non-compliance events are to be immediately reported to the Environment and Community Relations Manager and the Environmental Incident reporting process is to be initiated. A copy of the AWA Environmental Incident Form is attached in **Appendix F**.
- The Environment and Community Relations Manager will coordinate a monthly review of the GDWP's lodged, close out these when works are completed and audit the implementation of GDWPs to ensure compliance with GDWP conditions.

#### 4.1.3.5 Staff contact details

A register of contact details for all site based staff will be established, maintained up to date and available to ensure quick resolution of emerging issues. A copy of the staff contact details is attached in **Appendix G**.

## 4.2 DIEBACK MANAGEMENT

### 4.2.1 Background

Dieback (*Phytophthora cinnamomi*) is a microbe that invades and destroys the function of the root system in a range of plants. Human activity causes the most significant, rapid and widespread distribution of the pathogen. Road construction, earthmoving, driving unclean vehicles and stock movement all contribute to the increased spread of Dieback.

Some of the vegetation surrounding the footprints is in "Excellent" condition and provides a habitat for local fauna. The Alkimos buffer zone will allow for the conservation of over 43 Ha of good quality Banksia woodland which is extremely susceptible to Dieback, and it is therefore important that every effort is made to prevent the spread of Dieback within the area during the time that the AWA is working there.

### 4.2.2 Objective

The primary objectives in relation to Dieback are;

- to identify and manage infected areas (if any) so as to prevent the spread of Dieback further around the site area;
- to protect the areas that are Dieback free and to ensure they stay that way during the life of the project; and
- comply with any hygiene requirements as specified by DEC.

### 4.2.3 Management framework

#### 4.2.3.1 Plant and equipment hygiene procedure

A wide range of plant and equipment will be mobilised to the site. Given that plant and equipment may come from diverse locations and may potentially be carrying Dieback, it will be important to monitor the movements of vehicles and equipment and ensure that any dirty vehicles are decontaminated before entering the site. It will also be important to ensure that all equipment leaving the site is clean and free from any potentially deleterious materials prior to mobilising to the next destination. The procedure to be adopted is described below.

- All plant and equipment being mobilised to site will need to be washed down and cleaned of all soil and vegetation material prior to dispatch to site. The cleaning needs to be organised by the relevant Package Manager and Work Supervisors. Works Supervisors are to inspect plant and equipment ensuring that it is completely free of soil and vegetation and complete a Vehicle Hygiene Declaration Form (as shown in **Appendix H**). A copy of this form will be sent into the Site Environmental Coordinator via facsimile and a copy is to be retained with the plant/equipment for display upon arrival.
- All completed Vehicle Hygiene Declaration Forms need to arrive with the Site Environmental Coordinator at least 24 hours prior to plant/equipment arriving at the site.
- Upon arrival of plant/equipment to site will be inspected by the Site Environmental Coordinator or a representative appointed by the Site Environmental Coordinator to verify that assurances provided by the signed Vehicle Hygiene Declaration form are correct. If satisfied, the plant and equipment will be allowed entry. If the plant and equipment has not been cleaned to an appropriate standard it will not be permitted to be unloaded on to site, and it will need to be cleaned at a location off site and then reinspected upon return.

- A register is to be maintained by the Site Environmental Coordinator which contains all the completed Vehicle Hygiene Declaration forms.
- The Plant and Equipment Hygiene procedure is to be adopted for all plant and equipment when it is deployed offsite, and a wash down bay is to be installed at the main site office to facilitate this.

#### 4.2.3.2 Dieback survey

Prior to any ground disturbing activities a reconnaissance Dieback survey will be undertaken by a qualified Dieback interpreter to ensure that all areas affected by Dieback are appropriately quarantined and that the pathogen is not spread across the site and particularly into areas where vegetation will be retained in the long term or into rehabilitated areas.

On completion of the Dieback survey, specific Dieback management protocols will be actioned to ensure vehicle movements are controlled and materials are managed to avoid the spread of the pathogen around the site (should identifiable infections be recorded). Specifically, Dieback infected areas will be clearly delineated on the ground and vehicle and personnel movements controlled in and out of these areas.

A Dieback Management Plan has been prepared following Dieback interpretation of the project area as recommended above (see **Appendix I**). The Dieback Management Plan outlines hygiene procedures which will be implemented during the project.

#### 4.2.3.3 Wash down facilities

If Dieback is detected where site vehicles and plant/equipment must traverse a wash down facility will be installed and all plant/vehicles moving through the area will be required to go through a wash down station.

The wash down stations will remove and capture any Dieback infected soil attached to vehicles/plant and prevent Dieback spreading into Dieback free areas throughout the project area. A high pressure hose will be used to remove any attached soil, the runoff and sediment will be contained in a drain/sump situated within infected areas only, and not diverted into areas which are Dieback free.

#### 4.2.3.4 Infected topsoil

Materials sourced from within infected areas, such as topsoil, vegetation brush and excavated soil will be managed to ensure they are stockpiled and reused within the designated infection area. Based on the existing earthworks schedule, the haul and access roads will be constructed in the summer and early autumn months, before significant autumn and winter rainfall is expected, therefore minimising transmission risks since site conditions should be reasonably dry during construction.

## 4.3 WEED MANAGEMENT

### 4.3.1 Background

The key principle for weed management during the project will be to ensure that areas retaining remnant vegetation in “Very Good” condition or better and have been subject to less weed invasion, are managed such that weed invasion is not increased to the extent that poses a threat to the ongoing viability of remnant vegetation.

The areas that will be most susceptible to weed infestation will be areas near existing weed infestation that are also adjacent to areas where works will be undertaken. Disturbance to the ground surface such as clearing without appropriate hygiene procedures can lead to rapid weed spread. Dr Arthur Weston’s study of the Alkimos area in 2004-2005 found that approximately a quarter of the taxa recorded during field work were weed species.

Weeds, especially grasses, are abundant in the areas that have been cleared, where they have totally replaced the native vegetation, but several species are also common, and sometimes abundant, in the native vegetation. Most are Priority 3 (minor weeds), some are Priority 2 (nuisance weeds), and eight are Priority 1 (major weeds).

The Priority 1 species in the WWTP study area are *Avena* spp., *Ehrharta calycina*, *Euphorbia terracina*, *Gladiolus caryophyllaceus*, *Moraea flaccida*, *Lupinus cosentinii*, *Pelargonium capitatum* and *Romulea rosea*. A number of conspicuous, taller weeds, such as *Avena barbata*, *Ehrharta calycina*, *Euphorbia terracina* and *Gladiolus caryophyllaceus* are established in some bushland vegetation sparsely or in restricted areas, but some of the smaller weeds are widespread and abundant. These smaller weeds include *Briza maxima*, *Petrorhagia dubia*, *Hypochaeris glabra*, *Romulea rosea* and *Ursinia anthemoides* (Weston, 2005).

Due to the significant extent of weed invasion within the project area the only areas which will require control measures will be the rehabilitated areas and areas which currently have “Very Good” condition native vegetation and low density of weed infestation.

### 4.3.2 Objective

The primary objectives in relation to weed control are;

- to ensure that the spread of weeds is minimised during construction; and
- to ensure that the spread of additional weed species is prevented.

### 4.3.3 Management framework

A Plant and Equipment Vehicle Hygiene procedure is in place and is described in **Section 4.2.3.1**, which is relevant for controlling the dispersal of weeds.

Prior to works, a survey will be undertaken throughout the project area, specifically in areas adjacent to construction works. The survey will determine and demarcate areas that have been already subject to weed infestation and areas that are in “Very Good” condition or better.

For the duration of project, the areas in “Very Good” condition or better will be monitored to ensure that weed invasion is not increasing and that weeds are not affecting the condition of the intact remnant vegetation. Should weed invasion be occurring, appropriate weed control will be deployed involving chemical and/or physical control methods.

Prior to vegetation clearing and topsoil being stripped for site works, areas will be identified for topsoil management based on the degree of weed invasion (i.e. areas with low weed invasion will need to be carefully managed to preserve the native seed bank, whereas areas subject to high weed invasion will either be stockpiled to destroy the weed seed bank or deep buried at fill sites).

Outbreaks of larger woody and perennial weed species will be controlled through physical (manual removal) methods where possible, although should larger outbreaks occur, some chemical control may be required using spot spray or wick/wipe application techniques. In cases where surface disturbance could result from manual removal that could contribute to wind and/or water erosion, chemical control would be the preferred approach.

To be effective, the monitoring and control of weeds will need to extend outside of the directly affected areas of work and will need to include areas undisturbed by works that are already affected by weed invasion.

During the rehabilitation process weed management measures will be implemented as detailed in **Section 4.7.3.4.**

Site fencing is to be erected around the site to prevent recreational vehicles entering the site and driving through the project area, which will assist in the control of weed dispersal across the site.

## 4.4 FIRE MANAGEMENT

### 4.4.1 Background

There is a potential for a combination of natural fire fuel levels, high temperatures and strong winds during the construction of the Alkimos Wastewater Scheme, which could increase the fire risk. Frequent fires could lead to the decline in remnant vegetation values of surrounding areas.

The main factors for fire management include the prevention of ignition caused by human activity, site vehicles and weather, the deployment of fire fighting strategies, and the availability of suitably serviced equipment and trained personnel for fire response.

### 4.4.2 Objective

The objective for controlling fire out breaks during the project is:

- to ensure that project activities do not lead to the out break of fires that pose a risk to the project activities or lead to the decline in remnant vegetation values in surrounding areas.

### 4.4.3 Management framework

#### 4.4.3.1 Firebreaks

There will be a number of firebreaks established around project where fences are to be situated, which is shown in **Figure 11**. These firebreaks will be a minimum of three metres wide and can be used for fire control access during any fire incidents.

#### 4.4.3.2 Control of high risk activities

There will be no lighting of fires during any aspects of the works. This includes during clearing (i.e. no burning of cleared vegetation) or the disposal of waste materials.

Smoking of cigarettes will be prohibited within vehicles or other enclosed places. Smoking will be restricted to endorsed/designated smoking areas that are not vegetated (i.e. presenting a fire hazard). Cigarette butts are to be fully extinguished and not disposed of as litter. Smoking of cigarettes will not occur in areas outside the designated smoking areas. Purpose "butt disposal bins" will be provided at the designated smoking areas.

#### 4.4.3.3 Plant equipment maintenance

All site plant and equipment will be regularly maintained and serviced to ensure that it is in good running order and its operation does not pose a fire risk. This will be particularly relevant for exhaust systems and moving parts that could become hot from wear and friction. All site personnel will be informed of the need to monitor plant and equipment during works and particularly at the beginning and end of each shift. Any issues should be reported immediately to Site Supervisors for further inspection and maintenance/servicing where necessary.

#### 4.4.3.4 Weather conditions

In situations where weather conditions are particularly conducive to fire out break (i.e. very hot, dry and windy) Site Supervisors, in consultation with Package Managers and the Construction Manager, will review works scheduled to be undertaken during the shift and determine whether this needs to be altered in light of the increased fire risk posed. Should certain activities be postponed/ceased because of fire risk, all relevant site

personnel and the Site Environmental Coordinator will be notified immediately and then notified again once the high fire risk has subsided.

#### **4.4.3.5 Fire control**

Fire extinguishers will be located in vehicles and all offices/workshops. These will be placed at strategic locations and site personnel will be informed of these locations and the appropriate use of these should a fire incident arise.

During the summer months the earthworks water cart will always be left full of water should this need to be mobilised quickly for fire control purposes.

#### **4.4.3.6 Reporting fires**

All project personnel will be required to immediately report any incidence of fire outbreak to the relevant Site Supervisor. The site supervisor will then be responsible for determining the appropriate response action.

In the event of a fire event being reported to any Site Supervisor, after ensuring that there are no immediate risks to human health or safety or site infrastructure and undertaking any immediate control actions, the Works Supervisor will immediately report this to the Construction Manager, and contact will also be made with the Fire and Emergency Services Authority (FESA), local Bush Fire Brigade and Local Emergency Management Advisory Committee (LEMAC). This notification will make these agencies aware of the incident and seek additional response assistance if required.

## 4.5 HYDROLOGY

### 4.5.1 Background

Surface water (runoff) generation is unlikely to be an issue during construction due to the permeable nature of the underlying soils. Given there are no existing surface water features on the site, potential impacts would be limited to disruptions to the existing water balance of the site, and potential impacts to groundwater quality from runoff contaminated by construction and support activities.

Four production bores for groundwater abstraction will be active to assist with dust suppression and compaction of the soil during earthworks. Surface runoff will not be directed outside of working areas, and will either infiltrate to groundwater or evaporate. Therefore, it is not anticipated there will be any significant impacts to the existing water balance of the site.

### 4.5.2 Objectives

The primary objectives in relation to hydrology management are:

- to minimise changes to the water balance; and
- to manage potential impacts to groundwater quality.

### 4.5.3 Management Framework

#### 4.5.3.1 Table drains

Small table drains will be placed to redirect water from the site facilities/hardstand areas during heavy rainfall. Runoff will not be directed outside working areas to areas of remnant vegetation. Therefore, given that runoff water will not be exported from the site there are subsequently no anticipated impacts to the water balance of the site. The table drains will be maintained as necessary throughout the duration of the project.

#### 4.5.3.2 Refuelling activities

Refuelling of equipment will either be carried out at the main site office and the earthworks workshop area or by mobile refuelling vehicles according to accepted industry practices. These activities will be undertaken on limestone hardstand areas only.

Spill response kits will be available in all site areas and with refuelling trucks for use in the event of a spill.

#### 4.5.3.3 Ground water monitoring

There will be a total of four production bores within the site at various locations. The water from the production bores will be used for site offices and for construction works including compaction and dust suppression. The Licence to Take Water allows for the abstraction of 1 Gigalitre per year of groundwater.

As a requirement of the Licence to Take Water GWL NO.162181(1) (attached in **Appendix J**) issued by the Department of Water in April 2007, ground water levels in monitoring bores located around the site are to be measured on a monthly basis.

This will be the responsibility of the Site Environmental Coordinator or an appropriate delegate. The information collected will be forwarded to the Department of Water by 28 February each year that the licence is active.

Levels data collected from seven bores around the site will be stored in a spreadsheet and plotted to ensure that they remain consistent and that no significant drops in the water table occur during construction. If bores have dropped significantly it may be necessary to cease water abstraction in the area or to minimise the use of the production bore.

## 4.6 LANDFORM

### 4.6.1 Background

Landforms and soils within the project area are part of the Quindalup Dune Systems and Spearwood Dune Systems. The Quindalup Dunes are parabolic and coastal calcareous sand dunes and associated undulating landscapes, of different ages and with minimal soil profile development (McArthur and Bartle, 1980). There are six Quindalup dune system units in the study area: Q1, Q2, Q3, Q4, Qp and Qs, (see **Figure 4**). The Alkimos dune system has been identified as having geoheritage significance.

Due to the susceptibility to erosion by wind and water action coastal foreshores and dune systems require careful management. Areas of current instability already occur in the launch site area in the immediate coastal zone where the Q4 formation exists as shown in **Plate 1** and **Plate 2**. Areas that are currently stable are so because of the vegetative cover, however this is highly susceptible to pressures such as recreational activities which occur regularly in the area. During the project it will be important to ensure that interfaces between working and adjacent areas are stable and do not cause the progression of landform instability into areas outside the working footprints.

### 4.6.2 Objectives

The objectives in relation to landform is:

- to limit and minimise impacts to the dune features where practicable;
- to ensure that the dunes (within Bush Forever and Area 10b) are restored to a condition as good as if not better than the present condition; and
- ensure the stability of landforms at the interface between the working footprints and undisturbed areas.

### 4.6.3 Management Framework

#### 4.6.3.1 Design considerations

Modification of the landforms within the project area will be unavoidable, however, careful consideration has been given to the design and placement of the various footprints. Specifically the launch site and haul/access road locations have been selected to minimise impacts to significant landform features. In order to locate the outfall pipeline through an existing highly degraded blow-out area in the fore dune, the ocean outfall alignment was adjusted from that presented in the PER to an area 10 metres to the north. This also has the benefit of reducing the impact on limestone cliffs to the south of the excavation.

The design of the haul road aimed to minimise the impacts to Area 10b by reducing the footprint of disturbance. This was achieved by removing the access road and steepening the cut batters. The haul road will be constructed as a temporary road for use during construction activities and will be fully restored through re-contouring and rehabilitation to pre-disturbed levels upon completion of WWTP construction. The access road for entry to the WWTP was designed to avoid Area 10b as shown in **Figure 3**.

#### 4.6.3.2 Management of landform instability and erosion

Monthly site inspections will identify areas being affected by wind or water erosion. Depending on the location and nature of the resultant erosion effects, one of a number of erosion control responses will be deployed. These would include heavy vegetation brushing, the installation of wind trap fencing (1.2m high fences made of shade cloth), use of liquid surface binding agents, or in the most severe cases the use of erosion matting.

This will be particularly relevant at the edges of disturbed areas where erosion has the potential to impact areas outside the delineated extent of works. A high priority will be placed on identifying and treating these areas to avoid such indirect impacts outside works areas.

## 4.7 REHABILITATION

### 4.7.1 Background

The scope for rehabilitation works varies depending on the long term goal for the various areas of the project. Some areas will be restored to achieve long-term biodiversity values and some areas will be revegetated to achieve short term landform stability given the long-term land use will not facilitate the retention of vegetation. The designated works footprints will be completely cleared of vegetation and the rehabilitation will begin from a bare site. Details of species lists and procedures specific to the various elements of the project can be found in **Section 5 to Section 12**.

Rehabilitation will only be applied to areas which will not contain permanent infrastructure, and AWA will not be rehabilitating the entire site. In some cases rehabilitation will be for stabilisation purposes as these areas will be required again for operations or for permanent infrastructure in the future (i.e. the launch site area and the base of the WWTP excavation).

Actions relating to minimising impacts have been detailed in the previous sections. Some measures that are outlined as part of clearing management, such as stockpiling portions of the topsoil and cleared vegetation separately will also provide benefits to improve the success of the rehabilitation program. In these instances the measures are outlined, however they may also have been previously addressed in clearing management. There are also measures that are specific to rehabilitation management.

The general approach for rehabilitation is as follows:

- Avoid disturbances wherever possible to minimise the amount of rehabilitation required.
- Topsoil and vegetative material will be managed (as outlined in Section 5B Section 12) to ensure the highest degree of reproductive material is preserved, which will minimise topsoil stockpiling and avoid vegetation mulching.
- Provenance seed will be collected from the pre-disturbance areas and across the wider WWTP buffer site and beyond.
- A combination of tubestock seedlings and direct seeding will be adopted to ensure the best outcomes in terms of both rapid establishment and botanical diversity.
- Revegetation will be undertaken without irrigation so planting of seedlings and direct seeding will be carried out between Autumn and early winter (depending on rainfall).
- Follow-up monitoring and maintenance will be required to ensure that revegetation is successful.

### 4.7.2 Objectives

The overall rehabilitation objective will be:

- to rapidly stabilise with a vigorous cover of endemic vegetation areas where short term landform stabilisation is required; and
- to restore the previously existing flora characteristics to a state as good, if not exceeding previous condition in areas where future land use will allow the retention of remnant vegetation and conservation values.

### 4.7.3 Management framework

#### 4.7.3.1 Seed collection

Provenance seed will be collected from the project footprint areas. These areas can be collected at the highest rate. In other areas where vegetation will be retained in the long term, seed collection will need to be undertaken in a sustainable manner that does not affect the ongoing reproductive viability of that vegetation.

Seed collection contractors have already been engaged to collect local provenance seed during 2006 and 2007. Tubestock will be propagated by nurseries (ideally based in the local area) from provenance seed collected from the site. Nurseries will be accredited to ensure that tubestock is appropriately prepared and hardened and are free from pests and disease.

Due to schedule constraints there may be situations where it is not possible to collect adequate provenance seed and/or propagate sufficient tubestock from provenance seed supplies to satisfy the full annual rehabilitation requirements. In this case seed will be sourced from native seed suppliers who have sourced seed in the wider local area and this will be used to propagate tubestock and for direct seeding operations.

#### 4.7.3.2 Brush Management

Brushing is when vegetation is added to eroding surfaces, such as dune surfaces, to increase stability and to reduce the wind velocity at the land surface. It also provides protection for young seedlings and helps to retain soil moisture.

Cleared vegetation will be pushed up and "raked" into stockpiles at the edge of the disturbed areas. It will be retained as brush and not mulched due to its beneficial properties in this form and ease to work with. Larger trees will be kept relatively intact and placed back into rehabilitation areas to provide a rougher surface to minimise wind and water erosion and also to provide ground dwelling fauna habitat.

Brushing material will be free from any weed material and applied to the site using appropriate placement techniques and methods. Stockpiled vegetation in "brush" form will then be applied back to the rehabilitation surface, which will provide some surface protection and also potentially provide some native seed bank. As the brush is applied the areas will be "track-rolled" using a dozer to ensure the profile is sufficiently compacted to achieve surface stability and that brush is secured.

The integrity of the brushing will need to be monitored and documented through the ongoing monitoring process.

#### 4.7.3.3 Topsoil

A pre-disturbance topsoil assessment will be undertaken prior to earthworks commencing. This will identify the areas of best quality topsoil in terms of organic matter content, likely native seed bank, and avoidance of weed infested areas that are likely to carry high weed seed banks.

Sufficient topsoil will be identified to treat post-earthworks areas. Residual topsoil that is of lesser quality will not be retained and given its low organic matter content will be disposed of in fill areas. Better quality topsoil will be stripped (between 50 and 100mm), stockpiled in shallow windrows of no deeper than 1500 mm to preserve its biological properties and returned to rehabilitation areas as quickly as practical.

Topsoil will be stockpiled close to the works and within the construction footprint. The purpose of direct return and/or re-use of topsoil is to maximise the productivity of the seed bank that may be present.

Topsoil will be applied to the rehabilitated sites at a depth of up to 50 mm depending on the rehabilitation outcome required.

#### **4.7.3.4 Direct seeding and tubestock**

Once sufficient autumn/winter rain has been received and the soil profile is moist, direct seeding will be undertaken and tubestock seedlings planted. Direct seeding will be applied at a heavy rate that will ensure that post-germination emergence is reasonably dense and there is sufficient seed remaining for a following season germination.

Tubestock will be used in only those areas that require a high level of rehabilitation and restoration. Tubestock will be representative of the same species mix as the direct seeding and planted at a high density. Tubestock will also be planted with a slow release fertiliser to provide sufficient nutrients to establish the seedlings and develop healthy root systems. Any nurseries that supply tubestock to the project will be required to hold a current accreditation under the Nursery Industry Accreditation Scheme Australia (NIASA).

Tree-guards will not be used at the majority of the sites, given the windy environment and the likelihood of the tree-guards being blown away as experienced at other similar sites in the area. At Tamala Park tree guards have not been used and this has not had a negative impact on rehabilitation outcomes.

#### **4.7.3.5 Weed control**

Pre-revegetation weed invasion is not expected to be a major issue given the relatively short period of time the rehabilitated areas will be left bare and susceptible to weed invasion. However, there may be some areas where selective weed management is required to control grass weed species.

If necessary, initial weed control will be undertaken prior to the first rehabilitation planting/seeding. This will occur immediately after the first autumn/winter rains following construction and placement of vegetation brushing.

In all areas, chemical control will be used. A combination of selective spraying of grasses with Fusilade® and general spraying of glyphosphate will generally be adopted.

#### **4.7.3.6 Herbivore control**

Rehabilitation monitoring will involve tracking seed germination, evidence of water and/or wind erosion and investigating impacts to rehabilitated areas from herbivores (such as Kangaroos and Rabbits). Revegetated areas which are impacted by herbivores will be targeted during infill planting.

Rabbits are traditionally problematic and occur in high numbers along the coast. To minimise damage to rehabilitated areas from grazing Rabbits a baiting program using either Pindone or 1080 (sodium monofluoroacetate) will be implemented the summer before planting occurs, this program will be conducted annually if required. The program will be undertaken by a suitably qualified animal and pest controller. The baiting regime and agent will be selected in consultation with relevant government departments and baiting will be completed with the objective of minimising the risk to native fauna in the area.

## 5 ACCESS ROADS

This section outlines the specific details and management measures for the site access roads. The general management measures outlined in **Section 4** have been used as the basis and incorporated in the environmental management framework for the access roads.

A summary of the requirements for the specific management of the access roads including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 5.1** to **Section 5.7**.

### 5.1 DESIGN

The project will require site access to construction areas, which will be in operation simultaneously. There will be three access roads in operation throughout the project area. The access road from Romeo Rd to the WWTP will necessitate the clearing of an area of 1.55 Ha (within the buffer zone). An access road will be constructed connecting the WWTP to the launch site necessitating the clearing of approximately 0.8 Ha and an access road for the Quinns Main Sewer section within the buffer will also be required. The access roads are shown in **Figure 3** and the specific area of disturbance for the access road to the WWTP is shown in **Figure 12**.

The WWTP access road and the launch site access road will consist of twin 3.5 metre unsealed individual lanes with a 0.5 metre hard shoulder. Clearing of the access road will be completed incrementally. The Quinns Main Sewer access road will consist of a 3 metre unsealed road.

The majority of the access road will be 'cut to fill' and therefore will not require large areas for spoil storage. The brush and topsoil collected from the access road will be stockpiled to the edge of the clearing limits along the access road and within other footprints of disturbance such as the launch site. The brush and topsoil removed from the road will be used for the rehabilitation of the area when required as outlined in **Section 5.2.1**.

The access road into the WWTP is a temporary road which has been designed to follow the alignment of the Romeo Road reserve and will remain only until surrounding development installs permanent east-west and north-south access and hence will require decommissioning and rehabilitation in accordance with the **Management and Rehabilitation of the Haul Road, Including Area 10b Management Plan**. The access roads were designed to avoid areas that support significant environmental values and to take advantage of the natural contours of the land, minimising disturbance from construction and earthworks. The access road to the WWTP was specifically designed to avoid Area 10b, which was recognised through the Alkimos Eglington Metropolitan Regional Scheme as having geomorphological significance and was subsequently offered up as conservation estate by the Water Corporation.

### 5.2 CONSTRUCTION

#### 5.2.1 Disturbance management

The access roads will need to be cleared of all vegetation and this will necessitate the clearing of approximately 1.55ha (within the WWTP buffer zone). In order to comply with statutory approvals clearing for the access roads must remain within the allocated footprint approved. Specifically, the access road footprint into the WWTP has been designed and coordinates specified as shown in **Figure 12**.

**Table 5.2.1** below specifically outlines the implementation schedule and responsibilities for ground disturbance management which will be followed to ensure the objectives specified in **Section 4.1.2** are met.



Table 5.2.1 Implementation schedule and responsibilities for disturbance management for site access roads

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
AR-GD-PC-1	Undertake survey of the access roads and peg out alignment and boundaries	Earthworks Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the access roads.
AR-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
AR-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in Section 4.1.2.	Site Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
<b>Construction</b>					
AR-GD-C-1	Clearly mark-out the extent of disturbance/clearing along the access road with fencing/signage.	Earthworks Supervisor	At least two weeks prior to commencement of vegetation clearing.	Earthworks Package Manager	At least one week prior to the intended commencement of vegetation clearing.
AR-GD-C-2	Review clearing is being completed as authorised within the GDWP.	Earthworks Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
AR-GD-C-3	Review of vehicle movements to ensure that vehicles remain within fencing.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Daily during construction works.
AR-GD-C-4	Review GDWP to ensure that disturbance was within the approved boundary, mark up any variances with the permit. Follow up internally regarding the identified non-compliance with GDWP and report to the Alliance Manager.	Site Environmental Coordinator	At completion of construction.	Environment and Community Relations Manager	At completion of construction of the WWTP.
<b>Operation</b>					
AR-GD-O-1	Review vehicle movements to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.
AR-GD-O-2	Monitor and maintain of access road batters to ensure stability and deployment of further	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.



	stabilisation and management where required.				
Decommissioning					
AR-GD-D-1	Remove any signs/fencing installed.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of construction of the WWTP.

### 5.2.2 Dieback management

The access roads will facilitate the movement of light and heavy vehicles during the operational stage of the project. The movement of vehicles could potentially transport Dieback into other areas and/or spread existing infection within the project area. The major risk will be during the construction of the access roads.

Plant and equipment will be mobilised to site for construction of the access roads and without management there is the potential for Dieback to be transmitted to areas within the site. It is important to put in place management measures prior to site entry to reduce the risk of Dieback transmission.

On completion of works for the WWTP a post construction Dieback survey will be undertaken so that the effort to minimise any further spread of the pathogen along the access roads is maintained through appropriate quarantine procedures.

**Table 5.2.2** below specifically outlines the implementation schedule and responsibilities for Dieback management to ensure the objectives specified in **Section 4.2.2** are met.



Table 5.2.2 Implementation schedule and responsibilities for Dieback management for the access roads

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
AR-D-PC-1	Commission a Dieback interpreter to complete an preliminary Dieback survey across the project area.	Site Coordinator Environmental	Prior to any construction vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Prior to the construction of the access roads.
AR-D-PC-2	Following advice from the Dieback interpreter implement management measures if not already specified within the management plan.	Site Coordinator Environmental	Prior to any construction vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Following advice from Dieback interpreter.
AR-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Coordinator Environmental	Prior to any construction vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
AR-D-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Work Supervisor	At least 24 hours prior to site entry.	Site Coordinator Environmental	Upon plant/ equipment arrival.
AR-D-C-2	If Dieback exists along access roads ensure that appropriate wash down facilities are installed as outlined in Section 4.2.3.3.	Earthworks Manager Package	Prior to vehicle movements along roads.	Environment and Community Relations Manager	Prior to vehicle movements along roads.
AR-D-C-3	If Dieback exists ensure infected topsoil kept separate from uninfected areas.	Earthworks Supervisor	During topsoil stripping.	Site Coordinator Environmental	Weekly during topsoil stripping.
AR-D-C-4	Construct table drains so that water is not diverted from infected areas into uninfected areas (if Dieback exists).	Earthworks Supervisor	During table drain construction.	Site Coordinator Environmental	Weekly during road construction.
<b>Operation</b>					
AR-D-O-1	Review vehicle movements to ensure that vehicles remain within areas authorised for disturbance only.	Earthworks Supervisor	Daily during operation of access roads.	Site Coordinator Environmental	Daily during operation of access roads.
AR-D-O-2	Monitor the vegetation condition, especially surrounding infected areas and if Dieback is spreading review Dieback management framework.	Site Coordinator Environmental	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
AR-D-O-3	Commission a Dieback interpreter to undertake an annual Dieback survey	Site Coordinator Environmental	Annually throughout the project duration.	Environment and Community Relations Manager	Annually throughout the project duration.



Decommissioning						
AR-D-D-1	Topsoil from infected areas is to remain within infected areas (if any).	Earthworks Supervisor	At completion of construction activities.	Site Coordinator	Environmental	At completion of construction activities.
AR-D-D-2	Commission a Dieback interpreter to complete a Dieback survey post works and document results.	Site Coordinator	Environmental	After rehabilitation.	Environment and Community relations	After rehabilitation.

### 5.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as for Dieback. The access roads will facilitate the movement of light and heavy vehicles during the operational stage of the project. The movement of vehicles along the access roads could potentially transport weeds from other site areas and/or spread existing weed species within the project area.

Plant and equipment will be mobilised to site for construction of the access roads with the potential for weeds to be introduced to surrounding vegetation. The access road into the WWTP is in close proximity to Area 10b as shown in **Figure 3**, therefore it is important to put in place management measures prior to site entry to reduce the spread of weeds into this area.

**Table 5.2.3** below specifically outlines the implementation schedule and responsibilities for weed management to ensure the objectives specified in **Section 4.3.2** are met.



Table 5.2.3 Implementation schedule and responsibilities for weed management for the access roads

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
AR-W-PC-1	Undertake a survey of the weed invasion within and surrounding the site, document findings.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
AR-W-PC-2	Establish and map areas which currently have "Very Good" quality vegetation and low weed infestation.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
<b>Construction</b>					
AR-W-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Works Supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
AR-W-C-2	Review vehicle movements to ensure that vehicles remain on the access road alignment.	Earthworks Supervisor	Daily during road construction works.	Site Environmental Coordinator	Weekly during access road construction works.
<b>Operation</b>					
AR-W-O-1	Review vehicle movements to ensure that vehicles remain within areas authorised for disturbance.	Earthworks Supervisor	Daily during use of access roads.	Site Environmental Coordinator	Weekly during operations.
AR-W-O-2	Monitor the vegetation condition of areas specified in AR-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
AR-W-D-2	Monitor the vegetation condition of areas specified in AR-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community Relations Manager	Spring after completion of works.

#### 5.2.4 Fire management

Fire management is particularly relevant to areas where works are taking place within or adjacent to vegetation and bushland areas. The majority of the access roads will be surrounded by vegetation, especially the access road into the WWTP and from the WWTP to the launch site.

Fire management measures will need to be implemented and monitored throughout the duration of the project, and all staff will need to understand evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 5.2.4** below specifically outlines the implementation schedule and responsibilities for fire management which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 5.2.4. Implementation schedule and responsibilities for fire management for the access roads

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
Pre-Construction					
AR-PC-FM-1	Inductions of operational/management personnel, outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
Construction					
AR-C-FM-1	Ensure that all vehicles in operation have a fire extinguisher on board.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Monthly during construction.
AR-C-FM-2	Ensure that smoking is not occurring inside vehicles or outside designated smoking areas.	Site Supervisor	During road construction.	Site Environmental Coordinator	Weekly during road construction.
Operation					
AR-O-FM-1	During summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Daily during summer months throughout the project duration.
AR-O-FM-2	Ensure that smoking is not occurring inside vehicles or outside designated smoking areas.	Site Supervisor	During road operation.	Site Environmental Coordinator	Weekly during road operation.

### 5.2.5 Hydrology management

The Alkimos area is made up of coastal calcareous sand dunes which are highly permeable. The access roads will have a limestone hardstand surface which necessitates the construction of table drains to divert surface run-off away from the road surface during heavy rainfall events.

Construction water for dust suppression and compaction will be used along the alignment of the access roads throughout the duration of the project, construction water is sourced from ground water production bores at four locations within the project area. Abstraction from these production bores will be monitored monthly.

Table 5.2.5 below specifically outlines the implementation schedule and responsibilities for hydrology which must be followed to ensure the objectives specified in **Section 4.5.2** are met.



Table 5.2.5 Implementation schedule and responsibilities for hydrology management for the access roads

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
AR-PC-H-1	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' as specified in <b>Section 4.5.3.3</b> .	Site Environmental Coordinator	Prior to production bore construction.	Site Environmental Coordinator	Monthly.
AR-PC-H-2	Order and allocate spill kits for plant/equipment which will be working along the access roads during construction.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
AR-C-H-1	Construct table drains along the hardstand areas to direct water away from the road surface during heavy rainfall events, ensure table drains do not divert water into adjacent vegetation.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	During road construction.
AR-C-H-2	Undertake refuelling on limestone hardstand areas only.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Daily during construction.
AR-C-H-3	Install spill response kits in allocated plant and equipment.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Weekly during construction.
<b>Operation</b>					
AR-O-H-1	Monitor and maintain table drains to ensure that they are free of debris and are providing adequately drainage for the access roads.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly throughout project duration.
HR-O-H-2	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' as specified in <b>Section 4.5.3.3</b> .	Site Environmental Coordinator	Monthly during ground water abstraction.	Environment and Community Relations Manager	Monthly.
AR-O-H-3	Ensure spill kits are located within close proximity to operations at all times.	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator.	Monthly during operations.
AR-O-H-4	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Monthly throughout project duration.

### 5.2.6 Landform management

Once the WWTP construction is complete the access roads will remain temporary for the purpose of construction and initial operation but will be replaced by the developers as and when the District Structure Plan/development front reaches the area south and west of the WWTP.

The access roads align predominantly through Q3 sections of the Quindalup dune formations. There will be a strong focus on maintaining the stability and structure of the dune systems so that they are not adversely affected by wind and water erosion during construction activities.

**Table 5.2.6** below specifically outlines the implementation schedule and responsibilities for landform management which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 5.2.6 Implementation schedule and responsibilities for landform management for the access roads

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
AR-PC-L-1	Undertake survey of the access roads and peg out alignment and boundaries.	Site Surveyor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
AR-PC-L-2	Install flagging around Area 10b (to the north of the access road) to prevent access.	Construction Manager	Prior to the construction of the access road.	Environment and Community Relations Manager	Prior to the construction of the access road.
<b>Construction</b>					
AR-C-L-1	Review vehicle movements and construction activities to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will implement restoration measures as appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Daily during construction works.
AR-C-L-2	Stabilise construction batters using liquid stabilisers, matting and/or brush.	Earthworks Supervisor	At completion of access road construction	Environment and Community Relations Manager	At completion of access roads.
<b>Operation</b>					
AR-O-L-1	Review vehicle movements to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will implement restoration measures as appropriate.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
AR-O-L-2	Monitor and maintain access road batters to ensure the stability and deploy further stabilisation where required.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during project duration.

### 5.2.7 Rehabilitation management

The access roads into the WWTP will be decommissioned and therefore re-establishing stable and diverse vegetation communities will be the long-term objective. The access road to the launch site, the QMS manhole and the recovery shaft for the land based WWTP and launch site connection may need to remain to allow for safe access to these areas for future maintenance purposes.

Rehabilitation of the access roads will involve:

- Spreading of topsoil;
- brushing;
- weed control;
- direct seeding; and
- monitoring and maintenance.

The road surfaces will be deep ripped to approximately 500 mm in order to break up the surface and relieve soil profile compaction. Rip line spacing will need to be sufficiently close enough to achieve full treatment of the road surfaces, and ideally a winged tyne would be used.

Direct seeding will be applied at a rate of 6kg/Ha. The quantity of seeds required is listed in Table 5.2.7a.

Table 5.2.7a Seed to be used in rehabilitation of the access roads

	Species	% seed mix + tubestock (Tubestock used only in sewer areas within WWTP buffer)
<b>Tree</b>	<i>Eucalyptus gomphocephalla</i>	1
<b>Shrubs</b>	<i>Acacia lasiocarpa</i>	10
	<i>Acacia saligna</i>	5
	<i>Acanthocarpus preissii</i>	10
	<i>Hibbertia hypericoides</i>	3
	<i>Hibbertia subvaginata</i>	3
	<i>Leucopogon pauciflora</i>	3
	<i>Melaleuca systema</i>	10
	<i>Melaleuca huegelli</i>	8
	<i>Trymalium ledifolium</i>	5
<b>Herbs</b>	<i>Phyllanthus calycinus</i>	5
	<i>Gompholobium tomentosa</i>	15
	<i>Hardenbergia comptoniana</i>	5
	<i>Lepidosperma pubesquameum</i>	5
	<i>Conostylis pauciflora subsp. eury</i>	2
	<i>Desmocladius flexuosa</i>	1
	<i>Sarcozona bicarinata</i>	3
	<i>Threlkeldia diffusa</i>	

Follow-up monitoring and maintenance will be required to ensure that revegetation is successful and batters have been effectively stabilised. This will continue for 12 months after the completion of the rehabilitation and revegetation and would identify issues such as weed invasion, wind or water erosion, and be the basis for maintenance activities.

Table 5.2.7 below specifically outlines the implementation schedule and responsibilities for rehabilitation which must be followed to ensure the objectives specified in **Section 4.7.2** are met.



**Table 5.2.7 Implementation schedule and responsibilities for rehabilitation management for the access roads**

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
AR-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas.	Site Environmental Coordinator	Annually depending on seeding times for target species.	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
<b>Construction</b>					
AR-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly.	Site Environmental Coordinator	Prior to clearing commencing.	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
AR-C-R-2	Clear existing vegetation and push into brush piles at the edge of the road alignment. Aim to keep vegetation intact.	Earthworks Supervisor	Once topsoil assessment is completed.	Site Environmental Coordinator	During vegetation clearing.
AR-C-R-3	Strip topsoil and place into stockpiles at the edge of the road alignment and within defined area of disturbance. Aim to keep stockpiles less than 1,500mm deep.	Earthworks Supervisor	Once vegetation has been cleared.	Site Environmental Coordinator	During topsoil stripping.
<b>Decommissioning</b>					
AR-D-R-1	Undertake deep ripping of any hardstand areas along the road surface.	Earthworks Supervisor	At completion of the construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.
AR-D-R-2	Spread topsoil and provide surface stabilisation measures where required.	Earthworks Supervisor	Following re-contouring.	Site Environmental Coordinator	Once topsoil has been spread.
AR-D-R-3	Spread brush on top-soiled landform and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following spreading of topsoil.	Site Environmental Coordinator	Once brush has been placed and other surface stability measures have been deployed.
<b>Rehabilitation</b>					
AR-R-R-1	Undertake direct seeding.	Site Environmental Coordinator	After the break of the season (top 300mm of soil profile is wet).	Environment and Community Relations Manager	After direct seeding has taken place.
AR-R-R-2	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.



AR-R-R-3	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
AR-R-R-4	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter.	Site Environmental Coordinator	Following end of Summer (February).	Environment and Community Relations Manager	Following end of Summer (February).
AR-R-R-5	Undertake maintenance as required.	Site Environmental Coordinator	February to March.	Environment and Community Relations Manager	February to March.
AR-R-R-6	Undertake any infill direct seeding as required.	Site Environmental Coordinator	Immediately following first autumn/winter rain event.	Environment and Community Relations Manager	Immediately following first autumn/winter rain event.

## 6 SITE OFFICES, WORKSHOP AND AMENITIES

This section outlines the specific details and management measures for the site office and compound areas. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the site office areas and compounds/workshops.

A summary of the requirements for the specific management of the site offices/compounds/workshops including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 6.1** to **Section 6.7**.

### 6.1 DESIGN

To safely accommodate all the staff during the life of the project, there will be three site offices installed. The AWA main site office is located at the end of the existing Romeo Road outside of the WWTP buffer area. The main site office was installed under the authority of a Development Approval (DA07/0219). A workshop and earthworks office, the marine office and a QMS site office will need to be installed within the project area.

The earthworks site office will be located at the north-west corner of the WWTP along with workshop/fuel store taking up an area of approximately 100m x 150m. A temporary marine site office and laydown area for pipe sections and equipment will be located within the launch site footprint with dimensions of 12m x 3m. The QMS laydown area will also house a site office. Both the QMS and launch site offices will have pump out ablation facilities, where as the earthworks site office will be serviced with septic tanks and leach drains.

Office areas will be graded and levelled and will be constructed to provide appropriate drainage. On completion of the works, the offices will be removed and the areas will be rehabilitated. The locations of the various offices is shown in **Figure 11**.

### 6.2 CONSTRUCTION

#### 6.2.1 Disturbance management

People, vehicles and materials will be entering and exiting the site offices/workshop on a daily basis. It will be important to ensure that the works are maintained within the boundaries specified and that construction activity does not encroach into adjacent remnant vegetation.

**Table 6.2.1** below specifically outlines the implementation schedule and responsibilities for the management of ground disturbance which must be followed to ensure the objectives specified in **Section 4.1.2** are met.



Table 6.2.1 Implementation schedule and responsibilities for disturbance management for the site office, workshop and amenities

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
SO-GD-PC-1	Undertake survey of the site office/workshop areas and peg out boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Prior to ground disturbing activities.
SO-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
SO-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in <b>Section 4.1.2</b> .	Site Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
<b>Construction</b>					
SO-GD-C-1	Clearly mark-out the extent of disturbance/clearing with fencing, install signage.	Earthworks Supervisor	At least two weeks prior to commencement of vegetation clearing.	Earthworks Package Manager	At least one week prior to the intended commencement of vegetation clearing.
SO-GD-C-2	Review clearing is being completed as authorised within GDWP.	Earthworks Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
SO-GD-C-3	Review GDWP to ensure that disturbance was within the approved boundary, mark up any variances with the permit and undertake rehabilitation of those areas as specified in <b>Section 5.2.7</b> . Follow up internally regarding the identified non compliance with the GDWP and report it to the Alliance Manager.	Site Environmental Coordinator	At completion of construction.	Environment and Community Relations Manager	At completion of earthworks program.
<b>Operation</b>					
SO-GD-O-1	Review of vehicle movements, placement of materials to ensure that disturbance remains within fenced areas. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.
<b>Decommissioning</b>					



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SO-GD-D-1	Remove any signs/fencing that was installed.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of construction of the WWTP.
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### 6.2.2 Dieback management

The site office and compound areas, in particular the earthworks workshop will have vehicles, plant and equipment frequently passing through on a daily basis. It is therefore important that measures are in place within these areas to prevent the transmission of Dieback into and around the site.

Table 6.2.2 below specifically outlines the implementation schedule and responsibilities for Dieback management which must be followed to ensure the objectives specified in **Section 4.2.2** are met.



Table 6.2.2 Implementation schedule and responsibilities for Dieback management for the site office, workshop and amenities

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
SO-D-PC-1	Commission a Dieback interpreter to complete an preliminary Dieback survey across the project area.	Site Coordinator Environmental	Prior to any vehicle movements within WWTP buffer zone.	Environment and Community Relations Manager	Prior to construction of site office areas.
SO-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Coordinator Environmental	Prior to any vehicle movements within WWTP buffer zone.	Environment and Community Relations Manager	Prior to any vehicle movements along the access road.
SO-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Coordinator Environmental	Prior to any vehicle movements within WWTP buffer zone.	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
SO-D-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Work supervisor	At least 24 hours prior to site entry.	Site Coordinator Environmental	Upon plant/ equipment arrival.
SO-D-C-2	Construct table drains so that water is not diverted from infected areas into an uninfected areas (if Dieback exists).	Earthworks Supervisor	During table drain construction.	Site Coordinator Environmental	Weekly throughout the project duration.
SO-D-C-3	Ensure water from wash down bays is captured and contained in a sump and does not run off into adjacent Dieback free vegetation.	Environment and Community Relations Manager.	During construction of the wash-down.	Site Coordinator Environmental	Weekly throughout the project duration.
<b>Operation</b>					
SO-D-O-1	Review vehicle movements and material lay-down areas to ensure that vehicles remain within fenced areas.	Earthworks Supervisor	Daily during operation of site office area.	Site Coordinator Environmental	Daily during operation of site office area.
SO-D-O-2	Monitor the vegetation condition, especially surrounding infected area. If Dieback is spreading review Dieback management framework.	Site Coordinator Environmental	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
SO-D-D-1	Commission a Dieback interpreter to complete a post-works dieback survey and document results.	Site Coordinator Environmental	After rehabilitation and prior to handover to Water Corporation	Environment and Community Relations Manager	After rehabilitation and prior to handover to Water Corporation

### 6.2.3 Weed management

Site office and workshop areas are predominantly within central locations for ease of movement around the site. It is therefore important that these areas remain clean and free of invasive weed species which may be transferred from vehicles and spread throughout the site.

There are sections of significant vegetation and landforms which have been marked for conservation purposes, especially to the north of the earthworks site office and workshop which is to be protected for the long term (Area 9), and it will extremely important to maintain control of weed proliferation, especially within the “Very Good” quality vegetation areas.

**Table 6.2.3** below specifically outlines the implementation schedule and responsibilities for weed management which must be followed to ensure the objectives specified in **Section 4.3.2** are met.



Table 6.2.3 Implementation schedule and responsibilities for weed management for the site office, workshop and amenities

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
SO-W-PC-1	Undertake a weed survey within and surrounding the site and document findings.	Site Environmental Coordinator	Prior to any works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
SO-W-PC-2	Determine and map areas which currently have "Very Good" quality vegetation.	Site Environmental Coordinator	Prior to any works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
<b>Construction</b>					
SO-W-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Work supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
<b>Operation</b>					
SO-W-O-1	Review vehicle movements to ensure that vehicle and material lay-down areas remain within site office/compound boundaries	Construction Manager	Daily during use of the site office areas.	Site Environmental Coordinator	Weekly during use of the site office areas.
SO-W-O-2	Monitor the vegetation condition and weed intrusion (if any) and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Monthly when required.	Environment and Community Relations Manager	Monthly throughout the project duration.
SO-D-O-4	Ensure sediment from wash-down bays is captured and does not run off into adjacent vegetation.	Site Environmental Coordinator.	During operation of wash-down bays.	Environment and Community Relations Manager.	Monthly throughout the project duration.
<b>Decommissioning</b>					
SO-D-D-1	Monitor the vegetation condition and weed intrusion (if any) and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community Relations Manager	Spring after completion of works.

#### 6.2.4 Fire management

Fire management is particularly relevant in areas where works are taking place that are within or adjacent to vegetation and bushland areas. Site office areas will be adjacent to vegetation and may house ignition sources such as chemicals, fuels etc.

Fire management measures will need to be implemented and monitored throughout the duration of the project, and all staff will need to understand any evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 6.2.4** below specifically outlines the implementation schedule and responsibilities for fire management at site offices and workshops which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 6.2.4 Implementation schedule and responsibilities for fire management for the site office, workshop and amenities

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
Pre-Construction					
SO-PC-FM-1	Inductions of operational/management personnel, outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
Construction					
SO-C-FM-1	Ensure that all vehicles in operation have a fire extinguisher on board.	Earthworks Supervisor	Weekly.	Site Environmental Coordinator	Weekly during construction.
SO-C-FM-3	Allocate smoking areas and provide ash trays for cigarette butts	Environmental Coordinator	Prior to staff locating to the site office.	Environment and Community Relations Manager Site	First week of staff entering site office.
SO-C-FM-4	Install smoke alarms in site office.	Construction Manager	Prior to staff entering the site office.	Site Environmental Coordinator	Prior to staff entering the site office.
Operation					
SO-O-FM-1	Ensure that smoking is restricted to authorised areas only and ensure cigarette butts are placed in cigarette buckets located on site and removed regularly.	Site Environmental Coordinator	Weekly during project duration.	Environment and Community Relations Manager	Monthly during operations.
SO-O-FM-2	Maintain firebreaks, ensure that they are clear of vegetation/waste.	Site Environmental Coordinator	Weekly during the time that the fence is in place.	Environment and Community Relations Manager	Monthly during the time that the fence is in place.
SO-O-FM-3	During summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Weekly during summer months throughout the project duration.
SO-O-FM-5	Ensure site office smoke alarms are in working order.	Site Office Manager	Monthly.	Site Environmental Coordinator	Quarterly.
SO-O-FM-6	Ensure fire extinguishers are present on site.	Site Environmental Coordinator	Weekly during project duration.	Environment and Community Relations Manager	Monthly during project duration.

### 6.2.5 Hydrology management

The site office areas are small in comparison to other elements of the project. It is unlikely that the construction of the site office areas will cause any detrimental effects to the overall hydrology of the area. Activities within the site office areas will need to be managed so that hydrocarbons and chemicals are adequately contained with the appropriate bunding and storage facilities and that the area is kept clean and does not pose any threat to the quality of the ground water.

Table 6.2.5 below specifically outlines the implementation schedule and responsibilities for hydrology management which must be followed to ensure the objectives specified in Section 4.5.2 are met.



Table 6.2.5 Implementation schedule and responsibilities for hydrology management for the site office, workshop and amenities

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
SO-PC-H-1	Order and allocate spill kits for offices and the workshop.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
AR-C-H-3	Install spill response kits within the site office/workshop areas.	Earthworks Supervisor	Prior to construction works.	Site Environmental Coordinator	Prior to construction works.
<b>Construction</b>					
SO-C-H-1	Construct table drains to direct water away during heavy rainfall events, ensure table drains do not divert water into from working areas adjacent vegetation.	Earthworks Supervisor	During site office /compound construction.	Environment and Community Relations Manager	During site office /compound construction.
SO-C-H-2	Undertake refuelling on limestone hardstand areas only.	Earthworks Supervisor	During site office /compound construction.	Site Environmental Coordinator	Weekly during construction
<b>Operation</b>					
SO-O-H-1	Monitor and maintain table drains to ensure that they are free of debris and are providing adequate drainage.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly throughout the project duration.
SO-O-H-2	Ensure spill kits are in close proximity to operations at all times.	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator.	Monthly during operations.
SO-O-H-3	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly throughout project duration.

### 6.2.6 Landform management

The marine site office will be within Q1 of the Quindalup Dune system and the earthworks workshop and site office falls within Q3. The marine office and the QMS site office will be within the existing footprint for the launch site and within the laydown area for the sewer. All site office areas will be fenced, however, it will be important to monitor any disturbance beyond the boundaries of the specific site office areas.

**Table 6.2.6** below specifically outlines the implementation schedule and responsibilities for landform management for site offices and workshops which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 6.2.6 Implementation schedule and responsibilities for landform management for the site office, workshop and amenities

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
SO-PC-L-1	Undertake survey of designated office/workshop areas and peg out boundaries	Earthworks Supervisor	At least one month before ground disturbing activity	Environment and Community Relations Manager	Upon receiving the GDWP
SO-PC-L-2	Install fencing around the site office and workshop areas.	Earthworks Supervisor	After survey and clearing has taken place	Environment and Community Relations Manager	Once fencing is installed.
<b>Construction</b>					
SO-C-L-1	Review vehicle movements and construction activities to ensure that works remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will direct restoration measures as appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during construction works
<b>Operation</b>					
SO-O-L-1	Review of vehicle movements, to ensure that vehicles remain within fenced areas. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will direct restoration measures as appropriate.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
<b>Decommissioning</b>					
SO-D-L-1	Undertake restoration on the site areas, remove fencing and restore landform as much as practical.	Earthworks Supervisor	After the completion of the earthworks program	Environment and Community Relations Manager	After the completion of the earthworks program and prior to rehabilitation of the area

### 6.2.7 Rehabilitation management

The rehabilitation management of the site office areas has been incorporated into the rehabilitation management of various elements within the vicinity of the site offices.

The marine site office will be within the launch site footprint area, as a result of this rehabilitation seed density and species information will be the same as that specified for the rehabilitation of the launch site area as discussed in **Section 11.2.7**.

Similarly, the QMS site office and earthworks site office and workshop will be rehabilitated as discussed in **Section 8.2.7** and **9.2.7** respectively.

## 7 HAUL ROADS

This section outlines the specific details and management measures for the haul roads. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the haul roads.

A summary of the requirements for the specific management of the haul roads including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 7.1** to **Section 7.7**.

### 7.1 DESIGN

Haul roads are required to transport excavated material from the WWTP and the launch site to the LandCorp fill site to the south of the excavation. The haul roads have been designed for 85 tonne haul trucks and the alignment (vertical and horizontal) of the haul roads was designed to achieve the necessary road design specifications in terms of vertical and horizontal sight lines and road geometries. For safety and efficiency, the haul roads need to be separated from general site traffic on the access roads. The haul roads consist of twin 8.5 metre unsealed individual lanes. The design speed for the haul roads will be 40km/hr for loaded trucks and 60km/hr for unloaded trucks. A total area of 3.69 ha will be cleared for haul roads within the WWTP buffer zone.

The haul roads were designed to minimise impacts to areas that support significant environmental values, in particular Area 10b, which forms part of a prominent landform associated with the third phase of the Quindalup Dune system. While the haul roads will involve clearing and disturbance to landform, the areas will be restored to its original condition through re-contouring the landform to pre-disturbed levels and conducting extensive revegetation of the area. The management of Area 10b has been addressed in a separate Management Plan (Management and Rehabilitation of Haul Roads, including Area 10b).

Clearing for the haul roads will be completed in a step-wise fashion. As the haul roads are temporary, stockpiling of cleared material and topsoil will be undertaken and rehabilitation will be undertaken once the WWTP construction phase has been completed. Further details on the rehabilitation of the haul roads is contained in the document Management and Rehabilitation of Haul Roads, including Area 10b.

### 7.2 CONSTRUCTION

#### 7.2.1 Disturbance management

The design for the haul road aimed to minimise the inputs on Area 10b by reducing the footprint of disturbance. This was achieved by removing the access road and steepening the batters of the cut through the dune system. The haul road will be constructed as a temporary road for use during construction activities and will be fully restored through re-contouring to pre-disturbed levels and rehabilitation upon completion of WWTP construction.

**Table 7.2.1** below specifically outlines the implementation schedule and responsibilities for disturbance management which must be followed to ensure the objectives specified in **Section 4.1.2** are met.



Table 7.2.1 Implementation schedule and responsibilities for disturbance management for the haul road

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
HR-GD-PC-1	Undertake survey of the haul road areas and peg out alignment and boundaries.	Earthworks supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the haul roads.
HR-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
HR-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in Section 4.1.2.	Site Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the haul roads.
<b>Construction</b>					
HR-GD-C-1	Clearly mark-out the extent of disturbance/clearing with fencing/flagging, and erect signage.	Earthworks Supervisor	At least two weeks prior to commencement of vegetation clearing.	Earthworks Package Manager	At least one week prior to the intended commencement of vegetation clearing.
HR-GD-C-2	Review clearing is being completed as authorised within the GDWP.	Site Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
HR-GD-C-3	Review GDWP to ensure that disturbance was contained within the approved boundary, mark up any variances with the permit and conduct rehabilitation of those areas as specified in Section 5.2.7. Follow up internally regarding the identified non-compliance with GDWP and report to the Alliance Manager.	Site Environmental Coordinator	At completion of construction.	Environment and Community Relations Manager	At completion of earthworks program.
<b>Operation</b>					
HR-GD-O-1	Review vehicle/plant movements to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.
HR-GD-O-2	Monitor and maintain of access road batters to ensure stability and deploy further stabilisation and management	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.



	where required.				
Decommissioning					
HR-GD-D-1	Remove any signs/fencing that was installed.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of construction of the WWTP.

### 7.2.2 Dieback management

The haul roads will facilitate the movement of earthmoving vehicles/equipment during the operation stage of the project, and movement of vehicles could potentially transport Dieback into other areas and/or spread existing infection within the project area. The main risk of Dieback transmission will be during the construction of the haul roads.

Plant and equipment will be mobilised to site for construction of the haul roads and for the movement of spoil from the WWTP excavation area into the fill site. The haul road into the WWTP goes through Area 10b as shown in **Figure 3**, therefore it is important to put in place management measures prior to site entry to reduce the risk of transmission.

Once the WWTP has been commissioned, the haul roads will be removed and the area will be re-contoured and rehabilitated back to the original condition. It will be important to undertake a post construction Dieback survey to ensure that the pathogen has not spread or been introduced into the surrounding areas.

**Table 7.2.2** below specifically outlines the implementation schedule and responsibilities for Dieback management to ensure the objectives specified in **Section 4.2.2** are met.



Table 7.2.2 Implementation schedule and responsibilities for Dieback management for the haul road

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
HR-D-PC-1	Commission a Dieback interpreter to complete an preliminary Dieback survey/ recommendations.	Site Environmental Coordinator	Prior to any construction vehicle movements within WWTP buffer zone.	Environment and Community Relations Manager	Prior to construction of the haul roads.
HR-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Environmental Coordinator	Prior to any construction vehicle movements within WWTP buffer zone.	Environment and Community Relations Manager	Following advice from a Dieback interpreter.
HR-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Environmental Coordinator	Prior to any construction vehicle movements within WWTP buffer zone.	Environment and Community Relations Manager	Prior to any construction vehicle movements within WWTP buffer zone.
<b>Construction</b>					
HR-D-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Work supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
HR-D-C-2	If Dieback exists along the haul road ensure that appropriate wash down facilities are installed as outlined in Section 4.2.3.3.	Earthworks Package Manager	Prior to vehicle movements along roads.	Environment and Community Relations Manager	Prior to vehicle movements along roads.
HR-D-C-3	If Dieback exists ensure infected topsoil is stripped and kept separate from uninfected spoil.	Earthworks Supervisor	During topsoil stripping.	Site Environmental Coordinator	Weekly during topsoil stripping.
HR-D-C-4	Construct table drains so that water is not diverted from an infected area into an uninfected area (if Dieback exists).	Earthworks Supervisor	During table drain construction.	Site Environmental Coordinator	Weekly during road construction.
<b>Operation</b>					
HR-D-O-1	Review vehicle movements to ensure that vehicles remain within areas authorised for disturbance only.	Earthworks Supervisor	Daily during operation of haul roads.	Site Environmental Coordinator	Weekly during operation of haul roads
HR-D-O-2	Monitor vegetation condition, especially surrounding infected areas and if Dieback is spreading review Dieback management framework	Site Environmental Coordinator	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
HR-D-D-1	Topsoil from infected areas is to remain within	Earthworks Supervisor	At completion of construction	Site Environmental	At completion of

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	infected areas (if any).		activities.	Coordinator	construction activities.
HR-D-D-2	Commission a Dieback interpreter to complete a Dieback survey post works and document results.	Site Coordinator	Environmental After rehabilitation	Environment and Community relations Coordinator Manager	After rehabilitation.

### 7.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as exist for Dieback. The haul roads will facilitate the movement of heavy vehicles and equipment during the operation stage of the project and the movement of vehicles along the haul roads especially during construction could potentially transport weeds from other site areas and/or spread existing weed species within the project area.

Plant and equipment will be mobilised to site for construction of the haul roads and for the excavation of the WWTP site with the potential for weeds to be introduced to surrounding vegetation. The haul road into the WWTP runs through Area 10b as shown in **Figure 3**, therefore it is important to put in place management measures prior to site entry to reduce the spread of weeds.

**Table 7.2.3** below specifically outlines the implementation schedule and responsibilities for weed management to ensure the objectives specified in **Section 4.3.2** are met.



Table 7.2.3 Implementation schedule and responsibilities for weed management for the haul road

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
HR-W-PC-1	Undertake a weed survey within and surrounding the haul roads and document findings.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to construction works commencing.
HR-W-PC-2	Establish and map areas which currently have "Very Good" condition vegetation around haul roads.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
<b>Construction</b>					
HR-W-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Work supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
HR-W-O-1	Review all vehicle movements to ensure that vehicles remain on the haul road alignment.	Earthworks Supervisor	Daily during haul road construction.	Site Environmental Coordinator	Weekly during haul road construction.
<b>Operation</b>					
HR-W-O-1	Review vehicle movements to ensure that vehicles/plant remain within areas authorised for disturbance.	Earthworks Supervisor	Daily during operation of the haul road.	Site Environmental Coordinator	Weekly during operation of the haul road.
HR-W-O-2	Monitor the vegetation condition as outlined in HR-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout operation of the haul road.	Environment and Community Relations Manager	Monthly throughout operation of the haul road.
HR-D-O-4	Ensure sediment from wash-down bays is captured and does not run of into adjacent vegetation.	Environment and Community Relations Manager.	During operation of wash-down bays	Site Environmental Coordinator	Weekly throughout the project duration.
<b>Decommissioning</b>					
HR-D-D-1	Monitor the vegetation condition of areas specified in HR-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community Relations Manager	Spring after completion of works.

#### 7.2.4 Fire management

Fire management is particularly relevant in areas where works are taking place within or adjacent to vegetation and bushland areas. The majority of the haul road will be surrounded by vegetation and fire management measures will need to be implemented and monitored throughout the duration of the project. All staff will need to understand any evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 7.2.4** below specifically outlines the implementation schedule and responsibilities for fire management for haul roads which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 7.2.4 Implementation schedule and responsibilities for fire management for the haul road

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
Pre-Construction					
HR-PC-FM-1	Inductions of operational/management personnel, outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
Construction					
HR-C-FM-1	Ensure that all vehicles in operation have a fire extinguisher on board.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Monthly during construction.
HR-C-FM-2	Ensure that smoking is not occurring inside vehicles or outside designated smoking areas.	Site Supervisor	During road construction.	Site Environmental Coordinator	Weekly during road construction.
Operation					
HR-O-FM-1	During summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Weekly during summer months throughout the project duration.
HR-O-FM-2	Ensure that smoking is not occurring inside vehicles or outside designated smoking areas.	Site Supervisor	During road operation.	Site Environmental Coordinator	Weekly during road operation.

### 7.2.5 Hydrology management

The haul roads will require the clearing of 3.69Ha of vegetation and once constructed will be repeatedly utilised by heavy vehicles and machinery. It is therefore important for safety reasons that the haul roads are effective in directing surface runoff away from the road surface.

Table drains and drainage measures will be constructed to divert surface runoff away from the road. All machinery and equipment are to be kept in good working order and management measures are in place to avoid any spills which may impact the quality of the ground water.

**Table 7.2.5** below specifically outlines the implementation schedule and responsibilities for hydrology management for haul roads which must be followed to ensure the objectives specified in **Section 4.5.2** are met.



Table 7.2.5 Implementation schedule and responsibilities for hydrology management for the haul roads

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
HR-PC-H-1	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in Section 4.5.3.3.	Site Environmental Coordinator	Prior to bore construction.	Site Environmental Coordinator	Monthly.
HR-PC-H-2	Order and allocate spill kits to plant/equipment which will be working along the haul road during construction.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
HR-C-H-1	Construct table drains along roads to direct water away from the road surface during heavy rainfall events.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	During road construction.
HR-C-H-2	Undertake refuelling on limestone hardstand areas only.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Daily during construction.
HR-C-H-3	Install spill response kits in allocated plant and equipment.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Weekly during construction.
<b>Operation</b>					
HR-O-H-1	Monitor and maintain table drains to ensure that they are free of debris and are providing adequate drainage for the haul roads.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly throughout project duration.
HR-O-H-2	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in Section 4.5.3.3.	Site Environmental Coordinator	Monthly during ground water abstraction.	Environment and Community Relations Manager.	Annually.
HR-O-H-2	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly throughout project duration.

### 7.2.6 Landform management

Based on the environmental assessment undertaken for both the Alkimos-Eglington MRS amendment and the Alkimos Wastewater Scheme PER, Area 10b does not support any regionally significant environmental vegetation. However as discussed above in Section 7.1 Area 10b was identified by the Water Corporation as having geomorphologic values, since the area forms part of a prominent landscape feature associated with the Quindalup Dune system (second phase, Q2). The haul road alignment was designed to avoid the most prominent and elevated parts of the dune within the Area10b and remaining alignment of the haul roads not within Area 10b.

Upon decommissioning of the haul road re-contouring of the land through Area 10b will take place. The haul roads will need to be monitored and managed to ensure that disturbance is restricted to the authorised footprint only.

**Table 7.2.6** below specifically outlines the implementation schedule and responsibilities for landform management for the haul roads which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 7.2.6 Implementation schedule and responsibilities for landform management for the haul road

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
HR-PC-L-1	Undertake a survey of the haul road and peg out alignment and boundaries.	Earthworks Supervisor	Prior to construction of the haul roads.	Environment and Community Relations Manager	Upon receiving the GDWP.
HR-PC-L-2	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in Section 4.1.2.	Site Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the haul roads.
HR-PC-L-3	Install flagging around Area 10b to prevent access.	Construction Manager	Prior to construction of the haul road.	Environment and Community Relations Manager	Prior to construction of the haul road.
<b>Construction</b>					
HR-C-L-1	Mark out clearing/disturbance extent for haul road through Area 10b.	Earthworks supervisor	At least two weeks prior to intended commencement of vegetation clearing.	Earthworks package manager	At least one week prior to intended commencement of vegetation clearing.
HR-C-L-2	Confirmation of marked-out clearing/disturbance extent.	Environment and Community Relations Manager	At least two days prior to intended commencement of vegetation clearing	Construction Manager	Prior to vegetation clearing commencing.
HR-C-L-3	Installation of fences along defined edge of disturbance.	Earthworks supervisor	Daily during clearing works.	Site Environmental Coordinator	During topsoil stripping.
HR-C-L-4	Daily review of clearing to ensure that clearing and other disturbances are retained within marked-out areas.	Earthworks Supervisor	Daily during clearing works.	Site Environmental Coordinator	Daily during clearing works.
HR-C-L-5	Stabilise construction batters using liquid stabilizers, matting and/or brush.	Earthworks Supervisor	At completion of haul road construction.	Environment and Community Relations Manager	At completion of haul road construction.
<b>Operation</b>					
HR-O-L-1	Review vehicle movements to ensure that vehicles remain within areas of authorised disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will advise restoration measures as appropriate.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
HR-O-L-2	Monitor and maintain haul road batters to ensure stability and	Site Environmental	Weekly during	Environment and	Monthly during



	deployment of further stabilisation/maintenance where required.	Coordinator	earthworks program.	Community Relations Manager	earthworks program.
<b>Decommissioning</b>					
HR-D-L-1	Remove fencing without causing clearing or disturbance to landform outside previously cleared areas.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.
HR-D-L-2	Undertake deep ripping of road surface.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.
HR-D-L-3	Backfill haul road profile to achieve contours of pre-disturbance landform (Area 10b section).	Earthworks Supervisor	Following deep ripping.	Earthworks Package Manager	Once backfill operations are completed.
HR-D-L-4	Monitor the area for erosion and implement erosion control measures as outlined in the Management and Rehabilitation of the Haul Road, including Area 10b Plan.	Site Environmental Coordinator	Monthly after re-contouring for 1year.	Environmental and Community Relations Manager	Quarter yearly after re-contouring for 1 year.

### 7.2.7 Rehabilitation management

The rehabilitation of the haul road will follow the detail specified in the Management and Rehabilitation of the Haul Road, including Area 10b Plan. Below are species lists as presented in the Area 10b management plan. For more specific details on rehabilitation of the haul road refer to this document.

**Table 7.2.7a Species to be used in the rehabilitation of Area 10b and their mode of propagation**

Species list	Mode of propagation
<i>Acacia cochlearis</i>	Direct seed and tubestock
<i>Acacia lasiocarpa</i>	Direct seed and tubestock
<i>Acacia rostellifera</i>	Direct seed and tubestock
<i>Acacia saligna</i>	Direct seed and tubestock
<i>Banksia attenuata</i>	Direct seed and tubestock
<i>Desmocladius flexuosus</i>	Direct seed and tubestock
<i>Dryandra sessilis</i>	Direct seed and tubestock
<i>Eremophila glabra</i>	Direct seed and tubestock
<i>Exocarpos sparteus</i>	Direct seed and tubestock
<i>Hardenbergia comptoniana</i>	Direct seed only
<i>Hibbertia subvaginata</i>	Tubestock only
<i>Melaleuca huegelii</i>	Direct seed only
<i>Olearia axillaris</i>	Direct seed and tubestock
<i>Phyllanthus calycinus</i>	Direct seed only
<i>Rhagodia baccata</i>	Direct seed and tubestock
<i>Scaevola crassifolia</i>	Direct seed and tubestock
<i>Spyridium globulosum</i>	Direct seed and tubestock
<i>Threlkeldia diffusa</i>	Direct seed and tubestock

**Table 7.2.7b Species to be used in the rehabilitation of haul roads outside of Area 10b and their mode of propagation**

Species list	Mode of propagation
<i>Acacia cochlearis</i>	Direct seed
<i>Acacia lasiocarpa</i>	Direct seed
<i>Acacia rostellifera</i>	Direct seed
<i>Acacia saligna</i>	Direct seed
<i>Banksia attenuata</i>	Direct seed
<i>Desmocladius flexuosus</i>	Direct seed
<i>Dryandra sessilis</i>	Direct seed
<i>Eremophila glabra</i>	Direct seed
<i>Exocarpos sparteus</i>	Direct seed
<i>Hardenbergia comptoniana</i>	Direct seed
<i>Melaleuca huegelii</i>	Direct seed
<i>Olearia axillaris</i>	Direct seed

Phyllanthus calycinus	Direct seed
Rhagodia baccata	Direct seed
Scaevola crassifolia	Direct seed
Spyridium globulosum	Direct seed
Threlkeldia diffusa	Direct seed

Follow-up monitoring and maintenance will be undertaken to ensure that revegetation is successful and the area has effectively stabilised. This will continue for 24-months after the completion of the initial rehabilitation and revegetation works and would identify issues such as weed invasion, wind or water erosion, and be the basis for maintenance activities.

**Table 7.2.6** below specifically outlines the implementation schedule and responsibilities for rehabilitation which must be followed to ensure the objectives specified in **Section 4.7.2** are met.



**Table 7.2.6. Implementation schedule and responsibilities for rehabilitation management for the haul roads**

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
HR-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas.	Site Environmental Coordinator	Annually depending on seeding times for target species.	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
<b>Construction</b>					
HR-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly.	Site Environmental Coordinator	Prior to clearing commencing.	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
HR-C-R-2	Clear existing vegetation and push into brush piles at the edge of the road alignment. Aim to keep vegetation intact.	Earthworks Supervisor	Once topsoil assessment is completed.	Site Environmental Coordinator	During vegetation clearing.
HR-C-R-3	Strip topsoil and place into stockpiles at the edge of the road alignment and within defined area of disturbance. Aim to keep stockpiles less than 1,500mm deep.	Earthworks Supervisor	Once vegetation has been cleared.	Site Environmental Coordinator	During topsoil stripping.
<b>Decommissioning</b>					
HR-D-R-1	Undertake deep ripping of any hardstand areas along the road surface.	Earthworks Supervisor	At completion of the construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.
HR-D-R-2	Backfill haul road.	Earthworks Supervisor	Following deep ripping.	Earthworks Package Manager	Once backfill operations are completed.
HR-D-R-3	Spread topsoil over backfilled areas and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following re-contouring.	Site Environmental Coordinator	Once topsoil has been spread.
HR-D-R-4	Spread brush on top-soiled areas and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following spreading of topsoil.	Site Environmental Coordinator	Once brush has been placed and other surface stability measures have been deployed.
<b>Rehabilitation</b>					
HR-R-R-1	Undertake direct seeding and tubestock planting.	Site Environmental Coordinator	After the break of the season (first 300mm of soil profile is wet).	Environment and Community Relations Manager	After direct seeding/planting has taken place.
HR-R-R-2	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.



HR-R-R-3	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
HR-R-R-4	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter.	Site Environmental Coordinator	Following end of Summer (February).	Environment and Community Relations Manager	Following end of Summer (February).
HR-R-R-5	Undertake maintenance as required.	Site Environmental Coordinator	February to March.	Environment and Community Relations Manager	February to March.
HR-R-R-6	Undertake any infill direct seeding as required.	Site Environmental Coordinator	Immediately following first autumn/winter rain event.	Environment and Community Relations Manager	Immediately following first autumn/winter rain event.

## 8 QUINNS MAIN SEWER

This section outlines the specific details and management measures for the QMS within the WWTP buffer zone. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the Quinns Main Sewer. Clearing of native vegetation for the Quinns Main Sewer is authorised by the Part V Clearing Permit (CPS 1064/2) issued on the 9 August 2007.

A summary of the requirements for the specific management of the QMS including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 8.1** to **Section 8.7**.

### 8.1 DESIGN

The section of the Quinns Main Sewer situated within the WWTP buffer area will be constructed using both open cut trenching (cut and cover) and tunnelling techniques. Spoil will be excavated and placed on both sides of the trench. The sides of the trench will be battered.

A shaft (AC11) and lay-down area for pipe work will be installed at the conclusion of the trenched section for insertion of the Tunnel Boring Machine (TBM) which will facilitate tunnelling of the final section to the WWTP. The total area of disturbance within the WWTP buffer will be 6 Ha, which includes trenching and a lay down area required for the shaft. Once the sewer is constructed the trench will be backfilled and the areas within the WWTP buffer will be rehabilitated.

### 8.2 CONSTRUCTION

#### 8.2.1 Disturbance management

Disturbance will be limited to areas designated in the Clearing Permit (CPS 1064/2) only (see **Appendix B**). Where tunnelling methods are adopted for installation of the sewer pipes, the degree of surface disturbance will be minimal and mostly restricted to the construction of access shafts and access roads. Tunnelling will be adopted for the majority of the alignment. There are sections of the Quinns Main Sewer that involve a cut and cover approach, and in these areas surface disturbance will be higher than for tunnelling.

**Table 8.2.1** below specifically outlines the implementation schedule and responsibilities for ground disturbance management for the QMS which must be followed to ensure the objectives specified in **Section 4.1.2** are met.



Table 8.2.1 Implementation schedule and responsibilities for disturbance management for ground disturbance

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
QMS-GD-PC-1	Undertake survey of the QMS alignment and peg out alignment and boundaries.	Sewer Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
QMS-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
QMS-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in <b>Section 4.1.2</b> .	Sewer Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
<b>Construction</b>					
QMS-GD-C-1	Review clearing is being completed as authorised within a GDWP.	Sewer Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
QMS-GD-C-2	Clearly mark-out the extent of disturbance/clearing with fencing, install signage.	Sewer Supervisor	At least two weeks prior to commencement of vegetation clearing.	Sewer Package Manager	At least one week prior to the intended commencement of vegetation clearing.
QMS-GD-D-3	Review GDWP to ensure that disturbance was within the approved boundary. Mark up any variances with the permit and conduct rehabilitation of those areas as specified in <b>Section 5.2.7</b> . Follow up internally regarding the identified non compliance with GDWP and report to the Alliance Manager.	Site Environmental Coordinator	At completion of construction of the QMS.	Environment and Community Relations Manager	At completion of sewer construction program.
<b>Operation</b>					
QMS-GD-O-1	Review of vehicle movements to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Sewer Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.
QMS-GD-O-2	Monitor and maintain of batters to ensure stability and deployment of further stabilisation and management where required.	Sewer Supervisor	Weekly during operations.	Site Environmental Coordinator	Weekly during operations.



Decommissioning					
QMS-GD-D-1	Remove any signs/fencing that were installed.	Sewer Supervisor	At completion of construction of the QMS.	Site Environmental Coordinator	At completion of construction of the QMS.

### 8.2.2 Dieback management

The Quinns Main Sewer area will be an area of activity and vehicles, machinery and equipment will be moving through on a regular basis during the construction stage. The movement of vehicles/equipment along the access roads into the laydown area and along the trenched section of tunnel could potentially transport Dieback into adjacent areas and/or spread existing infection within the project area.

**Table 8.2.2** below specifically outlines the implementation schedule and responsibilities for Dieback management for the QMS which must be followed to ensure the objectives specified in **Section 4.2.2** are met.



Table 8.2.2 Implementation schedule and responsibilities for Dieback management for the Quinns Main Sewer

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
QMS-D-PC-1	Commission a Dieback interpreter to complete preliminary Dieback survey/recommendations.	Site Environmental Coordinator	Prior to any clearing.	Environment and Community Relations Manager	Prior to construction of the QMS.
QMS-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Environmental Coordinator	Prior to any vehicle movements along the access road.	Environment and Community Relations Manager	Following advice from a Dieback interpreter.
QMS-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Environmental Coordinator	Prior to any vehicle movements into the area.	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
QMS-D-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Sewer supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
QMS-D-C-2	If Dieback exists within the QMS area ensure that appropriate wash down facilities and installed.	Sewer Package Manager	Prior to vehicle movements within QMS area.	Environment and Community Relations Manager	Prior to vehicle movements within QMS area.
QMS-D-C-3	If Dieback exists ensure infected topsoil is stripped and kept separate from uninfected topsoil.	Sewer Supervisor	During topsoil stripping.	Site Environmental Coordinator	Weekly during topsoil stripping.
QMS-D-C-4	Construct table drains so that water is not diverted from infected areas into uninfected areas (if Dieback exists).	Sewer Supervisor	During table drain construction.	Site Environmental Coordinator	Weekly throughout the project duration.
QMS-D-C-5	Review vehicle movements to ensure that vehicles remain within areas authorised for disturbance only	Sewer Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during construction works.
<b>Decommissioning</b>					
QMS-D-D-1	Topsoil from infected areas is to remain within infected areas (if any).	Site Environmental Coordinator	At completion of earthworks program.	Environment and Community relations Manager	At completion of earthworks program.
QMS-D-D-2	Commission a dieback interpreter to complete a Dieback survey post works and document results.	Site Environmental Coordinator	After rehabilitation.	Environment and Community relations Manager	After rehabilitation.

### 8.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as exist for Dieback. Light vehicles, equipment and machinery will be frequently moving throughout the area during the project, and the movement of vehicles could potentially transport weeds from other site areas and/or spread existing weed species within the project area.

Plant and equipment will be mobilised to site for the shaft construction and tunnelling works, with the potential for weeds to be introduced to surrounding vegetation. It is therefore important that management measures are in place prior to site entry to reduce the spread of weeds.

**Table 8.2.3** below specifically outlines the implementation schedule and responsibilities for weed management for the QMS which must be followed to ensure the objectives specified in **Section 4.3.2** are met.



Table 8.2.3 Implementation schedule and responsibilities for weed management for the Quinns Main Sewer

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
OMS-W-PC-1	Undertake a survey of the weed invasion within and surrounding the site, document findings.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
OMS-W-PC-2	Establish and map areas which currently have "Good" condition vegetation.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
<b>Construction</b>					
OMS-W-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Work supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
OMS-W-C-2	Review vehicle movements to ensure that vehicles and material lay-down areas remain within areas authorised for disturbance.	Earthworks Supervisor	Daily during construction.	Site Environmental Coordinator	Weekly during construction.
OMS-W-C-3	Monitor the vegetation condition and weed intrusion of areas specified in QMS-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout the project duration.	Environment and Community relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
OMS-D-D-1	Monitor the vegetation condition and weed intrusion of areas specified in QMS-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community relations Manager	Spring after completion of works.

#### 8.2.4 Fire management

Fire management is particularly relevant to areas where works are taking place within or adjacent to vegetation and bushland areas.

Fire management measures will need to be implemented and monitored throughout the duration of the project, all staff will need to understand any evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 8.2.4** below specifically outlines the implementation schedule and responsibilities for fire management for the QMS which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 8.2.4 Implementation schedule and responsibilities for fire management for the Quinns Main Sewer

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
QMS-PC-FM-1	Inductions of operational/management personnel to address fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
<b>Construction</b>					
QMS-C-FM-1	Install site fencing with the appropriate firebreak of at least 3 metres wide along the fence line.	Sewer Supervisor	During clearing operations	Site Environmental Coordinator	After clearing of site office area has been completed.
QMS-C-FM-2	Ensure that all vehicles in operation have a fire extinguisher on board	Sewer Supervisor	During road construction	Site Environmental Coordinator	Weekly during construction.
QMS-C-FM-3	Designate smoking areas and provide ash trays for cigarette butts	Environment and Community Relations Manager	Prior to staff locating to the site office	Site Environmental Coordinator	Weekly during construction.
<b>Operation</b>					
QMS-O-FM-1	Ensure that smoking is restricted to smoking areas only and ensure cigarette butts placed in cigarette buckets located on site and removed regularly.	Site Environmental Coordinator	Weekly during operations.	Environment and Community Relations Manager	Monthly during operations.
QMS-O-FM-2	During summer months water cart is to be left full of water	Sewer Supervisor	Daily during summer months throughout the project duration	Site Environmental Coordinator	Daily during operations.
QMS-O-FM-3	Ensure fire extinguishers are present on site.	Site Environmental Coordinator	Weekly during operations.	Environment and Community Relations Manager	Monthly during operations.

### 8.2.5 Hydrology management

The Alkimos area comprises coastal calcareous sand dunes which are highly permeable. The QMS laydown area will have a limestone hardstand surface which necessitates table drains to divert surface run-off away from the hard surface during heavy rainfall events. The runoff will not be diverted into areas with existing remnant vegetation.

Construction water for dust suppression and compaction will be sourced from ground water production bores at four locations within the project area, abstraction from these production bores will be monitored monthly.

Table 8.2.5 below specifically outlines the implementation schedule and responsibilities for hydrology management for the QMS which must be followed to ensure the objectives specified in **Section 4.5.2** are met.



Table 8.2.5 Implementation schedule and responsibilities for hydrology management for the site Quinns main sewer

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
QMS-PC-H-1	Order and allocate spill kits for QMS works.	Sewer Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
QMS-C-H-1	Install spill response kits in allocated plant and equipment and within site laydown area. .	Sewer Supervisor	Prior to construction.	Site Environmental Coordinator	Prior to construction/d.
QMS-C-H-2	Construct table drains to direct water away during heavy rainfall events, ensure table drains do not divert water into and smother adjacent vegetation.	Sewer Supervisor	During site office /compound construction.	Environment and Community Relations Manager	During construction activities.
QMS-C-H-3	Undertake refuelling on limestone hardstand areas only.	Sewer Supervisor	During site office /compound construction.	Site Environmental Coordinator	Daily during construction
<b>Operation</b>					
QMS-O-H-1	Monitor and maintain table drains to ensure that they are free of debris and are providing adequate drainage.	Sewer Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly throughout project duration.
QMS-O-H-2	Ensure spill kits are in close proximity to operations at all times.	Sewer Supervisor	Weekly during operations.	Site Environmental Coordinator	Monthly during operations.
QMS-O-H-3	If spill kits are used/damaged replace immediately.	Sewer Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly throughout project duration.

### 8.2.6 Landform management

The QMS area is in close proximity to Area 10b a predominant landform protected for its geomorphological significance. A portion of the QMS will involve open trenching.

**Table 8.2.6** below specifically outlines the implementation schedule and responsibilities for ground disturbance management for the QMS which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 8.2.6 Implementation schedule and responsibilities for landform management for the Quinns Main Sewer

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
QMS-PC-L-1	Undertake survey of designated alignment and laydown area and peg out alignment and boundaries	Sewer Supervisor	At least one month before ground disturbing activity	Environment and Community Relations Manager	Upon receiving the GDWP
QMS-PC-L-2	Install site fencing to ensure works do not impact the surrounding vegetation and landform.	Sewer Supervisor	After survey and clearing has taken place	Environment and Community Relations Manager	Once fencing is installed.
<b>Construction</b>					
QMS-C-L-1	Review of vehicle movements to ensure that vehicles and construction activities remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will implement restoration measures as appropriate.	Sewer Supervisor	Daily during construction works.	Site Environmental Coordinator	Daily during construction works
QMS-C-L-2	Stabilise batters using liquid stabilisers, matting and/or brush.	Sewer Supervisor	At the completion of the trenched sections of the QMS.	Environment and Community Relations Manager	At the completion of the trenched sections of the QMS.
<b>Operation</b>					
QMS-O-L-1	Review of vehicle movements, material laydown areas to ensure that they remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will direct restoration measures as appropriate.	Sewer Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
QMS-O-L-2	Monitor and maintain trenches to ensure stability and deploy further stabilisation and management where required.	Sewer Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
<b>Decommissioning</b>					
QMS-D-L-1	Undertake restoration on the site areas, remove fencing and restore landform as much as practicable.	Sewer Supervisor	After the completion of the earthworks program	Environment and Community Relations Manager	After the completion of the earthworks program and prior to rehabilitation of the area

### 8.2.7 Rehabilitation management

Rehabilitation of cut and cover areas for the QMS will involve:

- Spreading of topsoil;
- Brushing;
- Weed control;
- Direct seeding;
- Tubestock planting; and
- Monitoring and Maintenance.

On completion of the cut and cover sections of the QMS excavation the site will be backfilled. Direct seeding will be applied at a rate of 6 kg/Ha, and tubestock will be planted at a density of 1 plant for every 2 square metres. The proportion of seeds and the numbers of tubestock required is contained in Table 8.2.7a.

Table 8.2.7a Seed and tubestock to be used in rehabilitation of the cut and cover sewer

	Species	% seed mix + tubestock
<b>Tree</b>	<i>Eucalyptus gomphocephalla</i>	1
<b>Shrubs</b>	<i>Acacia lasiocarpa</i>	10
	<i>Acacia saligna</i>	5
	<i>Acanthocarpus preissii</i>	10
	<i>Hibbertia hypericoides</i>	3
	<i>Hibbertia subvaginata</i>	3
	<i>Leucopogon pauciflora</i>	3
	<i>Melaleuca systema</i>	10
	<i>Melaleuca huegelli</i>	8
	<i>Trymalium ledifolium</i>	5
<b>Herbs</b>	<i>Phyllanthus calycinus</i>	5
	<i>Gompholobium tomentosa</i>	15
	<i>Hardenbergia comptoniana</i>	5
	<i>Lepidosperma pubesquameum</i>	5
	<i>Conostylis pauciflora subsp. eury</i>	2
	<i>Desmocladius flexuosa</i>	1
	<i>Sarcozona bicarinata</i>	3
	<i>Threlkeldia diffusa</i>	

Note: Tubestock will only be used in the WWTP buffer and in areas to be retained in the long term.

Follow-up monitoring and maintenance will be required to ensure that revegetation is successful. This will continue for 12 months after the completion of the rehabilitation and revegetation and will identify issues such as weed invasion, wind or water erosion, and be the basis for maintenance activities. Table 8.2.7 below specifically outlines the implementation schedule and responsibilities for ground rehabilitation management which must be followed to ensure the objectives specified in Section 4.7.2 are met.



Table 8.2.7 Implementation schedule and responsibilities for rehabilitation management for the Quinns Main Sewer

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
QMS-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas	Site Environmental Coordinator	Annually depending on seeding times for target species	Environment and Community Relations Manager	At least six months prior to revegetation commencing
<b>Construction</b>					
QMS-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly	Site Environmental Coordinator	Prior to clearing commencing	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
QMS-C-R-2	Clear existing vegetation and push into brush piles at the edge of the road alignment. Aim to keep vegetation intact.	Sewer Supervisor	Once topsoil assessment is completed	Site Environmental Coordinator	During vegetation clearing
QMS-C-R-3	Strip topsoil and place into stockpiles at the edge of the batters or lay down areas within defined area of disturbance. Aim to keep stockpiles less than 1,500mm deep	Sewer Supervisor	Once vegetation has been cleared	Site Environmental Coordinator	During topsoil stripping
<b>Decommissioning</b>					
QMS-D-R-1	Undertake deep ripping of any hardstand areas.	Sewer Supervisor	At completion of the construction of the QMS	Site Environmental Coordinator	At completion of earthworks program
QMS-D-R-2	Backfill trenched areas.	Sewer Supervisor	Following deep ripping	Earthworks Package Manager	Once backfill operations are completed
QMS-D-R-3	Spread topsoil (100mm) over backfilled areas and provide other surface stabilisation measures where required	Sewer Supervisor	Following re-contouring	Site Environmental Coordinator	Once topsoil has been spread
QMS-D-R-4	Spread brush on top-soiled landform and provide other surface stabilisation measures where required	Sewer Supervisor	Following spreading of topsoil	Site Environmental Coordinator	Once brush has been place and other surface stability measures have been deployed.
<b>Rehabilitation</b>					
QMS-R-R-1	Undertake direct seeding	Site Environmental Coordinator	After the break of the season (first 300mm of soil profile is wet)	Environment and Community Relations Manager	After direct seeding has taken place
QMS-R-R-2	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding



QMS-R-R-3	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding
QMS-R-R-4	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter.	Site Environmental Coordinator	Following end of Summer (February)	Environment and Community Relations Manager	Following end of Summer (February)
QMS-R-R-5	Undertake maintenance as require	Site Environmental Coordinator	February to March	Environment and Community Relations Manager	February to March
QMS-R-R-6	Undertake any infill direct seeding as required.	Site Environmental Coordinator	Immediately following first autumn/winter rain event	Environment and Community Relations Manager	Immediately following first autumn/winter rain event

## 9 WWTP SITE EXCAVATION

This section outlines the specific details and management measures for the site WWTP excavation area. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the WWTP excavation area.

A summary of the requirements for the specific management of the WWTP excavation area including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 9.1** to **Section 9.7**.

### 9.1 DESIGN

The ultimate capacity of the WWTP is proposed to be 160ML/d, however this capacity is not expected to be required until beyond 2050. Initially a 20ML/d WWTP will be installed at the site, which will utilise a footprint approximately one quarter of the size of that required for a 160ML/d plant. Due to geotechnical conditions, drill and blast is required as part of the earthworks program. On this basis, a step-wise excavation of the WWTP site in line with plant expansion requirements would not be feasible as future blasting may affect the existing plant's structural integrity. Since the WWTP earthworks cannot be undertaken progressively, the WWTP site will be prepared for the ultimate capacity, requiring the excavation and removal of approximately 2 million cubic metres of spoil that will be fully cleared of vegetation. This will provide for holistic planning of the rehabilitation of the WWTP site batters and avoid putting the constructed WWTP plant at risk through blasting in close proximity in the future.

The site excavation works will require a fleet of earthmoving equipment including excavators, dozers, graders, dump trucks and water carts. Portions of the footprint will be excavated to floor levels founded at RL2.6m and RL5m AHD. The majority of the footprint will be excavated to between approximately RL11.5-15m AHD.

The site will be cleared of all vegetation and topsoil in a step-wise fashion. An area of approximately 29.5 Ha will be cleared over a period of approximately 25 days. The vegetation will not be mulched, rather it will be pushed into stockpiles remaining in "brush" form. Topsoil will be stripped within the WWTP site and used for rehabilitation of the batters. Where sequencing will allow, topsoil will be stripped from one location and immediately placed where rehabilitation works are active. In all other instances where immediate re-use is not possible, topsoil will be stockpiled for later re-spreading as required, or incorporated in the fill.

Excavated material from the WWTP site will be trucked via haul roads and disposed of as fill within LandCorp's development fill site to the south of the WWTP. Haul road alignments are shown in **Figure 3**. Ground water production bores as mentioned in **Section 4.5.3.3** will be located within the area to assist with compaction and dust suppression.

The WWTP site final levels will be battered back to a grade that will vary depending on the geology, and it is proposed that the batters will have a final grade of 1V:2.5H in sand and 1V:1.75H in rock. This will provide a high degree of geotechnical stability and provide a sound basis for rehabilitation. These batters will comprise both loose coarse sand and consolidated limestone at depth.

Rehabilitation of the WWTP sand batters will be undertaken progressively as excavation proceeds. This will involve respreading topsoil and cleared vegetation in "brush" form, planting tubestock and direct seeding using provenance seed collected throughout the area in 2006 and 2007. Revegetating the sand batters will ensure long-term stability and prevent wind and water erosion onsite. Approximately 10 Ha of the WWTP footprint will be

rehabilitated after works have been completed (not including WWTP floor area). A 1.2 metre high, ring-lock fence will be erected around the project area. The fencing alignment is shown in **Figure 11**.

## 9.2 CONSTRUCTION

### 9.2.1 Disturbance management

The WWTP excavation will cause the greatest amount of ground disturbance. It requires an estimated two million cubic metres of spoil to be removed and a total of approximately 29.5 Ha of clearing to be completed in a relatively short timeframe. It is therefore important that the disturbance is managed appropriately so that all disturbance remains in designated foot prints as outlined in **Figure 13**.

**Table 9.2.1** below specifically outlines the implementation schedule and responsibilities for ground disturbance management for the WWTP earthworks which will be followed to ensure the objectives specified in **Section 4.1.2** are met.



Table 9.2.1 Implementation schedule and responsibilities for disturbance management for the WWTP excavations

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-GD-PC-1	Undertake survey of the WWTP excavation area and mark out boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
W-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
W-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in <b>Section 4.1.2</b> .	Earthworks Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
<b>Construction</b>					
W-GD-C-1	Clearly mark-out the extent of disturbance/clearing with fencing, install signage	Earthworks Supervisor	Once clearing has been completed.	Earthworks Package Manager	Once week after clearing has been completed.
W-GD-C-2	Clear incrementally and do not create islands where fauna could potentially get stranded.	Earthworks Supervisor	Daily during ground disturbing activities.	Site Environmental Coordinator	Daily during ground disturbing activities
W-GD-C-3	Review clearing is being completed as authorised within the GDWP.	Earthworks Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
W-GD-C-4	Review vehicle movements and construction activities to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Daily during construction works.

### 9.2.2 Dieback management

During the implementation of the WWTP excavations vehicles will be moving in and out of the area. Haul trucks and equipment will travel from the WWTP excavation area along haul roads into the fill site and back again on a regular basis, new equipment will be mobilised to site and demobilised off site. There is potential for Dieback to spread into and throughout the project area if the pathogen is not properly managed during the excavation stage of the project.

**Table 9.2.2** below specifically outlines the implementation schedule and responsibilities for Dieback management which must be followed to ensure the objectives specified in **Section 4.2.2** are met.



Table 9.2.2 Implementation schedule and responsibilities for Dieback management for the WWTP excavation

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-D-PC-1	Commission a Dieback interpreter to complete an preliminary Dieback survey.	Site Coordinator Environmental	Prior to any vehicle movements inside WWTP buffer zone.	Environment and Community Relations Manager	Prior to the WWTP excavation.
W-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Coordinator Environmental	Prior to any vehicle movements inside WWTP buffer zone.	Environment and Community Relations Manager	Following advise from Dieback interpreter.
W-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Coordinator Environmental	Prior to any vehicle movements inside WWTP buffer zone..	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
W-D-C-1	Ensure all plant and equipment have been subject to the a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Earthworks supervisor	At least 24 hours prior to site entry.	Site Coordinator Environmental	Upon plant/ equipment arrival.
W-D-C-2	If Dieback exists within the WWTP area ensure that appropriate wash down facilities are installed.	Earthworks Manager Package	Prior to vehicle movements within WWTP area.	Site Coordinator Environmental	Prior to vehicle movements within WWTP area.
W-D-C-3	If Dieback exists ensure infected topsoil is stripped and kept separate from uninfected areas.	Earthworks Supervisor	During topsoil stripping.	Site Coordinator Environmental	Weekly during topsoil stripping.
W-D-C-4	Construct drainage so that water is not diverted from infected areas into an uninfected area (if Dieback exists).	Earthworks Supervisor	During drainage construction.	Site Coordinator Environmental	Weekly throughout the project duration.
W-D-C-1	Review of vehicle movements, material lay-down areas to ensure they remain within areas authorised for disturbance only.	Earthworks Supervisor	Daily during operations.	Site Coordinator Environmental	Weekly during operations.
W-D-C-2	Monitor the vegetation condition, especially surrounding infected areas, if Dieback is spreading review Dieback management framework.	Site Coordinator Environmental	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.

### 9.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as exist for Dieback. Light vehicles, haulage equipment and machinery will be frequently moving throughout the area during the WWTP excavations and the movement of vehicles could potentially transport weeds from other site areas and/or spread existing weed species within the project area. In particular the haulage equipment will be transporting spoil from the WWTP area along haul roads into the fill site several times a day.

Plant and equipment will be mobilised to site for excavation of the WWTP, with the potential for weed to be introduced to surrounding vegetation. The MhMs vegetation to the north of the WWTP site is currently vegetation which is in "Good" to "Very Good" condition and this will need to be maintained during the course of excavations for the WWTP site.

**Table 9.2.3** below specifically outlines the implementation schedule and responsibilities for weed management for the WWTP excavations to ensure the objectives specified in **Section 4.3.2** are met.



Table 9.2.3 Implementation schedule and responsibilities for weed management for the WWTP excavation

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-W-PC-1	Undertake a survey of the weed invasion within and surrounding the site and document findings.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
W-W-PC-2	Establish and map areas which currently have "Very Good" condition vegetation.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
<b>Construction</b>					
W-W-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Earthworks supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
W-W-C-2	Review vehicle movements to ensure that vehicles and material lay-down areas remain within boundaries.	Construction Manager	Daily during WWTP excavation.	Site Environmental Coordinator	Weekly during WWTP excavation.
W-W-C-3	Monitor the vegetation condition and weed of areas specified in W-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.

#### 9.2.4 Fire management

Fire management is particularly relevant to areas where works are taking place within or adjacent to vegetation and bushland areas.

Fire management measures will need to be implemented and monitored throughout the duration of the WWTP excavations and all staff will need to understand evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 9.2.4** below specifically outlines the implementation schedule and responsibilities for fire management for WWTP excavations which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 9.2. Implementation schedule and responsibilities for fire management for the WWTP excavation site

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-PC-FM-1	Inductions of operational/management personnel, outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
<b>Construction</b>					
W-C-FM-1	Install site fencing with the minimum firebreak width of 3 metres back along the fence line.	Earthworks Supervisor	During clearing operations.	Site Environmental Coordinator	After clearing of site office area has been completed.
W-C-FM-2	Monitor to ensure that all vehicles in operation have a fire extinguisher on board.	Earthworks Supervisor	During construction.	Site Environmental Coordinator	Weekly during construction.
W-C-FM-3	Ensure that smoking is restricted to designated areas only and ensure cigarette butts are placed in cigarette buckets located on site and removed regularly.	Site Environmental Coordinator	Weekly during works.	Environment and Community Relations Manager	Weekly during works.
W-C-FM-4	During summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Daily during summer months throughout the project duration.
W-C-FM-5	Ensure fire extinguishers are present on site.	Site Environmental Coordinator	Weekly during project duration.	Environment and Community Relations Manager	Monthly.

### 9.2.5 Hydrology management

The Alkimos area is made up of coastal calcareous sand dunes which are highly permeable. The water table is below the reduced level (RL) to be excavated so no dewatering is required. Due to the size of the site, surface runoff may be generated during heavy rainfall events. Cut-off bunding will be installed around the top of the excavation to ensure that run-off will not flow down excavation batters. Any surface run-off water within the excavation area will be contained within table drains which will allow for percolation through the soil profile and the permeable nature of the underlying soils will infiltrate water quickly. Runoff needs to be managed to avoid disturbance/impacts to adjacent remnant vegetation.

Construction water for dust suppression and compaction will be sourced from ground water production bores at four locations within the project area, abstraction from these production bores will be monitored monthly.

Given that there are no existing surface water features on the site, the potential impacts are limited to disruptions to the existing water balance of the site, and impacts to groundwater quality from runoff contaminated by construction and support activities.

Table 9.2.5 below specifically outlines the implementation schedule and responsibilities for hydrology for the WWTP excavations which must be followed to ensure the objectives specified in Section 4.5.2 are met.



Table 9.2.5. Implementation schedule and responsibilities for hydrology management for the WWTP excavation

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-PC-H-1	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in <b>Section 4.5.3.3</b> .	Site Environmental Coordinator	Prior to production bore construction.	Site Environmental Coordinator	Monthly
W-PC-H-2	Order and allocate spill kits to plant/equipment which will be working within the WWTP excavation area.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
W-C-H-1	Construct appropriate bunding around top of the excavation to prevent any runoff from rainfall events cascading down batters.	Earthworks Supervisor	During the WWTP excavation.	Site Environmental Coordinator	During the WWTP excavation.
W-C-H-2	Construct table drains (if required) within the WWTP excavation area to contain any run-off generated during rainfall events.	Earthworks Supervisor	During the WWTP excavation.	Site Environmental Coordinator	During the WWTP excavation.
W-C-H-3	Undertake refuelling offsite or with mobile refuelling vehicles on hard stand areas and within workshop areas.	Earthworks Supervisor	During the WWTP excavation.	Site Environmental Coordinator	During the WWTP excavation.
W-C-H-4	Install spill response kits in allocated plant and equipment.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Weekly during construction
W-C-H-5	Allow for surface runoff to infiltrate to groundwater within table drains.	Earthworks Supervisor	During construction.	Site Environmental Coordinator	During Construction.
W-C-H-6	Monitor and maintain table drains to ensure that they are free of debris and are providing adequately drainage for the access roads.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly during project duration
W-C-H-7	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in <b>Section 4.5.3.3</b> .	Site Environmental Coordinator	Monthly whilst ground water abstraction is taking place.	Site Environmental Coordinator	Yearly whilst ground water abstraction is taking place.
W-C-H-8	Monitor cut-off bunding to ensure it is intact and in working order.	Site Environmental Coordinator	Weekly after bunding is installed.	Environment and Community Relations Manager	Monthly bunding is installed.
W-C-H-9	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly during project duration

### 9.2.6 Landform management

The WWTP site is located predominantly within the Q3 system the excavation severs the link between the Q3 and Q2 systems. The alliance has been working towards reducing the size of the excavation and minimising impacts to the dunal landforms.

To the north of the WWTP excavation is an area of outstanding regional significance known as Area 9. The area contains a consolidated vegetated area of Quindalup Dunes and it is also important habitat for Carnaby's Cockatoo. AWA will be particularly diligent to avoid any disturbance to the vegetation values of the area arising from construction activities.

The disturbed footprint will be permanent as it will be the location of the WWTP. The excavation batters will be rehabilitated to provide stability and to maintain native vegetation within the project area. Management will focus on maintaining the surrounding vegetation and landforms.

**Table 9.2.6** below specifically outlines the implementation schedule and responsibilities for landform management for the WWTP excavations which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 9.2.6 Implementation schedule and responsibilities for landform management for the WWTP excavation

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-PC-L-1	Undertake survey of the WWTP site area and peg out boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity	Environment and Community Relations Manager	Prior to ground disturbing activities.
W-PC-L-1	Ensure the WWTP footprint is within the area specified for clearing within the GDWP.	Earthworks Supervisor	Prior to ground disturbing activities.	Environment and Community Relations Manager	Prior to ground disturbing activities.
<b>Construction</b>					
W-C-L-1	Review of vehicle movements to ensure that vehicles remain within fenced areas.	Earthworks Supervisor	Daily during the excavation.	Site Environmental Coordinator	Daily during the excavation.
W-C-L-2	Excavate down to design levels and ensure batters have correct gradient.	Earthworks Supervisor	Daily during the excavation.	Environment and Community Relations Manager	Weekly during the excavation.
W-C-L-3	Initially stabilise any batters using liquid stabilisers, matting and/or brush.	Earthworks Supervisor	Incrementally during the excavation.	Environment and Community Relations Manager	Weekly until the area is rehabilitated.
W-C-L-4	Monitor the surrounding area around the WWTP excavation for signs of erosion, and if any, report to the Environment and Community Relations Manager for stabilisation.	Earthworks Supervisor	Weekly during the excavation period.	Site Environmental Coordinator	Weekly during the excavation period.
W-C-L-5	Monitor and maintain batters to ensure the stability and deployment of further stabilisation and management where required.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during project duration.

### 9.2.7 Rehabilitation management of WWTP batters

The construction of the WWTP involves excavating into limestone. Geotechnical information indicates these batters will be situated in solid limestone with variably soft and partially cemented limestone above (at the limestone-sand interface) and in isolated pockets within the solid limestone, with coarse siliceous sand above Quindalup sands).

The primary objective for rehabilitation of this area is to stabilise the slopes, particularly from wind erosion using brushing and establishing locally occurring species that can tolerate exposed windy conditions.

The batters will not be restored to their original landform and it is likely the soil profile of the batters will be different from the original profile, due to excavation and construction required for the WWTP.

Rehabilitation of the excavation batters will involve:

- Spreading of topsoil;
- Brushing;
- Weed control;
- Direct seeding;
- Tubestock planting;
- Infill planting; and
- Monitoring and Maintenance.

The excavation batter areas will be revegetated as soon as practical to limit wind erosion. Direct seeding will be applied at a rate of 6 kg/Ha, and tubestock will be planted at a density of 1 plant for every 2 square metres. The proportion of seeds and tubestock required is illustrated in Table 9.2.7a.

Table 9.2.7a Seed and Tubestock to be used in rehabilitation of the excavation batters.

	<b>Species</b>	<b>% seed mix + tubestock</b>
<b>Tree</b>	<i>Eucalyptus gomphocephalla</i>	5
<b>Shrubs</b>	<i>Acacia cyclops</i>	5
	<i>Acacia saligna</i>	10
	<i>Acacia lasiocarpa</i>	5
	<i>Melaleuca systema</i>	8
	<i>Rhagodia baccata</i>	10
	<i>Olearia axillaris</i>	10
	<i>Acanthocarpus preissii</i>	7
	<i>Spyridium globulosum</i>	5
	<i>Scaevola crassifolia</i>	5
<b>Herbs</b>	<i>Hardenbergia comptoniana</i>	5
	<i>Phyllanthus calycinus</i>	5
	<i>Gompholobium tomenstosum</i>	5
	<i>Threlkeldia diffusa</i>	3
	<i>Austrostipa flavescens</i>	3
	<i>Kennedia prostrata</i>	4
	<i>Conostylis candicans</i>	5

Follow-up monitoring and maintenance will be required to ensure revegetation is successful and batters have been effectively stabilised. This will continue for two years following rehabilitation and revegetation and will identify issues such as weed invasion, death of seedlings, predation, wind or water erosion, and be the basis for maintenance activities.

Quadrats will be set up within the excavation batter area to cover approximately 4% of the area.

Infill planting and seeding will be conducted over two years, with the first year at 20% of the initial application rate (1.2 kg/Ha for direct seeding and 1 plant every 10 m<sup>2</sup> for tubestock). The second year infill planting and seeding will be conducted at 10% of the initial density (0.6 kg/Ha for direct seeding and 1 plant every 20 m<sup>2</sup> for tubestock).

### 9.2.8 Rehabilitation management of the WWTP floor areas

Once the earthworks for the Alkimos WWTP have been completed, there will be areas at the base of the excavation which will not be immediately used for the WWTP. This will be due to the staged WWTP construction and subsequent stages may not be constructed for more than 20 years.

On this basis, it is proposed that the best treatment for these areas will be temporary revegetation, persisting for up to 20 years for stabilisation and prevention of wind and/or water erosion.

This area will not be restored to its original landform and it is likely the soil profile will be different from the original profile, due to excavation and construction required for the WWTP.

Rehabilitation of the excavation floor areas will involve:

- Spreading of topsoil;
- Brushing;
- Weed control;
- Direct seeding; and
- Monitoring and Maintenance.

The rehabilitation of the site, including the office/workshop areas, will require the ripping of hard stand layers, respreading of excavated material and replacement of topsoil applied at a depth of approximately 50 mm.

Direct seeding will be applied at a rate of 6 kg/Ha. The quantity of seeds required is listed in Table 9.2.8a.

Table 9.2.8a Seed to be used in rehabilitation of the excavation floor areas

	Species	% seed mix
<b>Shrubs</b>	<i>Acacia cyclops</i>	20
	<i>Acacia saligna</i>	20
	<i>Acacia truncata</i>	10
	<i>Acacia lasiocarpa</i>	10
	<i>Melaleuca systema</i>	10
	<i>Melaleuca cardiophylla</i>	10
	<i>Rhagodia baccatta</i>	20



Table 9.2.7 Implementation schedule and responsibilities for rehabilitation management for the WWTP excavation

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
W-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas.	Site Environmental Coordinator	Annually depending on seeding times for target species.	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
W-PC-R-2	Organise seedling propagation as required, at a local nursery.	Site Environmental Coordinator	Annually depending on tubestock times for target species.	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
<b>Construction</b>					
W-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly.	Site Environmental Coordinator	Prior to clearing commencing.	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
W-C-R-2	Clear existing vegetation and push into brush piles. Aim to keep vegetation intact.	Earthworks Supervisor	Once topsoil assessment is completed.	Site Environmental Coordinator	During vegetation clearing.
W-C-R-3	Strip topsoil and place into stockpiles within defined area of disturbance. Aim to keep stockpiles less than 1,500mm deep.	Earthworks Supervisor	Once vegetation has been cleared.	Site Environmental Coordinator	During topsoil stripping.
W-C-R-4	Bury weed contaminated vegetation and topsoil separately within the soil column at least 200mm below the surface.	Earthworks Supervisor	Once topsoil has been stripped.	Site Environmental Coordinator	Once topsoil has been stripped.
<b>Decommissioning</b>					
W-D-R-1	Undertake deep ripping of any hardstand areas.	Earthworks Supervisor	At completion of the construction of the ocean outfall pipe pull.	Site Environmental Coordinator	At completion of the construction of the WWTP.
W-D-R-3	Spread topsoil and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following re-contouring.	Site Environmental Coordinator	Once topsoil has been spread.
W-D-R-4	Spread brush and track roll on top-soiled landform and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following spreading of topsoil.	Site Environmental Coordinator	Once brush has been place and other surface stability measures have been deployed.



Rehabilitation					
W-R-R-2	Plant tubestock and undertake direct seeding at specified rates as shown in <b>Table 9.2.7a</b> and <b>Table 9.2.8a</b> .	Site Environmental Coordinator	After the break of the season (first 300mm of soil profile is wet).	Environment and Community Relations Manager	After tubestock planting and direct seeding has taken place.
W-R-R-3	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
W-R-R-4	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
W-R-R-5	Prepare a progress report for following the first year of monitoring and maintenance.	Site Environmental Coordinator	December of the first calendar year following the completion of rehabilitation and revegetation works.	Environment and Community Relations Manager	December of the first calendar year following the completion of rehabilitation and revegetation works.
W-R-R-6	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter and any maintenance required including weed control.	Site Environmental Coordinator	December of the first calendar year following the completion of rehabilitation and revegetation works.	Environment and Community Relations Manager	December of the first calendar year following the completion of rehabilitation and revegetation works.
W-R-R-7	Prepare a progress report for following the second year of monitoring and maintenance.	Site Environmental Coordinator	December of the second calendar year following the completion of rehabilitation and revegetation works.	Environment and Community Relations Manager	December of the second calendar year following the completion of rehabilitation and revegetation works.

## 10 LAND BASED CONNECTION FROM THE WWTP TO THE LAUNCH SITE

This section outlines the specific details and management measures for the land based connection. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the land based connection.

A summary of the requirements for the specific management of the land based connection including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 10.1** to **Section 10.7**.

### 10.1 DESIGN

The WWTP will be connected to the launch site (the start of the ocean outfall) by a 968 metre section of pipe. The connection will extend from the WWTP outlet flume to a chamber at the launch site.

In order to avoid surface disturbance associated with cut and cover techniques, the AWA proposes to use a Tunnel Boring Machine (TBM) that caters for the diverse nature of the geotechnical conditions that are expected to be encountered to install the pipeline and minimise surface disturbance.

The distance between the WWTP and the launch site will necessitate an intermediate shaft to be located between the two sites as the pipe jacking TBM cannot continuously tunnel for more than 700 metres. The necessary jacking forces beyond 700 metres exceeds the maximum force than can be delivered by a hydraulic jacking system and therefore the total connection distance of 968 metres cannot be jacked directly. Therefore there will be some ground disturbance along the alignment of this section of pipeline to construct and access a retrieval/jacking shaft. This disturbance will be significantly less than that incurred if the connection was installed through cut and cover (open trench) construction methods for the connection's full length. The area will be rehabilitated on the completion of tunnelling activities.

### 10.2 CONSTRUCTION

#### 10.2.1 Disturbance management

The access road and the shaft/laydown area will need to be cleared of all vegetation. Ministerial Statement 755 (Condition 6-1) allowed for the clearing for an intermediate recovery chamber between the WWTP and the launch site. The location of the chamber was selected after a thorough review of the area and its biological values.

**Table 5.2.1** below specifically outlines the implementation schedule and responsibilities for ground disturbance management for the land based connection which must be followed to ensure the objectives specified in **Section 4.1.2** are met.



Table 10.2.1 Implementation schedule and responsibilities for ground disturbance management for the land based connection

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LC-GD-PC-1	Undertake survey of the shaft area and access road.	Earthworks Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
LC-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
C-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in Section 4.1.2.	Earthworks Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP.
<b>Construction</b>					
LC-GD-C-1	Clearly mark-out the extent of disturbance/clearing with fencing and install signage.	Earthworks Supervisor	At least two weeks prior to commencement of vegetation clearing.	Earthworks Package Manager	At least one week prior to the intended commencement of vegetation clearing.
LC-GD-C-2	Review clearing is being completed as authorised within the GDWP.	Earthworks Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
LC-GD-C-3	Review of vehicle movements and placement of materials to ensure that disturbance remains within areas authorised for disturbance. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during construction works.
LC-GD-C-4	Review GDWP to ensure that disturbance is within the approved boundary, mark up any variances with the permit conduct rehabilitation of those areas as specified in Section 10.2.7.	Site Environmental Coordinator	At completion of the construction of land based connection.	Environment and Community Relations Manager	At completion of the construction of land based connection.
<b>Decommissioning</b>					
LC-GD-D-1	Remove any signs/fencing that was installed for the construction period.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.

### 10.2.2 Dieback management

Plant and equipment will be mobilised to site for construction of the shaft and laydown area, there is the potential for Dieback to be transmitted to areas within the site if this is not appropriately managed.

Once the tunnelling is complete and the shaft and laydown area has been decommissioned it will be important to undertake a Dieback survey post construction so to minimise any further spread of the pathogen through appropriate quarantine procedures.

Table 10.2.2 below specifically outlines the implementation schedule and responsibilities for dieback management to ensure the objectives specified in Section 4.2.2 are met.



Table 10.2.2 Implementation schedule and responsibilities for Dieback management for the land based connection

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LC-D-PC-1	Commission a Dieback interpreter to complete a preliminary Dieback survey throughout the project area.	Site Coordinator Environmental	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Prior to construction of the land based connection.
LC-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Coordinator Environmental	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Following advice from Dieback interpreter.
LC-D-PC-3	Clearly delineate any areas infected with dieback.	Site Coordinator Environmental	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
LC-D-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Work Supervisor	At least 24 hours prior to site entry.	Site Coordinator Environmental	Upon plant/ equipment arrival.
LC-D-C-2	If Dieback exists along access roads ensure that appropriate washdown facilities are in place.	Earthworks Manager Package	Prior to vehicle movements along roads.	Environment and Community Relations Manager	Prior to vehicle movements along roads.
LC-D-C-3	If Dieback exists ensure infected topsoil is stripped and kept separate from uninfected areas.	Earthworks Supervisor	During topsoil stripping.	Site Coordinator Environmental	Weekly during topsoil stripping.
LC-D-C-4	Construct table drains so that water is not diverted from infected areas into uninfected areas (if Dieback exists).	Earthworks Supervisor	During table drain construction.	Site Coordinator Environmental	At completion of construction.
LC-D-C-5	Review vehicle movements to ensure that vehicles remain within the shaft laydown area and along the road to the shaft.	Earthworks Supervisor	Daily during construction works.	Site Coordinator Environmental	Weekly during construction works.
LC-D-C-6	Monitor the vegetation condition, especially surrounding infected areas, if Dieback is spreading review Dieback management framework.	Site Coordinator Environmental	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
LC-D-C-7	Commission a dieback interpreter to undertake an annual dieback survey	Site Coordinator Environmental	Annually throughout the project duration.	Environment and relations Manager	Annually throughout the project duration.
<b>Decommissioning</b>					



LC-D-D-1	Topsoil from infected areas is to remain within infected areas (if any).	Earthworks Supervisor	At completion of construction activities.	Site Coordinator	Environmental	At completion of construction activities.
LC-D-D-2	Commission a Dieback interpreter to complete a Dieback survey post works and document results.	Site Coordinator	Environmental	After rehabilitation.	Environment and relations Community Manager	After rehabilitation.

### 10.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as exist for Dieback. Light vehicles, equipment and machinery will be frequently moving throughout the area during the construction of the land based connections. The movement of vehicles could potentially transport weeds from other site areas and/or spread existing weed species within the project area.

Plant and equipment will be mobilised to site for the shaft construction, with the potential for weeds to be introduced to surrounding vegetation. It is therefore important to put in place management measures prior to site entry to reduce the spread of weeds.

**Table 10.2.3** below specifically outlines the implementation schedule and responsibilities for weed management for the construction of the land based connection to ensure the objectives specified in **Section 4.3.2** are met.



**Table 10.2.3 Implementation schedule and responsibilities for weed management for the land based connection**

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LC-W-PC-1	Undertake a survey of the weed invasion within and surrounding the site and document findings.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
LC-W-PC-2	Establish and map areas which currently have "Very Good" condition vegetation and low weed infestation.	Site Environmental Coordinator	Prior to any construction works commencing.	Environment and Community Relations Manager	Following survey and prior to any construction works commencing.
<b>Construction</b>					
LC-W-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Earthworks supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
LC-W-C-2	Review vehicle movements to ensure that vehicles remain on the road alignment footprints and within the laydown area.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during construction works.
LC-W-C-3	Monitor the vegetation condition of areas specified in LC-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
LC-W-D-2	Monitor the vegetation condition of areas specified in LC-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community Relations Manager	Spring after completion of works.

#### 10.2.4 Fire management

Fire management is particularly relevant to areas where works are taking place within or adjacent to vegetation and bushland areas. The shaft area for the land based connection will be surrounded by vegetation.

Fire management measures will need to be implemented and monitored throughout the duration of the project, and all staff will need to understand evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 10.2.4** below specifically outlines the implementation schedule and responsibilities for fire management for the construction of the land based connection which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 10.2.2 Implementation schedule and responsibilities for fire management for the land based connection

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
Pre-Construction					
LC-PC-FM-1	Inductions of operational/management personnel to outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
Construction					
LC-C-FM-1	Ensure that all vehicles in operation have a fire extinguisher on board.	Earthworks Supervisor	During construction of the land based connection.	Site Environmental Coordinator	Monthly during construction.
LC-C-FM-2	Ensure that no smoking is occurring inside vehicles or outside designated smoking areas.	Site Supervisor	During construction of the land based connection.	Site Environmental Coordinator	Weekly during road construction.
LC-C-FM-3	During summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Daily during summer months throughout the project duration.

### 10.2.5 Hydrology management

The Alkimos area is made up of coastal calcareous sand dunes which are highly permeable. The laydown area will have a limestone hardstand surface which necessitates table drains to divert surface run-off away from the road surface during heavy rainfall events, runoff will be managed to ensure it does not impact remnant vegetation outside of the working areas.

Construction water for dust suppression and compaction will be sourced from ground water production bores at four locations within the project area, abstraction from these production bores will be monitored monthly.

Table 10.2.5 below specifically outlines the implementation schedule and responsibilities for hydrology for the construction of the land based connection which must be followed to ensure the objectives specified in **Section 4.5.2** are met.



Table 10.2.5. Implementation schedule and responsibilities for hydrology management for the land based connection

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LC-PC-H-1	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in Section 4.5.3.3.	Site Environmental Coordinator	Prior to production bore construction.	Site Environmental Coordinator	Monthly
LC-PC-H-2	Order and allocate spill kits to plant/equipment.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
LC-C-H-1	Construct table drains (if required) along site the hardstand areas to direct water away from the road surface during heavy rainfall events.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	During road construction.
LC-C-H-2	Undertake refuelling on limestone hardstand areas only.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Daily during construction
LC-C-H-3	Install spill response kits in allocated plant and equipment.	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Weekly during construction
<b>Operation</b>					
LC-O-H-1	Monitor and maintain table drains to ensure that they are free of debris and are providing adequately drainage for the access roads.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly during project duration
LC-O-H-2	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in Section 4.5.3.3.	Site Environmental Coordinator	Monthly whilst ground water abstraction is taking place.	Site Environmental Coordinator	Yearly whilst ground water abstraction is taking place.
LC-O-H-3	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly during project duration

### 10.2.6 Landform management

Once the shaft is complete access will need to remain open to the shaft area as a manhole will be constructed in its place to provide access for inspections and maintenance in the future.

**Table 10.2.6** below specifically outlines the implementation schedule and responsibilities for landform management which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 10.2.6 Implementation schedule and responsibilities for landform management for the land based connection

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LC-PC-L-1	Undertake survey of the shaft laydown area and access road and peg out alignment and boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity	Environment and Community Relations Manager	Upon receiving the GDWP
<b>Construction</b>					
LC-C-L-1	Review of vehicle movements to ensure that vehicles remain areas authorised for disturbance only. If transgressions occur and the landform is undermined notify the Site Environmental Coordinator who will specify restoration measures where appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during construction works
AR-C-L-2	Stabilise any construction batters using liquid stabilisers, matting and/or brush.	Earthworks Supervisor	At completion of access road and laydown area construction	Environment and Community Relations Manager	At completion of access road and laydown area construction
<b>Operation</b>					
LC-O-L-1	Review of vehicle movements to ensure that vehicles remain within fenced areas. If transgressions occur and the landforms is undermined notify the Site Environmental Coordinator who will specify restoration measures as appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during operations.
LC-O-L-2	Monitor and maintain batters to ensure the stability and deployment of further stabilisation and management where required.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during project duration
<b>Decommissioning</b>					
LC-D-L-1	Backfill area as much as practicable.	Earthworks Supervisor	After the completion of tunnelling to the beach access structure.	Environment and Community Relations Manager	After the completion of tunnelling to the beach access structure.

### 10.2.7 Rehabilitation management

The access road into the shaft will become permanent once construction is complete. The areas, adjacent to permanent roads will require rehabilitation. These areas will be rehabilitated for the long-term and therefore re-establishing stable and diverse vegetation communities will be the primary objective.

Rehabilitation of the access roads will involve:

- Spreading of topsoil;
- Brushing;
- Weed control;
- Direct seeding; and
- Monitoring and Maintenance.

The road surface and laydown area will be deep ripped to a depth of approximately 500 mm in order to break up the surface and relieve soil profile compaction. Rip line spacing will need to be sufficiently close enough to achieve full treatment of the road surfaces, and ideally a winged tyne would be used.

Direct seeding will be applied at a rate of 6kg/Ha. The quantity of seeds required is listed in Table 10.2.7a.

Table 10.2.7a Seed to be used in rehabilitation of the land based connection

	Species	% seed mix + tubestock
<b>Tree</b>	<i>Eucalyptus gomphocephalla</i>	1
<b>Shrubs</b>	<i>Acacia lasiocarpa</i>	10
	<i>Acacia saligna</i>	5
	<i>Acanthocarpus preissii</i>	10
	<i>Hibbertia hypericoides</i>	3
	<i>Hibbertia subvaginata</i>	3
	<i>Leucopogon pauciflora</i>	3
	<i>Melaleuca systema</i>	10
	<i>Melaleuca huegelli</i>	8
	<i>Trymalium ledifolium</i>	5
<b>Herbs</b>	<i>Phyllanthus calycinus</i>	5
	<i>Gompholobium tomentosa</i>	15
	<i>Hardenbergia comptoniana</i>	5
	<i>Lepidosperma pubesquameum</i>	5
	<i>Conostylis pauciflora subsp. eury</i>	2
	<i>Desmocladius flexuosa</i>	1
	<i>Sarcozona bicarinata</i>	3
	<i>Threlkeldia diffusa</i>	

Follow-up monitoring and maintenance will be required to ensure that revegetation is successful and batters have been effectively stabilised. This will continue for 12 months after the completion of the rehabilitation and revegetation and would identify issues such as weed invasion, wind or water erosion, and be the basis for maintenance activities.

**Table 10.2.7** below specifically outlines the implementation schedule and responsibilities for rehabilitation for the land based connection which must be followed to ensure the objectives specified in **Section 4.7.2** are met.



Table 10.2.7 Implementation schedule and responsibilities for rehabilitation management for the land based connection

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LC-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas.	Site Environmental Coordinator	Annually depending on seeding times for target species .	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
<b>Construction</b>					
LC-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly.	Site Environmental Coordinator	Prior to clearing commencing.	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
LC-C-R-2	Clear existing vegetation and push into brush piles. Aim to keep vegetation intact.	Earthworks Supervisor	Once topsoil assessment is completed.	Site Environmental Coordinator	During vegetation clearing.
LC-C-R-3	Strip topsoil and place into stockpiles within defined area of disturbance. Aim to keep stockpiles less than 1,500mm deep.	Earthworks Supervisor	Once vegetation has been cleared.	Site Environmental Coordinator	During topsoil stripping.
<b>Decommissioning</b>					
LC-D-R-1	Undertake deep ripping of any hardstand areas.	Earthworks Supervisor	At completion tunnelling.	Site Environmental Coordinator	At completion tunnelling.
LC-D-R-2	Backfill access roads to where the permanent roads will be constructed.	Earthworks Supervisor	Following deep ripping.	Earthworks Package Manager	Once backfill operations are completed.
LC-D-R-3	Spread topsoil over backfilled areas and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following re-contouring.	Site Environmental Coordinator	Once topsoil has been spread.
LC-D-R-4	Spread brush on top-soiled landform and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following spreading of topsoil.	Site Environmental Coordinator	Once brush has been place and other surface stability measures have been deployed.
<b>Rehabilitation</b>					
LC-R-R-1	Undertake direct seeding.	Site Environmental Coordinator	After the break of the season (first 300mm of soil profile is wet).	Environment and Community Relations Manager	After direct seeding has taken place.
LC-R-R-2	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.



LC-R-R-3	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
LC-R-R-4	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter.	Site Environmental Coordinator	Following end of Summer (February).	Environment and Community Relations Manager	Following end of Summer (February).
LC-R-R-5	Undertake maintenance as require.	Site Environmental Coordinator	February to March.	Environment and Community Relations Manager	February to March.
LC-R-R-6	Undertake any infill direct seeding as required.	Site Environmental Coordinator	Immediately following first autumn/winter rain event.	Environment and Community Relations Manager	Immediately following first autumn/winter rain event.

## 11 LAUNCH SITE

The launch site is situated within a Metropolitan Region Scheme “Public Purposes” Reserve, and part of this is also within Bush Forever Site 397. The Water Corporation will require access to the launch site in the future when a second ocean outfall is installed as the capacity of the WWTP expands. At this point in time the long-term management objectives of the wider launch site area (outside the Bush Forever site which is addressed separately in **Section 12**) has not been specified and is likely to be offered by the Water Corporation to the City of Wanneroo for a regional recreational facility. Given the discussions to finalise the long term use of the launch site have not taken place, the manner in which the site should be left after construction has also not been finalised.

It is intended, however, that the area within the Bush Forever site will be fully rehabilitated in line with its conservation status as a Bush Forever site. At this stage it is envisaged that the area of the launch site outside the Bush Forever boundary will not be re-contoured and will be revegetated to provide surface stability, however this revegetation may not remain in the longer term.

The entire launch site construction and string preparation will take up to 12 months to complete and will be undertaken prior to the pipe pull. Overall, the construction of the site will require the clearing of approximately 7.3 Ha of vegetation. The launch site has been engineered to optimise the storage, handling and welding of the pipe strings in preparedness for drawing the pipeline offshore to the ocean, and has been positioned to minimise impacts to vegetation occurring in the area, in particular, the vegetation community to the north of the site. The layout of the launch site is shown in **Figure 14**.

This section outlines the specific details and management measures for the site launch site. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the launch site.

A summary of the requirements for the specific management of the launch site including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 11.1** to **Section 11.7**.

### 11.1 DESIGN

The selection of the launch site during the PER phase compared two other sites Launch Site 2 and Launch Site 1A. Based on minimising impacts to significant vegetation, Launch Site 1B (as shown in **Figure 15**) was selected as the preferred site. The launch site has been positioned to minimise impacts to vegetation occurring in the area.

The site will be levelled, with some material being excavated to fill over the lower lying areas, as the site will need to form a level working platform for pipeline fabrication. A longitudinal profile of the constructed launch site is shown in **Figure 16**, and associated cross sections from a number of selected points along its long axis are shown in **Figure 17**. As shown in these figures, the entire launch site will be constructed with a slight fall of 4% towards the beach to assist in handling of the ocean outfall strings on the trestles.

The floor of the launch site will comprise a 300mm compacted limestone base to provide a hardstand. Scheduling of hardstand construction will be planned to take advantage of limestone material being excavated from the WWTP.

The launch site excavation will be undertaken using a 70-tonne excavator, a Cat D400 and 40-tonne articulated dump trucks. Clearing of the launch site will be completed incrementally. Vegetation will be cleared so that it remains in “brush” form and topsoil will be removed and stockpiled adjacent to both the north and south sides of the trench at the top of the launch site. Excavated material will be stockpiled within the launch site footprint as shown in **Figure 15** and no stockpiling outside of this boundary will be undertaken.

Pipe plinths or base blocks will be constructed, and a temporary construction facility to receive pipe joints will be set out. The pipe will be assembled in the north of the launch site, where single joints of 12 metre long pipe will be welded into pipe strings.

Once the pipeline construction has been completed, the main pad of the launch site will remain level, and no re-contouring will be undertaken. The ground will be deep ripped and revegetated with the aim to stabilise the area. The launch site area will need to remain in a condition suitable to accommodate another pipe pull in the future if required. The remaining beach corridor sections through the Bush Forever site will be rehabilitated and re-contoured extensively as described in **Section 12**.

#### 11.1.1 Pipeline construction

The pipeline construction will involve single sections of 12m long pipe being welded into pipe strings. The pipe strings will be assembled within the launch site. The pipeline will be assembled into 24 strings, each approximately 158m in length.

The pipe joints will be mobilised to site by truck via established access roads and offloaded at the launch yard, directly onto the pipe plinths. A project specific Traffic Management Plan will be developed for the mobilisation of the pipe sections and equipment to the site. The pipe joints will be aligned and welded by teams of pipe welders. The pipe welds (field joint) will be allowed to cool, and then undergo non-destructive testing to ensure the weld is acceptable. **Plate 6** shows an indicative pipe stringing yard from a project undertaken in the United Kingdom.

A series of 20 tonne rollers will be installed along the pipeline alignment where the pipeline is above sea level. These rollers will be installed onto small pad footings (subject to ground conditions encountered in the trench floor). The rollers will be spaced along the route between CH100 and CH400, as required by the installation engineering, to avoid overstressing the pipe and reduce the pull loads.

A pull head will be installed to the front of the first pipe string, to which the pulling wire will be attached. This pull head will be bolted to a welded flange attached to the first pipe joint.

Blind flanges will be attached to the diffuser ports and the first pipe string will be hydro-tested prior to being pulled out by the barge. Buoyancy tanks will be installed to the pipe strings in preparation for the commencement of the pipe installation works. A buoyancy marker float will also be installed at the pull head to allow visual confirmation of the pipe position in relation to the pipe alignment during the installation.

The pipe strings will be assembled using field joints. As the pipe string is pulled out along the ocean outfall alignment the next section of pipe will be rolled out and welded to the end of the previous string. The field joint will be prepared for corrosion coating, and the heat shrink sleeve applied, ensuring a minimum of 25mm overlap onto the pipe corrosion coating. CANUSA type KLS heat shrink sleeve or equivalent will be used.

Once the shrink sleeve has been applied, reinforcing will be installed to the field joints, formwork applied to the outside face of the adjacent pipe weight coat and the joint concreted. Cement mortar lining will be applied from

the inside of the pipe string using a field mixed mortar that will be trowelled onto the inside face of the primed steel pipe surface.

Further details in relation to the seabed preparation and the pipeline pull/installation are described in the OOPCMP.

## 11.2 CONSTRUCTION

### 11.2.1 Disturbance management

To the north of the launch site supports a locally significant vegetation community (MhMs and described in **Section 2.2.3**) which is in "Good" to "Very Good" condition as shown in **Figure 10**. Fencing will be placed along the boundary adjacent to this vegetation community to the north of the launch site to ensure that no impact occurs to the vegetation outside the designated footprint during site works.

Fencing will also be erected around the site as a barrier to recreational vehicles. Vehicular traffic and pedestrian access to the site will be controlled by appropriate signage and fencing. The fences will also serve to ensure that construction activities do not extend beyond the proposed footprint area.

**Table 11.2.1** below specifically outlines the implementation schedule and responsibilities for disturbance management for the launch site to ensure the objectives specified in **Section 4.2.2** are met.



Table 11.2.1 Implementation schedule and responsibilities for ground disturbance management for the launch site

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-GD-PC-1	Undertake survey of the launch site area and peg out boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the launch site area.
LS-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
LS-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in Section 4.1.2.	Site Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the launch site area.
<b>Construction</b>					
LS-GD-C-1	Install fencing along the northern border of the launch site to protect the vegetation community.	Earthworks Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	At least a week prior to ground disturbing activity.
LS-GD-C-2	Clearly mark-out the extent of disturbance/clearing with fencing, install signage	Earthworks Supervisor	At least two weeks prior to commencement of vegetation clearing.	Earthworks Package Manager	At least one week prior to the intended commencement of vegetation clearing.
LS-GD-C-3	Review clearing is being completed as authorised within the GDWP.	Site Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
LS-GD-C-4	Review GDWP to ensure that disturbance was within the approved boundary, mark up any variances with the permit conduct rehabilitation of those areas as specified in Section 11.2.7. Follow up internally regarding any identified non-compliance with GDWP and report to the Alliance Manager.	Site Environmental Coordinator	At completion of construction of the launch site.	Environment and Community Relations Manager	At completion of the launch site.
<b>Operation</b>					
LS-GD-O-1	Review of vehicle movements and placement of materials to ensure that disturbance remains within fenced areas. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise of restoration measures as appropriate.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
<b>Decommissioning</b>					




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LS-GD-D-1	Remove any signs/fencing that were installed.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.
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### 11.2.2 Dieback management

Plant and equipment will be mobilised to site for construction of the launch site and the risk of Dieback transmission will be largest during the earthworks component of the launch site preparation.

The launch site will remain active during the operational stage up to when the pipe pull occurs. During this time, trucks will be delivering pipe segments and equipment continuously. Without adequate management there is the potential for Dieback to be transmitted to areas within the site. It is important to put in place management measures prior to site entry to reduce the risk of transmission.

Table 11.2.2 below specifically outlines the implementation schedule and responsibilities for dieback management to ensure the objectives specified in Section 4.2.2 are met.



Table 11.2.2. Implementation schedule and responsibilities for Dieback management for the launch site

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-D-PC-1	Commission a Dieback interpreter to complete an preliminary Dieback survey across the project area.	Site Environmental Coordinator	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Prior to the construction of the launch site.
LS-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Environmental Coordinator	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Following advice from Dieback interpreter.
LS-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Environmental Coordinator	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
LS-D-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Work Supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
LS-D-C-2	If Dieback exists along access roads leading into the launch site area ensure that appropriate washdown facilities are in place.	Earthworks Package Manager	Prior to vehicle movements along roads.	Environment and Community Relations Manager	Prior to vehicle movements along roads.
LS-D-C-3	If Dieback exists ensure infected topsoil is stripped and kept separate from uninfected areas.	Earthworks Supervisor	During topsoil stripping.	Site Environmental Coordinator	Weekly during topsoil stripping.
LS-D-C-4	Construct table drains so that water is not diverted from infected areas into uninfected areas (if Dieback exists).	Earthworks Supervisor	During table drain construction.	Site Environmental Coordinator	At completion of road construction.
LS-D-C-5	Review vehicle movements to ensure that vehicles remain within the launch site area.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during construction works.
<b>Operation</b>					
LS-D-O-1	Review vehicle movements to ensure they are within areas authorised for disturbance.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly during operations.
LS-D-O-2	Monitor the vegetation condition, especially surrounding infected areas and if Dieback is spreading review Dieback management framework.	Site Environmental Coordinator	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					



LS-D-D-1	Topsoil from infected areas is to remain within infected areas (if any).	Earthworks Supervisor	At completion of construction activities.	Site Coordinator	Environmental	At completion of construction activities.
LS-D-D-2	Commission a Dieback interpreter to complete a Dieback survey post works and document results.	Site Coordinator	Environmental	After rehabilitation.	Environment and relations Community Manager	After rehabilitation.

### 11.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as exist for Dieback. Light vehicles, equipment and machinery will be frequently moving throughout the area during construction and the movement of vehicles could potentially transport weeds from other site areas and/or spread existing weed species within the project area.

Plant and equipment will be mobilised to site for the construction of the launch site area and then for the pre-works for the preparation of the ocean outfall pipe pull, with the potential for weed to be introduced to surrounding vegetation. The MhMs vegetation to the north of the launch site is currently vegetation which is in "Very Good" condition, and this will need to be maintained during the course of construction and operation of the launch site area. It is therefore important to put in place management measures prior to site entry to reduce the spread of weeds within the area.

**Table 11.2.3** below specifically outlines the implementation schedule and responsibilities for weed management to ensure the objectives specified in **Section 4.3.2** are met.



Table 11.2.3. Implementation schedule and responsibilities for weed management for the launch site

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-W-PC-1	Undertake a survey of the weed invasion within and surrounding the site, document findings.	Site Environmental Coordinator	Prior to any works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
LS-W-PC-2	Establish and map areas which currently have "Very Good" quality vegetation and low weed infestation. In particular the vegetation to the north of the launch site.	Site Environmental Coordinator	Prior to any works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
<b>Construction</b>					
LS-W-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Earthworks supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
LS-W-C-2	Review vehicle movements to ensure that vehicles remain on the road alignment and within the laydown area.	Earthworks Supervisor	Daily during launch site construction works.	Site Environmental Coordinator	Daily during construction works.
<b>Operation</b>					
LS-W-O-1	Review vehicle movements to ensure that vehicles remain on within approved areas.	Earthworks Supervisor	Daily during use of the launch site.	Site Environmental Coordinator	Weekly during use of the launch site.
LS-W-O-2	Monitor the vegetation condition of areas specified in LS-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout the project duration.	Environment and Community relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
LS-W-D-2	Monitor the vegetation condition of areas specified in LC-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community relations Manager	Spring after completion of works.

#### 11.2.4 Fire management

Fire management is particularly relevant to areas where works are taking place within or adjacent to vegetation and bushland areas.

Fire management measures will need to be implemented and monitored throughout the duration of the project, all staff will need to understand any evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 11.2.4** below specifically outlines the implementation schedule and responsibilities for fire management which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 11.2.4. Implementation schedule and responsibilities for fire management for the launch site

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-PC-FM-1	Inductions of operational/management personnel, outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
<b>Construction</b>					
LS-C-FM-1	Monitor to ensure that all vehicles in operation have a fire extinguisher on board	Earthworks Supervisor	During launch site construction.	Site Environmental Coordinator	Weekly during construction
LS-C-FM-3	Ensure that no smoking is occurring inside operational vehicles or outside designated smoking areas.	Site Supervisor	During launch site construction.	Site Environmental Coordinator	Daily during construction.
<b>Operation</b>					
LS-O-FM-2	If work occurs during summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Daily during summer months throughout the project duration.
LS-O-FM-3	Ensure that no smoking is occurring inside operational vehicles or outside designated smoking areas.	Site Supervisor	During launch site construction.	Site Environmental Coordinator	Daily during construction.

### 11.2.5 Hydrology management

The Alkimos area is made up of coastal calcareous sand dunes which are highly permeable. The launch site area will have a limestone hardstand surface which necessitates table drains to divert surface run-off away from the surface during heavy rainfall events, runoff will be managed to ensure that it does not impact the surrounding remnant vegetation.

Construction water for dust suppression and compaction will be sourced from ground water production bores at four locations within the project area, abstraction from these production bores will be monitored monthly.

Surface water generation will is unlikely to be an issue during the construction and operation of the launch site, due to the permeable nature of the underlying soils. Given that there are no existing surface water features on the site, the potential impacts are limited to disruptions to the existing water balance of the site, and impacts to groundwater quality from runoff contaminated by construction and support activities.

Table 11.2.5 below specifically outlines the implementation schedule and responsibilities for hydrology which must be followed to ensure the objectives specified in **Section 4.5.2** are met.



Table 11.2.5. Implementation schedule and responsibilities for hydrology management for the launch site

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-PC-H-1	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in <b>Section 4.5.3.3</b> .	Site Environmental Coordinator	Prior to production bore construction.	Site Environmental Coordinator	Monthly.
LS-PC-H-2	Order and allocate spill kits to plant/equipment which will be working at the launch site during construction.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
LS-C-H-1	Construct hardstand with slope towards the beach and/or table drains.	Earthworks Supervisor	During construction of the launch site.	Site Environmental Coordinator	During construction of the launch site.
LS-C-H-2	Construct table drains (if required) along site the hardstand areas to direct water away from the road surface during heavy rainfall events.	Earthworks Supervisor	During construction of the launch site.	Site Environmental Coordinator	During construction of the launch site.
LS-C-H-3	Undertake refuelling offsite or with mobile refuelling vehicles on hard stand areas.	Earthworks Supervisor	During launch site construction.	Site Environmental Coordinator	Daily during construction
LS-C-H-4	Install spill response kits in allocated plant and equipment.	Earthworks Supervisor	During launch site construction.	Site Environmental Coordinator	Weekly during construction
<b>Operation</b>					
LS-O-H-1	Allow for surface runoff to infiltrate to groundwater within table drains.	Earthworks Supervisor	During operations at the launch site.	Site Environmental Coordinator	During operations at the launch site.
LS-O-H-2	Monitor and maintain table drains to ensure that they are free of debris and are providing adequately drainage for the launch site.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly during project duration
LS-O-H-3	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in <b>Section 4.5.3.3</b> .	Site Environmental Coordinator	Monthly whilst ground water abstraction is taking place.	Site Environmental Coordinator	Monthly.
LS-O-H-4	Ensure spill kits as in close proximity to operations at all times.	Earthworks Supervisor	Weekly during operations.	Site Environmental Coordinator	Monthly during operations.
LS-O-H-5	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly during project duration
LS-O-H-6	Undertake refuelling offsite or with mobile refuelling vehicles on hard stand areas.	Earthworks Supervisor	During operations at the launch site.	Site Environmental Coordinator	During operations at the launch site.

### 11.2.6 Landform management

The launch site design has been carefully planned to minimise impacts to landform features and vegetation communities. The area of the launch site pad will not be re-contoured similar to the foredune area as specified in **Section 12.2.6**, however construction activities will need to be managed so that the integrity of the area and the foredune area maintained during both construction and operation activities. Monitoring will focus on surface stability of the area during works.

**Table 11.2.6** below specifically outlines the implementation schedule and responsibilities for landform management for the launch site which must be followed to ensure the objectives specified in **Section 4.6.2** are met.



Table 11.2.6. Implementation schedule and responsibilities for landform management for the launch site

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-PC-L-1	Undertake survey of the launch site area and peg out alignment and boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity	Environment and Community Relations Manager	Upon receiving the GDWP for the launch site area.
<b>Construction</b>					
LS-C-L-1	Review of vehicle movements to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will direct restoration measures as appropriate.	Earthworks Supervisor	Daily during construction works for the launch site.	Site Environmental Coordinator	Daily during construction works
LS-C-L-2	Construct limestone area using materials from site, where practicable.	Earthworks Supervisor	During construction works for the launch site.	Environment and Community Relations Manager	During construction works for the launch site.
LS-C-L-3	Stabilise any construction batters using liquid stabilisers, matting and/or brush.	Earthworks Supervisor	At completion of construction of the launch site hardstand.	Environment and Community Relations Manager	At completion of launch site.
<b>Operation</b>					
LS-O-L-1	Review of vehicle movements to ensure that vehicles remain within areas authorised for disturbance only. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will direct restoration measures as appropriate.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during operations.
LS-O-L-2	Monitor and maintain batters to ensure the stability and deploy further stabilisation and management where required.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Weekly during project duration.

### 11.2.7 Rehabilitation management

An area reserved for “Public Purposes” covers the majority of the launch site (outside of the Bush Forever Site). This area is likely to be developed as a reserve in the future to coincide with urban development. Therefore, the rehabilitation for this area will involve revegetation for surface stability, however it is currently unclear whether this area will remain for the long term. In any event the area must remain level to allow for a future ocean outfall launch site if the demand requires. This means the original landform and soil profile will not be retained.

Rehabilitation of the outfall launch site will involve:

- Brushing (may or may not be used);
- Weed control;
- Direct seeding; and
- Monitoring and Maintenance.

Direct seeding will be applied at a 6 kg/Ha and the proportion of species required is listed in Table 6.7.6.2a.

Table 11.2.7a Seed and tubestock to be used in rehabilitation of the launch site

	Species	% seed mix
<b>Shrubs</b>	<i>Acacia lasiocarpa</i>	3
	<i>Acacia rostellifera</i>	2
	<i>Acacia saligna</i>	1
	<i>Melaleuca systema</i>	5
	<i>Melaleuca huegelii</i>	2
	<i>Hibbertia subvaginata</i>	2
	<i>Leucopogon parviflorus</i>	2
	<i>Acanthocarpus preissii</i>	3

Follow-up monitoring and maintenance is required to ensure that revegetation is successful and the launch site has been effectively stabilised. This will continue for two years after the completion of the rehabilitation and revegetation and would identify issues such as weed invasion, death of seedlings, predation, wind or water erosion, and be the basis for maintenance activities.

Table 11.2.7 below specifically outlines the implementation schedule and responsibilities for rehabilitation which must be followed to ensure the objectives specified in Section 4.7.2 are met.



**Table 11.2.7. Implementation schedule and responsibilities for rehabilitation management for the launch site**

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
LS-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas.	Site Environmental Coordinator	Annually depending on seeding times for target species .	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
<b>Construction</b>					
LS-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly.	Site Environmental Coordinator	Prior to clearing commencing.	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
LS-C-R-2	Clear existing vegetation and push into brush piles at the edge of the launch site. Aim to keep vegetation intact.	Earthworks Supervisor	Once topsoil assessment is completed.	Site Environmental Coordinator	During vegetation clearing.
LS-C-R-3	Strip topsoil and place into stockpiles at the edge of the launch site and within defined area of disturbance. Aim to keep stockpiles less than 1,500mm deep.	Earthworks Supervisor	Once vegetation has been cleared.	Site Environmental Coordinator	During topsoil stripping.
<b>Decommissioning</b>					
LS-D-R-1	Undertake deep ripping of any hardstand areas along the launch site surface .	Earthworks Supervisor	At completion of the construction of the WWTP.	Site Environmental Coordinator	At completion of the construction of the WWTP.
LS-D-R-3	Spread topsoil on launch site areas and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following deep ripping.	Site Environmental Coordinator	Once topsoil has been spread.
LS-D-R-4	Spread brush on top-soiled landform and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following spreading of topsoil.	Site Environmental Coordinator	Once brush has been place and other surface stability measures have been deployed.
<b>Rehabilitation</b>					
LS-R-R-1	Undertake direct seeding.	Site Environmental Coordinator	After the break of the season (first 300mm of soil profile is wet).	Environment and Community Relations Manager	After direct seeding has taken place.
LS-R-R-2	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
LS-R-R-3	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.



LS-R-R-4	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter	Site Environmental Coordinator	Following end of Summer (February).	Environment and Community Relations Manager	Following end of Summer (February).
LS-R-R-5	Undertake maintenance as require.	Site Environmental Coordinator	February to March.	Environment and Community Relations Manager	February to March.
LS-R-R-6	Undertake any infill direct seeding as required.	Site Environmental Coordinator	Immediately following first autumn/winter rain event.	Environment and Community Relations Manager	Immediately following first autumn/winter rain event.

## 12 LAUNCH SITE DUNE CROSSING (THROUGH BUSH FOREVER SITE) AND BEACH ACCESS CORRIDOR

This section outlines the specific details and management measures for the site launch site beach crossing. The general management measures outlined in **Section 4** have been referred to and incorporated in the environmental management framework for the launch site beach crossing.

A summary of the requirements for the specific management of the launch site beach crossing including timing and the designation of responsibility for ensuring that these requirements are implemented is provided within various tables in **Section 12.1** to **Section 12.7**

### 12.1 DESIGN

The trenched section required for the pipeline will be excavated from the launch site down through Bush Forever Site 397 to the ultimate pipe invert level of the ocean outfall. The alignment of this dune corridor was adjusted from the alignment presented in the PER to an area 10 metres to the north, in order to locate the pipeline through an existing highly degraded blowout in the foredune as shown in **Plate 1** and **Plate 2**. This also reduces the impact on limestone cliffs to the south of the excavation.

The profile of the launch site and the proposed dune crossing trench, and the extent of the trench batters are shown in **Figure 15**. The sidewall batter grade of the trench will be a maximum of 1:2 in order to ensure stability of the trench, but also to minimise the horizontal intrusion of batters into nearby vegetation and dunal landforms.

Material excavated from the launch site trench (through the primary dune) will be stockpiled within the launch site footprint (in areas previously cleared) and will be used for re-contouring and rehabilitation of the primary dune once the pipe launch is complete.

In association with the pipe launch activities, it will be necessary to excavate and access the excavated sub-ocean trench via a beach crossing. This beach crossing will comprise of a limestone-armoured groyne/cofferdam with internal sheet piling for the passage of the outfall pipe. This temporary beachhead structure connects to the outfall pipe trench excavated through the beach dunes providing passage for the pipe from the launching yard to the sub-ocean trench. Management of the beach crossing, groyne and coffer dam have been documented within the OOPCMP.

### 12.2 CONSTRUCTION

#### 12.2.1 Disturbance management

The launch site area within the Bush Forever site 397 is to be managed in the longer term for conservation purposes, it is part of the Quindalup dune complex and it has vegetation which ranges from “Completely Degraded” where the existing blow out is located as seen in **Plate 1** and **Plate 2** to “Very Good” along the foredune area.

The area cleared will be re-contoured and re-instated to achieve pre-disturbance biodiversity values. It is therefore important to manage any ground disturbance during the construction and operation phase to ensure that this can be achieved and that all disturbances to the surrounding terrestrial vegetation is minimised.

**Table 12.2.1** below specifically outlines the implementation schedule and responsibilities for disturbance management for the dune crossing to ensure the objectives specified in **Section 4.1.2** are met.

Table 12.2.1 Implementation schedule and responsibilities for ground disturbance management for the launch site dune crossing

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
BF-GD-PC-1	Undertake survey of the launch site dune crossing and beach access corridor to mark out footprint areas.	Earthworks Supervisor	At least one month before ground disturbing activity.	Environment and Community Relations Manager	Prior to ground disturbing activities.
BF-GD-PC-2	Conduct inductions for operational/management personnel.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
BF-GD-PC-3	Prepare a GDWP and submit it to the Environment and Community Relations Manager as outlined in Section 4.1.2.	Site Supervisor	At least a week prior to ground disturbing activity.	Environment and Community Relations Manager	Upon receiving the GDWP for the launch site dune crossing and beach access corridor.
<b>Construction</b>					
BF-GD-C-1	Clearly mark-out the extent of disturbance/clearing with fencing, and install signage.	Earthworks Supervisor	At least two weeks prior to commencement of vegetation clearing.	Earthworks Package Manager	At least one week prior to the intended commencement of vegetation clearing.
BF-GD-C-3	Review clearing is being completed as authorised within a GDWP.	Site Supervisor	During ground disturbing activities.	Site Environmental Coordinator	During ground disturbing activities and at the completion of ground disturbing activities.
BF-GD-C-4	Review GDWP to ensure that disturbance was within the approved boundary, mark up any variances with the permit and conduct rehabilitation of those areas as specified in Section 12.2.7. Follow up internally regarding the identified non-compliance with GDWP and report to the Alliance Manager.	Site Environmental Coordinator	At completion of construction of the launch site.	Environment and Community Relations Manager	At completion of the launch site.
<b>Operation</b>					
BF-GD-O-1	Review vehicle movements and, placement of materials to ensure that disturbance remains within fenced areas only. If transgressions occur and vegetation is damaged notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Daily during operations.
BF-GD-O-2	Monitor and maintain launch site dune crossing to ensure that the area is stable and deploy further stabilisation and	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Daily during operations.



	management where required.				
Decommissioning					
BF-GD-D-1	Remove any signs/fencing installed.	Earthworks Supervisor	At completion of construction of the WWTP.	Site Environmental Coordinator	At completion of earthworks program.

### 12.2.2 Dieback management

Plant and equipment will be mobilised to site for construction of the launch site area, the risk of transmission will be greatest during the excavation component of the launch site preparation. Without adequate management there is the potential for Dieback to be transmitted to areas within the site and from there to other areas within the project area.

**Table 12.2.2** below specifically outlines the implementation schedule and responsibilities for dieback management for the dune crossing to ensure the objectives specified in **Section 4.2.2** are met.

Table 12.2.2. Implementation schedule and responsibilities for Dieback management for the launch site dune crossing

Action Item Reference	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
BF-D-PC-1	Commission a Dieback interpreter to complete an initial Dieback survey across the project area.	Site Coordinator Environmental	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Prior to the construction of the launch site.
BF-D-PC-2	Following advice from the Dieback interpreter develop management measures if not already specified within the management plan.	Site Coordinator Environmental	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Following advice from Dieback interpreter.
BF-D-PC-3	Clearly delineate any areas infected with Dieback.	Site Coordinator Environmental	Prior to any vehicle movements inside the WWTP buffer zone.	Environment and Community Relations Manager	Weekly throughout project duration.
<b>Construction</b>					
BF-D-C-1	Ensure all plant and equipment have been subject to the Plant and Equipment Hygiene procedure as outlined in Section 4.2.1	Work Supervisor	At least 24 hours prior to site entry.	Site Coordinator Environmental	Upon plant/ equipment arrival.
BF-D-C-2	If Dieback exists ensure that appropriate wash down facilities are installed.	Earthworks Manager Package	Prior to vehicle movements within the dune crossing area.	Site Coordinator Environmental	Prior to vehicle movements within the launch site area.
BF-D-C-3	If Dieback exists ensure infected topsoil is stripped and kept separate from uninfected areas.	Earthworks Supervisor	During topsoil stripping.	Site Coordinator Environmental	Weekly during topsoil stripping.
BF-D-C-4	Construct table drains so that water is not diverted from infected areas into uninfected areas (if Dieback exists).	Earthworks Supervisor	During table drain construction.	Site Coordinator Environmental	At completion of road construction.
BF-D-C-5	Review of vehicle movements to ensure that vehicles remain within the dune crossing area and within areas authorised for disturbance.	Earthworks Supervisor	Daily during construction works.	Site Coordinator Environmental	Weekly during construction works.
<b>Operation</b>					
BF-D-O-1	Review of vehicle movements to ensure that vehicles remain within fenced areas.	Earthworks Supervisor	Daily during operations.	Site Coordinator Environmental	Daily during operations.
BF-D-O-2	Monitor the vegetation condition, especially surrounding infected areas and if Dieback is spreading review Dieback management framework.	Site Coordinator Environmental	Monthly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
LS-D-O-3	Commission a Dieback interpreter to undertake an	Site Coordinator Environmental	Annually throughout the	Environment and	Annually throughout the



	annual Dieback survey	Coordinator	project duration.	Community relations Manager	project duration.
<b>Decommissioning</b>					
LS-D-D-1	Topsoil from infected areas is to remain within infected areas (if any).	Earthworks Supervisor	At completion of construction activities.	Site Environmental Coordinator	At completion of construction activities.
LS-D-D-2	Commission a Dieback interpreter to complete a Dieback survey post works and document results.	Site Environmental Coordinator	After rehabilitation.	Environment and Community relations Manager	After rehabilitation.

### 12.2.3 Weed management

Similar potential exists for the transportation and spread of weeds as exist for Dieback. Plant and equipment will be mobilised to site for construction of the dune crossing area and then for the pre-works for the preparation of the ocean outfall pipe pull with the potential for weed to be introduced to surrounding vegetation. The surrounding vegetation of the Bush Forever site supports vegetation which ranges in quality from “Good” to “Very Good” and this will need to be maintained during the course of construction and operation of the dune crossing.

**Table 12.2.3** below specifically outlines the implementation schedule and responsibilities for weed management for the dune crossing to ensure the objectives specified in **Section 4.3.2** are met.

Table 12.2.3. Implementation schedule and responsibilities for weed management for the launch site dune crossing

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
BF-W-PC-1	Undertake a survey of the weed invasion within and surrounding the dune crossing, document findings.	Site Environmental Coordinator	Prior to any works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
BF-W-PC-2	Establish and map areas which currently have "Very Good" quality vegetation and low weed infestation. In particular the vegetation to the north of the launch site.	Site Environmental Coordinator	Prior to any works commencing.	Environment and Community Relations Manager	Following survey and prior to any works commencing.
<b>Construction</b>					
BF-W-C-1	Ensure all plant and equipment have undertaken a Plant and Equipment Hygiene procedure as outlined in Section 4.2.1.	Earthworks supervisor	At least 24 hours prior to site entry.	Site Environmental Coordinator	Upon plant/ equipment arrival.
BF-W-C-2	Review vehicle movements to ensure that vehicles remain within the dune crossing.	Earthworks Supervisor	Daily during construction works.	Site Environmental Coordinator	Daily during construction works.
<b>Operation</b>					
BF-W-O-1	Review vehicle movements to ensure that vehicles remain on within footprint/fenced areas.	Earthworks Supervisor	Daily during use of the launch site.	Site Environmental Coordinator	Weekly during use of the launch site.
BF-W-O-2	Monitor the vegetation condition of areas specified in BF-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Weekly throughout the project duration.	Environment and Community Relations Manager	Monthly throughout the project duration.
<b>Decommissioning</b>					
BF-W-D-2	Monitor the vegetation condition of areas specified in LC-W-PC-2 and implement weed control measures if necessary as outlined in Section 4.3.	Site Environmental Coordinator	Spring after completion of works.	Environment and Community Relations Manager	Spring after completion of works.

#### 12.2.4 Fire management

Fire management is particularly relevant to areas where works are taking place within or adjacent to vegetation and bushland areas. The launch site dune crossing area is surrounded by vegetation and the site itself will be isolated from the main site office.

Fire management measures will need to be implemented and monitored throughout the duration of the project, all staff will need to understand any evacuation procedures and site requirements specified in **Section 4.4.3.2**.

**Table 12.2.4** below specifically outlines the implementation schedule and responsibilities for fire management which must be followed to ensure the objectives specified in **Section 4.4.2** are met.



Table 12.2.2. Implementation schedule and responsibilities for fire management for the launch site dune crossing

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
Pre-Construction					
BF-PC-FM-1	Inductions of operational/management personnel, outline fire procedures as described in Section 4.4.	Environment and Community Relations Manager	Prior to commencement of works.	Construction Manager	Prior to commencement of works.
Construction					
BF-C-FM-1	Monitor to ensure that all vehicles in operation have a fire extinguisher on board	Earthworks Supervisor	During road construction.	Site Environmental Coordinator	Weekly during construction
BF-C-FM-2	Ensure that no smoking is occurring inside operational vehicles or outside designated smoking areas.	Site Supervisor	During road construction.	Site Environmental Coordinator	Daily during construction.
Operation					
BF-O-FM-1	If work occurs during summer months water cart is to be left full of water.	Earthworks Supervisor	Daily during summer months throughout the project duration.	Site Environmental Coordinator	Weekly during summer months throughout the project duration.
BF-O-FM-2	Ensure that no smoking is occurring inside operational vehicles or outside designated smoking areas.	Site Supervisor	During road construction.	Site Environmental Coordinator	Weekly during construction.

### 12.2.5 Hydrology management

The Alkimos area is made up of coastal calcareous sand dunes which are highly permeable. The launch site area will have a limestone hardstand surface which necessitates table drains to divert surface run-off away from the surface during heavy rainfall events.

Construction water for dust suppression and compaction will be sourced from ground water production bores at four locations within the project area, abstraction from these production bores will be monitored monthly.

Surface water generation will be unlikely to be an issue during the construction and operation of the launch site, due to the permeable nature of the underlying soils. Given that there are no existing surface water features on the site, the potential impacts are limited to disruptions to the existing water balance of the site, and impacts to groundwater quality from runoff contaminated by construction and support activities.

**Table 12.2.5** below specifically outlines the implementation schedule and responsibilities for hydrology for the dune crossing which must be followed to ensure the objectives specified in **Section 4.5.2** are met.



Table 12.2.5. Implementation schedule and responsibilities for hydrology management for the launch site dune crossing

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
BF-PC-H-1	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in Section 4.5.3.3.	Site Environmental Coordinator	Prior to production bore construction.	Site Environmental Coordinator	Monthly.
BF-PC-H-2	Order and allocate spill kits to plant/equipment which will be working along the access roads during construction.	Earthworks Supervisor	Prior to construction activities.	Environment and Community Relations Manager	Prior to construction activities.
<b>Construction</b>					
BF-C-H-1	Construct hardstand with slope towards the beach and/or table drains.	Earthworks Supervisor	During construction of the launch site.	Site Environmental Coordinator	During construction of the launch site.
BF-C-H-3	Undertake refuelling offsite or with mobile refuelling vehicles on hard stand areas.	Earthworks Supervisor	During dune crossing construction.	Site Environmental Coordinator	Daily during construction
BF-C-H-4	Install spill response kits in allocated plant and equipment.	Earthworks Supervisor	During dune crossing construction.	Site Environmental Coordinator	Weekly during construction
<b>Operation</b>					
BF-O-H-1	Allow for surface runoff to infiltrate to groundwater within table drains or via flow into the beach zone.	Earthworks Supervisor	During operations at the dune crossing .	Site Environmental Coordinator	During operations at the launch site.
BF-O-H-2	Monitor and maintain table drains to ensure that they are free of debris and are providing adequately drainage for the launch site area.	Earthworks Supervisor	Weekly after table drain construction.	Site Environmental Coordinator	Weekly during project duration
BF-O-H-3	Measure Department of Water monitoring bores as specified in the 'Licence to Take Water' and described in Section 4.5.3.3.	Site Environmental Coordinator	Monthly whilst ground water abstraction is taking place.	Site Environmental Coordinator	Yearly whilst ground water abstraction is taking place.
BF-O-H-4	If spill kits are used/damaged replace immediately.	Earthworks Supervisor	Immediately after a spill kit has been used.	Site Environmental Coordinator	Weekly during project duration
BF-O-H-5	Undertake refuelling offsite or with mobile refuelling vehicles on hard stand areas.	Earthworks Supervisor	During operations at the dune crossing.	Site Environmental Coordinator	During operations at the launch site.

### 12.2.6 Landform management

Careful consideration has been given to the design and placement of the launch site to minimise impacts to significant geoheritage features. In order to locate the pipeline through an existing highly degraded blow-out area in the fore dune the ocean outfall alignment was adjusted from that presented in the PER to an area 10 metres to the north. This has the benefit of reducing the impact on limestone cliffs to the south of the excavation.

The side wall of the trench through the foredune of the launch site will have an average 1:2 grade, in order to ensure stability of the trench, thereby reducing the potential need for further restorative works to the trench during construction (that could potentially impact adjacent areas), but also minimising the extent of batter intrusion into adjacent areas. Landform management will focus on avoiding any further blow-outs occurring in the area and ensuring trench stability during construction.

The potential impacts to landform and geoheritage and beach profile are not anticipated to be long term, given that the foredune will be reconstructed and the site will be re-contoured as a part of the site rehabilitation measures. Therefore, landform monitoring is only relevant to the construction stage. Furthermore, given that the launch site and the beach access trench will be located predominantly within an existing blowout area and will avoid localised limestone cliff features, the potential short-term impacts are anticipated to be minimal and extremely localised.

The construction of a groyne and coffer dam to facilitate the excavation of the marine trench and pipe pull are not likely to have a permanent impact on the beach profile however the infrastructure may affect movement of sand up and down the beach causing accretion and erosion. A management measure will be to monitor for any significant accretion or erosion around the groyne and coffer dam to ensure that the integrity of the beach remains during the operation stage. Removal and relocation of sand can be facilitated if required and directed by the Environment and Community Relations Manager.

**Table 12.2.6** below specifically outlines the implementation schedule and responsibilities for landform management for the dune crossing which must be followed to ensure the objectives specified in **Section 4.6.2** are met.

Table 12.2.6. Implementation schedule and responsibilities for landform management for the launch site dune crossing

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
BF-PC-L-1	Undertake survey of the launch site area including beach profile and peg out alignment and boundaries.	Earthworks Supervisor	At least one month before ground disturbing activity	Environment and Community Relations Manager	Upon receiving the GDWP for the launch site area.
<b>Construction</b>					
BF-C-L-1	Review vehicle movements to ensure that vehicles remain within authorised areas of disturbance. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Daily during construction works for the launch site.	Site Environmental Coordinator	Daily during construction works
BF-C-L-2	Construct trench with 1:2 sidewalls to ensure stability and low maintenance.	Earthworks Supervisor	After the limestone hardstand is constructed.	Environment and Community Relations Manager	After the beach access corridor is constructed.
BF-C-L-3	Construct limestone area using materials from site, where practicable.	Earthworks Supervisor	During construction works for the launch site.	Environment and Community Relations Manager	During construction works for the launch site.
BF-C-L-4	Stabilise any construction batters using liquid stabilisers, matting and/or brush.	Earthworks Supervisor	At completion of construction of the beach access structure.	Environment and Community Relations Manager	At completion of construction of the beach access structure
<b>Operation</b>					
BF-O-L-1	Review vehicle movements to ensure that vehicles remain within authorised areas of disturbance. If transgressions occur and landform is undermined notify the Site Environmental Coordinator who will advise on restoration measures where appropriate.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Daily during operations.
BF-O-L-2	Monitor and maintain batters to ensure the stability and deploy further stabilisation and management where required.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly throughout project duration.
BF-O-L-3	Monitor the beach profile for any significant accretion or erosion, if observed report to the Environment and Community Relations Manager for implementation of remedial measures.	Earthworks Supervisor	Daily during operations.	Site Environmental Coordinator	Weekly throughout project duration.
<b>Decommissioning</b>					
BF-D-L-1	Backfill and re-contour the foredune to pre-disturbed levels.	Earthworks Supervisor	After the pipe pull is complete.	Environment and Community Relations Manager	After the pipe pull is complete.

### 12.2.7 Rehabilitation management

The primary dune crossing for rehabilitation purposes is the “cutting” for the launch site and access to the beach to facilitate outfall towing and laying processes. This dune is within a Bush Forever site and is also a very prominent and visually accessible location for the wider community. Given this and the degree of disturbance likely to occur during the outfall construction process a high degree of rehabilitation effort will be required. The primary dune will be removed and stockpiled in order to reinstate the landform following the completion of the construction works.

Rehabilitation of the site will involve:

- Brushing;
- Weed control;
- Direct seeding;
- Tubestock planting;
- Tree guards;
- Sand trap fencing;
- Infill planting; and
- Monitoring and Maintenance.

The approach for rehabilitation on the primary dune crossing area will be different to all other rehabilitation areas, given the area is a dune formation. Therefore dune restoration techniques will be adopted. These techniques are based around achieving stability in what are known to be instable landform features when vegetation is absent. This is due to the exposure of these areas to strong coastal winds and the tendency for the coarse dunal sands to be wind mobile.

Brushing will need to be undertaken in this area to achieve an intensive coverage, particularly on the ocean side of the dune formation. Brushing will cover approximately 50% of the rehabilitated dune area. In addition, 150 metres of sand trap fencing will need to be installed to slow prevailing wind velocities at the soil surface and to trap moving sand to prevent dune blowouts forming. Given well developed topsoil is not a common component of primary dune soil profiles, topsoil will not be reapplied to the disturbed area.

Direct seeding will be undertaken in the second year (after the above works have been completed and in place for 12 months) at 6 kg/Ha so that the soil surface is more stabilised and seed is not excessively lost through wind and sand movements. Tubestock will be planted at a density of 1 per square metre. Tree-guards should also be allowed to protect the tubestock from weather conditions and predation by kangaroos and rabbits.

The revegetation of the dune areas will attempt to reinstate the existing vegetation units, in their relative quantities along the dune (vegetation units is shown in **Figure 10**). The quantity of seeds and tubestock required is illustrated in **Table 11.7.2b**

**Table 12.7.2b Seed and tubestock to be used in rehabilitation of the primary dune crossing and Bush Forever area**

<b>Melaleuca systema - Lomandra maritima herbland</b>	<b>% seed mix + tubestock</b>
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<i>Conostylis pauciflora</i> subsp. <i>euryrhipis</i> (P3)	5
<i>Melaleuca systema</i>	1
<i>Acacia lasiocarpa</i>	5
<i>Gompholobium tomentosum</i>	10
<i>Acanthocarpus preissii</i>	3
<i>Desmocladius flexuosus</i>	0.5
<i>Hardenbergia comptoniana</i>	3
<i>Hibbertia subvaginata</i>	1
<i>Lepidosperma pubisquameum</i>	0.5
<i>Gastrolobium nervosum</i>	1
<i>Phyllanthus calycinus</i>	5
<i>Leucopogon parviflorus</i>	1

<b>Spyridium globulosum- crassifolia shrubland</b>	<b>Scaevola</b>	<b>% seed mix + tubestock</b>
<i>Scaevola crassifolia</i>		13
<i>Spinifex hirsutus</i>		22
<i>Spinifex longifolius</i>		22
<i>Hemiandra pungens</i>		5
<i>Ficinia nodosa</i>		1
<i>Olearia axillaris</i>		1
<i>Rhagodia baccata</i>		1
<i>Threlkeldia diffusa</i>		1
<i>Hardenbergia comptoniana</i>		1
<i>Lepidosperma gladiatum</i>		1
<i>Acanthocarpus preissii</i>		6
<i>Exocarpos sparteus</i>		1

<b>Dryandra sessilis closed heath</b>	<b>% seed mix + tubestock</b>
<i>Dryandra sessilis</i>	72
<i>Gompholobium tomentosum</i>	16
<i>Hakea trifurcata</i>	2
<i>Hardenbergia comptoniana</i>	1
<i>Melaleuca systema</i>	4
<i>Melaleuca huegelii</i>	2.5
<i>Lepidosperma pubisquameum</i>	0.5
<i>Gastrolobium nervosum</i>	0.5
<i>Phyllanthus calycinus</i>	0.5
<i>Rhagodia baccata</i>	0.5
<i>Spyridium globulosum</i>	0.5

<b>Frankenia pauciflora shrubland (outfall site)</b>	<b>% seed mix + tubestock</b>
<i>Spinifex hirsutus</i>	27
<i>Spinifex longifolius</i>	27
<i>Olearia axillaris</i>	3
<i>Scaevola crassifolia</i>	5

<i>Rhagodia baccata</i>	4
<i>Threlkeldia diffusa</i>	2
<i>Cassythra racemosa</i>	2
<i>Frankenia pauciflora</i>	2
<i>Hardenbergia comptoniana</i>	2
<i>Lepidosperma gladiatum</i>	2
<i>Acanthocarpus preissii</i>	2
<i>Leucopogon sp.</i>	2
<i>Exocarpus sparteus</i>	2
<i>Hemiandra pungens</i>	2
<i>Acacia saligna</i>	2

<b>Melaueca huegelii - Melaleuca systema shrublands</b>	<b>% seed mix + tubestock</b>
<i>Acacia cyclops</i>	1
<i>Acacia truncata</i>	4
<i>Astroloma microcalyx</i>	1
<i>Conostephium pendulum</i>	1
<i>Conostylis pauciflora ssp eury</i>	1
<i>Dianella revoluta</i>	1
<i>Drosera sp.</i>	1
<i>Dryandra sessilis</i>	9
<i>Eremophila glabra</i>	2
<i>Gompholobium tomentosum</i>	12
<i>Hakea trifurcata</i>	1
<i>Hardenbergia comptoniana</i>	2
<i>Leucopogon pauciflora</i>	1
<i>Melaleuca huegelii</i>	20
<i>Melaleuca systema</i>	9
<i>Phyllanthus calycinus</i>	2
<i>Pimelea calcicola</i>	3
<i>Pimelea ferruginea</i>	1
<i>Rhagodia baccata subsp. dioica</i>	1
<i>Sarcozona bicarinata</i>	16
<i>Scaevola nitida</i>	8
<i>Spyridium globulosum</i>	1
<i>Thomasia cognata</i>	1
<i>Trymalium ledifolium</i>	1

Follow-up monitoring and maintenance will be required to ensure that revegetation is successful and the primary dune area has been effectively stabilised and revegetation is stable and self-sustaining. This will continue for two years after the completion of tubestock planting and will identify issues such as weed invasion, death of seedlings, predation, wind or water erosion, and be the basis for maintenance activities.

Infill planting and seeding will be conducted in the third year, after tubestock planting in the first year and direct seeding in the second year. The infill will be applied at 20% of the initial application rate (1 plant every 5 m<sup>2</sup> for tubestock and 1.2 kg/Ha for direct seeding).

Table 12.2.7 below specifically outlines the implementation schedule and responsibilities for rehabilitation for the dune crossing which must be followed to ensure the objectives specified in Section 4.7.2 are met.

Table 12.2.7 Implementation schedule and responsibilities for rehabilitation management for the launch site dune crossing

Action Item Ref	Details of Management Actions	Responsibility for Implementation	Timing for Implementation	Responsibility for Audit and Review	Timing for Review/Audit
<b>Pre-Construction</b>					
BF-PC-R-1	Collection of provenance seed material from areas within Lot 101 and surrounding areas.	Site Environmental Coordinator	Annually depending on seeding times for target species.	Environment and Community Relations Manager	At least six months prior to revegetation commencing.
BF-PC-R-2	Salvage plants/cuttings of species which cannot be propagated from seed for rehabilitation.	Site Environmental Coordinator	Prior to clearing activities.	Environment and Community Relations Manager	Prior to clearing activities.
<b>Construction</b>					
BF-C-R-1	Undertake topsoil quality assessment and formulate topsoil segregation/management approach accordingly.	Site Environmental Coordinator	Prior to clearing commencing.	Environment and Community Relations Manager	After topsoil assessment has been undertaken and prior to clearing commencing.
BF-C-R-2	Clear existing vegetation and push into brush piles at the edge of the road alignment. Aim to keep vegetation intact.	Earthworks Supervisor	Once topsoil assessment is completed.	Site Environmental Coordinator	During vegetation clearing.
BF-C-R-3	Bury weed contaminated vegetation and topsoil separately within the soil column at least 200mm below the surface.	Earthworks Supervisor	Once topsoil has been stripped.	Site Environmental Coordinator	Once topsoil has been stripped.
<b>Decommissioning</b>					
BF-D-R-1	Undertake deep ripping of any hardstand areas along the road surface.	Earthworks Supervisor	At completion of the construction of the ocean outfall pipe pull.	Site Environmental Coordinator	At completion of the construction of the ocean outfall pipe pull.
BF-D-R-2	Re-contour foredune area to resemble natural profile using stockpiled spoil and limestone.	Earthworks Supervisor	At completion of the construction of the ocean outfall pipe pull.	Environment and Community Relations Manager	At completion of the construction of the ocean outfall pipe pull.
BF-D-R-3	Spread brush and track roll on top-soiled landform and provide other surface stabilisation measures where required.	Earthworks Supervisor	Following recontouring.	Site Environmental Coordinator	Once brush has been place and other surface stability measures have been deployed.

Rehabilitation					
BF-R-R-1	Install sand trap fencing.	Earthworks Supervisor	Following brushing.	Environment and Community Relations Manager	Once sand trap fencing and other surface stability measures have been deployed.
BF-R-R-2	Plant tubestock and undertake direct seeding at specified rates as seen in <b>Table 12.2.7a</b> .	Site Environmental Coordinator	After the break of the season (first 300mm of soil profile is wet).	Environment and Community Relations Manager	After tubestock planting and direct seeding has taken place.
BF-R-R-3	Undertake the first monitoring event to track seed germination and evidence of water and/or wind erosion.	Site Environmental Coordinator	Following end of Spring (November) after direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
BF-R-R-4	Undertake post works maintenance as required (including weed control).	Site Environmental Coordinator	December following direct seeding.	Environment and Community Relations Manager	Following end of Spring (November) after direct seeding.
BF-R-R-5	Prepare a progress report for following the first year of monitoring and maintenance.	Site Environmental Coordinator	December of the first calendar year following the completion of rehabilitation and revegetation works.	Environment and Community Relations Manager	December of the first calendar year following the completion of rehabilitation and revegetation works.
BF-R-R-6	Undertake second monitoring event to track seed germination, evidence of water and/or wind erosion and/or impacts from herbivores. If necessary schedule infill direct seeding for late autumn/early winter and any maintenance required including weed control.	Site Environmental Coordinator	December of the first calendar year following the completion of rehabilitation and revegetation works.	Environment and Community Relations Manager	December of the first calendar year following the completion of rehabilitation and revegetation works.
BF-R-R-7	Prepare a progress report for following the second year of monitoring and maintenance.	Site Environmental Coordinator	December of the second calendar year following the completion of rehabilitation and revegetation works.	Environment and Community Relations Manager	December of the second calendar year following the completion of rehabilitation and revegetation works.

## **13 OPERATIONAL MONITORING**

Weekly progress meetings covering environmental performance will be held between the Environment and Community Relations Manager and the Site Environmental Coordinator, with findings from these meetings being directly reported to the Alliance Manager.

### **13.1 ENVIRONMENTAL AND COMPLIANCE MONITORING**

During the course of the project, monthly Environmental Audits will be undertaken internally by the Environment and Community Relations Manager and the Site Environmental Coordinator. The audit will ensure compliance with the TCMP is being achieved with a view to immediately rectifying any shortcomings that are identified. All audit findings will be reported directly to the Alliance Manager.

Quarterly Environmental Audits by Water Corporation Environment Branch will be conducted to ensure compliance with the TCMP, with findings being reported directly to the Environment and Community Relations Manager and the Alliance Manager.

The AWA in conjunction with the Water Corporation will need to undertake annual Compliance Audits to ensure compliance with all the conditions outlined in the Ministerial Statement 755. These reports will be provided annually to the DEC Audit and Compliance Branch.

## 14 REPORTING

### 14.1 INTERNAL REPORTING

Weekly reports will be available following weekly meetings between the Site Environmental Coordinator and the Environmental and Community Relations Manager.

Reporting will include;

- Induction procedures review and records of inducted personnel;
- Area of clearing completed to date; and
- Issues/incidents with operations and actions/resolutions for these.

All findings will be reported back to the Alliance Manager and will be made available to the Water Corporation.

The TCMP is a live document and as such will be reviewed annually, all revisions will be incorporated where necessary so it maintains an accurate and up to date tool to be used throughout the projects duration.

### 14.2 EXTERNAL REPORTING

The Water Corporation will be provided with quarterly environmental update reports. Included in the report will be information pertaining to the TCMP, which will outline:

- Induction procedures and records of inducted personnel;
- Area of clearing completed to date; and
- Issues/incidents with operations and actions/resolutions for these;

An Environmental Compliance Report will be submitted to the DEC annually on behalf of the Water Corporation as the proponent for the project. The report will document the process of compliance with all the environmental conditions outlined in the Ministerial Statement 755.

### 14.3 ROLES AND RESPONSIBILITIES

To ensure the AWA adequately resources and complies with the TCMP throughout the life of the Alliance, various responsibilities have been delegated to personnel within the Alliance. The table attached in **Appendix D** outlines the roles and responsibilities for the AWA personnel.

## 15 SUMMARY

This TCMP details how the AWA will manage the terrestrial environment during construction activities for the Alkimos Wastewater Scheme. The design and construction of the Alkimos Wastewater Scheme was undertaken by the AWA on behalf of the Water Corporation will be in accordance with the guiding principle of minimising impacts to the existing environment.

The management measures detailed in this TCMP are considered to be the most appropriate to achieve the objectives stated throughout the document, given the environment in which construction is to occur. Furthermore, the TCMP has been prepared in a manner to comply with Condition 6 associated with Ministerial Statement 755, which was issued in accordance with the provisions of Part IV of the Environmental Protection Act 1986. This TCMP is a live document, which may require revision and modification throughout the life of the project.

## 16 REFERENCES

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PLATES



**Plate 1:** The proposed location of the Launch Site primary dune crossing through an existing dune blow out, looking directly west towards the ocean.



**Plate 2:** The proposed location of the Launch Site primary dune crossing, looking directly east.



Plate 3: Photograph of the WWTP area looking north from the southern end



Plate 4: Photograph of the Launch Site looking south indicating the generally degraded nature of the vegetation



**Plate 5:** Photograph of the Launch Site looking northeast showing the clear delineation between the degraded vegetation and the limestone ridge vegetation community

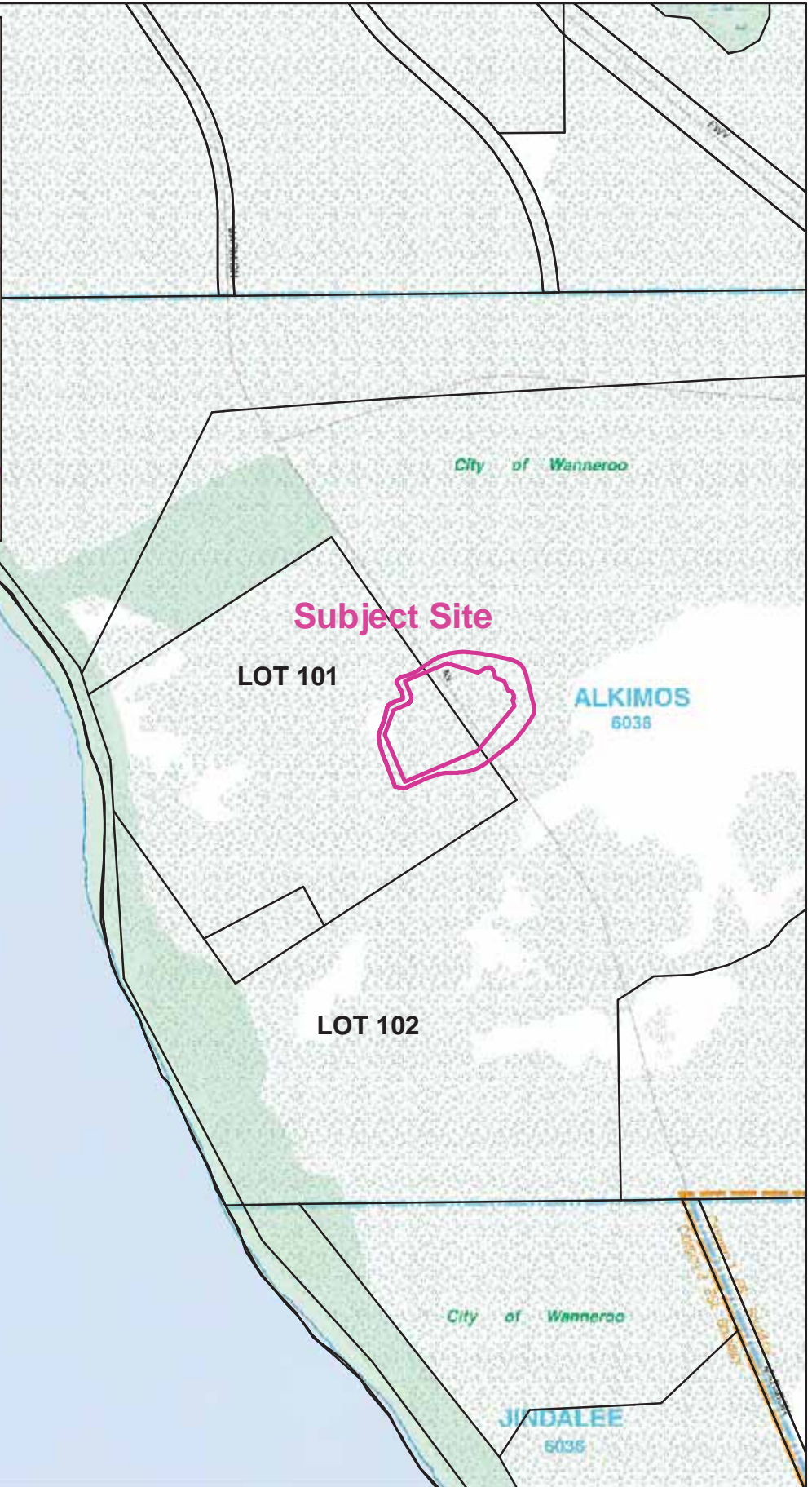


Plate 6: An indicative Launch Site layout on another project in the United Kingdom

## Figures



**Subject Site**



**Legend**

 PER WWTP Footprint

DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHK'D	APP'D	DATE	No.	ACTIVITY - REVISION DESCRIPTION	DES	DRN	CHK'D	APP'D
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Scale: **1:24,000** 

PROJECT **ALKIMOS WASTEWATER SCHEME  
TERRESTRIAL CONSTRUCTION MANAGEMENT PLAN**

DRAWING TITLE **FIGURE 1 :Alkimos WWTP locality plan**



Project Number <b>12769</b>	Original <b>A4</b>
Drawing Number <b>SK01</b>	Revision <b>00</b>
Designed ND	Checked
Drawn MGW	Approved
Local Authority City of Wanneroo	
Sheet 1 of 1	Date 4/01/08

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