

Appendix S

**Technical Specification for Rehabilitation
Works**



Haughton Pipeline Stage 2

Technical Specification for Rehabilitation Works

Townsville City Council

21 October 2022

→ **The Power of Commitment**



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1. Introduction

1.1 Purpose

This specification has been prepared to provide a scope of works for the rehabilitation of all disturbance areas within the construction corridor for the Houghton Pipeline Stage 2 (HPS2) Project, comprising the following:

1. Areas of potential habitat for the southern black-throated finch, bare-rumped sheath-tail bat and koala, listed as Matters of National Environment Significance (MNES) pursuant to the *Environment Protection and Biodiversity Conservation Act 1999*
2. All other areas within the construction corridor including non-remnant vegetation watercourses, temporary construction access roads and stockpile yards.

This document has been prepared based on the Houghton Pipeline Stage 2 Project Rehabilitation Management Plan (GHD, 2022).

1.2 Definitions

The following definitions are relevant to this specification:

- Hydromulch – A planting process that uses a mixture of seed, wood fibre, and stabilising emulsion
- Vegetation Management Watercourses – Watercourses depicted on the Queensland Department of Resources (DoR) Vegetation Management Watercourses Map under the *Vegetation Management Act 1999*. The location of these are shown in Appendix A.

Pipeline construction corridor clearing extent through Vegetation Management Watercourses – Clearing shall not exceed 20 m wide within the following extents past the defining bank for the relevant stream order:

- 10 m from the defining bank of a stream order 1 or 2 watercourse
- 25 m from the defining bank of a stream order 3 or 4 watercourse
- 50 m from the defining bank of a stream order 5 or greater watercourse
- Defining bank - The defining bank is the bank that confines seasonal flows but which may be inundated by flooding from time to time, and can be either of the following:
 - The bank or terrace that confines the water before the point of flooding
 - Where there is no bank, the seasonal high-water line that represents the point of flooding.
 - The seasonal high-water line is defined as the zone that represents the usual peak seasonal flow level, identifiable by deposits, debris or characteristic vegetation zonation.

1.3 Contractor responsibilities

This Technical Specification prescribes standard rehabilitation methods that shall be applied to disturbed land as a minimum. The Contractor(s) shall be responsible for developing and implementing site and stage-specific rehabilitation plans as required, taking into consideration construction staging of works and the requirement for progressive rehabilitation, local environmental and landholder requirements and relevant conditions of State and Commonwealth approvals.

2. Rehabilitation objectives

2.1 Key rehabilitation objectives

The key rehabilitation objective is to return disturbed areas as close as practicable to pre-disturbed conditions within the construction footprint through a combination of active and passive rehabilitation. This incorporates the following requisites:

- The establishment and reinstatement of land surface consistent with the surrounding topography
- The long-term stability of soils, landforms and hydrology
- Use of local provenance species in the revegetation areas (as defined in pre-disturbance surveys/mapping)
- Rehabilitation areas are self-sustainable and resilient (i.e. require no long term water and weed management except to control invasive weed species as legally obliged)
- Establish rehabilitated areas that provide appropriate habitat for local flora and fauna
- Rehabilitation areas are suitable for location (e.g. regeneration of native vegetation, endemic grass species, riparian vegetation) while maintaining the ongoing access to and for operation of the pipeline
- The execution of planning, implementation, monitoring and reporting on rehabilitation in a manner consistent with industry practice.

2.2 MNES rehabilitation objectives

The assessment of impacts to Matters of National Environmental Significance (MNES) associated with the construction, operational and maintenance identified that the Project is likely to result in significant impacts on the following MNES species:

- Bare-rumped sheathtail bat – Due to the impact on habitat critical to the survival of the species, notably loss of potential roosting trees including loss of 10 large and 27 moderate-sized *E. platyphylla* hollows
- Black-throated finch (southern) – Due to the impact on habitat critical to the survival of the species associated with localised indiscriminate loss of trees within 1 km of water
- Koala – Due to the impact on habitat critical to the survival of the species.

While it is acknowledged that rehabilitation measures do not constitute mitigation measures to counteract impacts, habitat reinstatement and improvement for the above MNES was considered in developing the following rehabilitation objectives:

- Black throated finch
 - **Weed management:** Given the extensive weed coverage that currently exists in the Project area, there are substantial opportunities to improve the habitat values for the southern black-throated finch through removal and ongoing management of weeds in all rehabilitation areas.
 - **Revegetation of remnant vegetation areas within 400 m from a DoR Vegetation Management Watercourse:**
 - Remnant areas within 400 m from a DoR Vegetation Management Watercourse will be revegetated (with the exception of the 4 m wide gravel access road and the 10 m wide zone of influence) to establish future areas of suitable habitat for the species. Specifically, these rehabilitation areas will be replanted with tubestock of species that characterise the endemic riparian open forest and woodland communities.
 - **Sowing food grass species:** Rehabilitation areas will be subject to sowing of native grasses that are documented to be food species for the southern black-throated finch.
- Bare-rumped sheathtail bat
 - **Avoiding direct impact to potential roost trees:** Potential large roost trees will be protected from direct and indirect impact, by avoiding the removal of these potential roost trees where possible. Where avoidance is not possible in the remnant watercourse areas, these areas will be replanted with *E. platyphylla* tubestock to increase the availability of future roosting habitat.
 - **Revegetation of remnant vegetation areas within 400 m from a DoR Vegetation Management Watercourse:** Remnant areas within 400 m from a DoR Vegetation Management Watercourse will be revegetated (with the exception of the 4 m wide gravel access road and the 10 m wide zone of influence) to establish future areas of suitable habitat for the species.

– Koala

- **Weed management:** Given the extensive weed coverage that currently exists in the Project area, there are substantial opportunities to improve the habitat values for the koala through removal and ongoing management of weeds in all rehabilitation areas.
- **Revegetation of remnant vegetation areas within 400 m from a DoR Vegetation Management Watercourse:** Remnant areas within 400 m from a DoR Vegetation Management Watercourse will be revegetated (with the exception of the 4 m wide gravel access road and the 10 m wide zone of influence) to establish future areas of suitable habitat for the species. Specifically, these rehabilitation areas will be replanted with tubestock of species that characterise the endemic riparian open forest and woodland communities.

3. Rehabilitation extents and treatments

Rehabilitation shall be undertaken to all disturbance areas within the construction corridor, with the exception of a 4 m wide permanent access track. Land within the construction corridor has been categorised into two distinct rehabilitation extents, each of which will receive a different rehabilitation treatment, as follows:

- To provide future habitat values for black-throated finch, bare-rumped sheath-tail bat and koala, areas that currently support remnant vegetation and are located within 400 m from a watercourse depicted on the Department of Resources (DoR) Vegetation Management Watercourse and Drainage Feature Map will be revegetated with tubestock consistent with the relevant riparian or woodland Regional Ecosystems (i.e. RE 11.3.25 or 11.3.35) and hydromulch comprising endemic grass species. These areas exclude a 10m wide zone of influence above the pipeline which shall only be hydromulched to enable future maintenance of the pipeline.
- To achieve sufficient protection against erosion, all areas of the pipeline construction corridor will be hydromulched with endemic grass species. These areas include minor watercourses and drainage lines that are not mapped on the DoR Vegetation Management Watercourse and Drainage Feature Map, the pipeline 10 m wide zone of influence centred about the pipeline (i.e. 5 m either side of the pipeline centerline), temporary construction access roads and stockpile yards.

Where requested by a landholder, some temporary construction areas (e.g. laydown areas, access tracks etc.) may be retained by the landholder subject to formal agreement and handover and where permitted under approvals.

The type of proposed disturbance, indicative impact and rehabilitation requirements for each of the rehabilitation extents are detailed in Table 3.1.

A schematic representation of the proposed revegetation is presented in Figure 3-1.

The extents of the rehabilitation treatments, as well as the locations of DoR Vegetation Management Watercourses, and the required REs to be restored, are presented in Appendix A and on the engineering drawings.

Table 3.1 Project construction components and rehabilitation requirements

Rehabilitation extent	Disturbance	Indicative impact	Rehabilitation requirements	Total rehabilitation area
Remnant vegetation within 400 m of a DoR Vegetation Management Watercourse	<p><i>Temporary</i></p> <ul style="list-style-type: none"> – Clearing of remnant vegetation within a 20 m corridor of a defined distance from a mapped DoR Vegetation Management Watercourse, and 40 m corridor in all other areas – Clearing of temporary construction access roads and stockpile yards within 400 m of a vegetation management water course <p><i>Permanent</i></p> <ul style="list-style-type: none"> – 4 m gravel access track to the defining bank 	<ul style="list-style-type: none"> – Clearing/felling/grubbing vegetation within construction corridor – Construction of pipeline trench within pipeline corridor – Gabion mattress scour protection to watercourse defining bank with 300 mm topsoil overlaid – Construction of a 4 m wide access track 	<ul style="list-style-type: none"> – Plant tubestock of canopy, sub-canopy, shrub and ground strata (excluding grasses) outside the pipelines 10 m zone of influence and 4m access track; hydromulch with endemic grasses – Hydromulching with endemic grasses to full extent of disturbed corridor including pipeline 10 m zone of influence (i.e. pipeline's 10 m zone of influence is to remain free from tubestock planting) 	<ul style="list-style-type: none"> – 0.63 ha RE 11.3.25b – 22.2 ha RE 11.3.35 – 134.74 ha Hydromulch
All other areas in the pipeline construction corridor including watercourses not mapped on the DoR Vegetation Management Watercourse and Drainage Feature Map, the pipeline 10 m wide zone of influence, temporary construction access roads and stockpile yards	<p><i>Temporary</i></p> <ul style="list-style-type: none"> – Clearing of a 40 m corridor in a non-mapped vegetation management watercourse. – Clearing of temporary construction access roads, stockpile yards and site construction compounds <p><i>Permanent</i></p> <ul style="list-style-type: none"> – 4 m wide gravel access track parallel to pipeline. 	<ul style="list-style-type: none"> – Clearing/felling/grubbing vegetation within construction corridor. – Construction of pipeline trench within pipeline corridor – Gabion mattress scour protection to watercourse defining bank with 300 mm topsoil overlaid – Construction of a 4 m gravel access track 	<ul style="list-style-type: none"> – Hydromulching with endemic grasses 	

Rehabilitation extent - Remnant vegetation within 400m of a DoR Vegetation Management Watercourse

Plan View

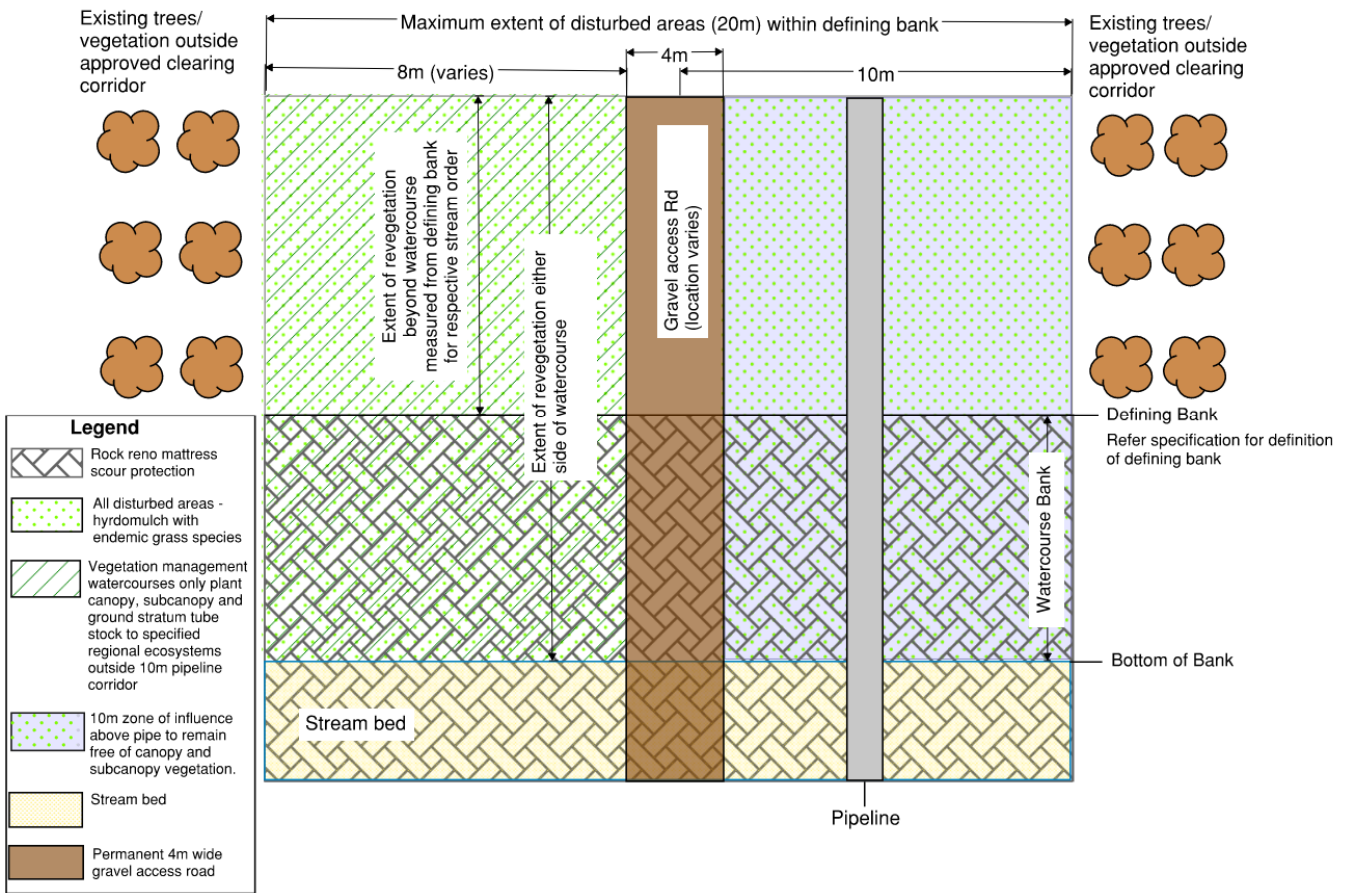


Figure 3-1 Revegetation plan for DoR Vegetation Management Watercourses

4. Rehabilitation requirements

4.1 Pre-rehabilitation site preparation

4.1.1 Timing

Site preparation works shall be undertaken following completion of the excavation and any construction activities.

Rehabilitation shall occur progressively as areas are no longer required for construction activities. Rehabilitation shall commence within six weeks of the cessation of construction works in the relevant area.

4.1.2 Soil assessment

A soil assessment within the revegetation areas shall be undertaken by the Contractor to provide site specific recommendations for soil amelioration.

The soil sampling and assessment program shall be undertaken by a suitably qualified soil scientist. Soil analysis will be undertaken by an Australasian Soil and Plant Analysis Council (ASPAC) certified laboratories.

4.1.2.1 Topsoil

Topsoil sampling shall comply with the following requirements:

- Samples shall be representative of the topsoil type (i.e. no mixing different soil types or subsoils).
- Samples shall be collected as per the frequency outlined in Table 4.1.
- If sampling stockpiles, sub-samples shall be sampled from various locations and 0.5 m apart.
- Composite samples shall include 10 sub-samples.
- Approximately 3 kg of sample shall be collected.

Table 4.1 Topsoil sampling frequency

Topsoil	Frequency
In situ topsoil	1 per 2,500 m ² With a minimum of one test per topsoil type
Site stockpile	1 per 500 m ³ With a minimum of one test per topsoil type
Manufactured site topsoil	1 per 500 m ³ With a minimum of one test per topsoil type
Imported topsoil	1 per 500 m ³ With a minimum of one test per topsoil type

Laboratory analysis shall include:

- Bulk density
- Organic matter
- Wettability
- pH Electrical conductivity
- Extractable Phosphorus content
- Permeability
- Texture
- Water repellence (hydrophobicity)
- Dispersion
- Exchangeable Calcium, Magnesium
- Calcium/Magnesium ratio
- Exchangeable Sodium percentage
- Exchangeable Potassium, Aluminium
- Effective cation exchange capacity
- If EC > 1.2 dS/m – Soluble Chloride*
- If EC > 1.2 dS/m – Extractable Sulfur*

Note: * not included when testing manufactured topsoil

4.1.2.2 Subsoil

Subsoil sampling shall comply with the following requirements:

- Samples shall be representative of the subsoil type (i.e. no mixing different soil types or topsoils)
- One test per subsoil type
- Composite samples shall include 10 sub-samples
- Approximately 1 kg of sample shall be collected.

Laboratory analysis shall include:

- Wettability
- pH
- Electrical conductivity
- Texture
- Water repellence (hydrophobicity)
- Exchangeable Calcium
- Exchangeable Magnesium
- Calcium/Magnesium ratio
- Exchangeable Sodium percentage
- Exchangeable Potassium
- Exchangeable Aluminium
- Effective cation exchange capacity

4.1.3 Weed management

Topsoil to be spread over revegetation areas shall be in a weed-free condition prior to the commencement of ground preparation operations. The contractor shall nominate the appropriate weed controls. Weed control methods can include any of the following:

- Mechanical application of non-residual glyphosate herbicide using boom spray or high-volume power applicator
- Manual application of non-residual glyphosate herbicide from knapsack or similar applicator
- Manual mechanical methods, such as hand-pulling.

4.1.4 Land stabilisation and erosion management

Disturbed areas shall be reshaped to a stable form and blended in with surrounding natural landforms and shall be undertaken in the following manner:

- Disturbed surface areas shall be roughened to reduce the effects of compaction, allowing for natural regeneration processes to occur
- Natural drainage patterns shall be reinstated as close to pre-disturbance as reasonably possible
- Slope lengths and angles shall be compatible with the surrounding landscape
- Backfilling of trenches shall ensure that soil horizons (topsoil, sub-soil) are placed similar to pre-disturbance. Trenches shall be compacted, capped with a layer of topsoil to a level at least 75 mm above adjoining ground level
- Watercourses and drainage line embankments shall be reprofiled and rock protection placed as specified
- Binders suitable for cold spray application may be applied to stabilise mulched or seeded surfaces on banks or high erosion areas.

4.1.5 Ripping

Following land stabilisation, any areas where soil has become compacted during site works shall be deep ripped and shall be undertaken in the following manner:

- Deep ripping shall take place across the natural slope (i.e. parallel to contours) to reduce overland flow velocity and mitigate erosion, at a depth of approximately 100 mm
- Highly compacted areas such as hardstands, laydowns and temporary access tracks may need to be ripped to a greater depth of 300 mm.

4.1.6 Amelioration and roughening

Any required soil amelioration, as determined through the assessment described in Section 4.1.2 and herein, is to be completed.

Soil amelioration agents shall conform to specifications outlined in Table 4.2, where agents have passed quality tests. Amelioration shall be completed in the pre-rehabilitation activities along with other soil preparation. The compost and fertiliser shall be suitable for the plants used for revegetation works.

Table 4.2 Soil amelioration agents

Agent	Comments
Agricultural lime	Naturally occurring limestone rather than liquid form. Neutralising value (NV) of 90 or above. pH value of 8.5 +/- 0.5. Fine grade (90% passing 100-500 microns).
Agricultural gypsum	Naturally occurring grade 1 gypsum (fine graded).
Agricultural dolomite	Naturally occurring dolomite rather than liquid form. Neutralising value (NV) of 90 or above. pH value of 8.5 +/- 0.5. Fine grade (90% passing 100-500 microns).
Fertiliser	Composted manure is suitable (to minimise introduction of weeds). NPK as specified following laboratory analysis.
Organic soil conditioner	Composted manure is suitable (to minimise introduction of weeds).
Microbial inoculants	Not considered required for establishment of topsoil with appropriate topsoil and stockpile management.
Soil wetting agents	Addressed through application of mulch and organics. Depending on depth of topsoil available, deep ripping may be suitable for moisture retention.
Water holding agents	Not considered required with appropriate care and maintenance.

Soil sampling and analysis conducted during Houghton Pipeline Duplication Stage 1 determined the soil treatments provided in Table 4.3 were required to ensure soil parameters conformed. It is likely that similar treatments will be required for the HPS2. The soil amelioration requirements provided Table 4.3 shall be included in the Contractors tender price as a baseline. Notwithstanding, soil sampling and analysis will be required to ensure appropriate treatments are applied.

Table 4.3 Soil treatment schedule

Component	Rate
Compost addition	Min 30 % by volume
Ag Gypsum	1.5 kg/m ²
Fertiliser as appropriate NPK	400 kg/ha

Roughening shall occur immediately after the application of amelioration agents. Roughening shall:

- Be approximately 50 mm depth
- Incorporate amelioration agents into the subsoil
- Occur when soils are dry enough to break up / crumb the surface
- Be parallel to the contour.

4.1.7 Topsoil re-instatement

Topsoil shall be redistributed across the area in accordance with the following steps:

- The source stockpile must comprise topsoil taken from the area or from a location with similar types of soil and vegetation
- Recovery and dispersal of any soil shall not occur if the stockpiles are in a saturated condition
- Topsoil shall be respread to a depth of approximately 100 mm
- Spreading of topsoil will occur from the far edge of the disturbed area (i.e. further from the access point), progressively moving inwards as to reduce the risk of compaction and destruction of seed bank
- Topsoil shall tie in evenly to the natural slope and adjacent vegetation to mitigate erosion risk.

4.2 Revegetation

4.2.1 Fauna habitat return

Clause Deleted.

4.2.2 Preparation for revegetation

Prior to hydromulching and tubestock planting, the following site preparation will be undertaken:

- Revegetation to be undertaken by a suitably qualified and experienced contractor
- Mark out the 10 m corridor over the pipeline (with star pickets and high visibility tape) that is to remain free of tubestock planting (i.e. no canopy, sub-canopy, shrub or ground strata tube-stock)
- Eradicate weeds prior to undertaking revegetation works
- Calculate material requirements for rehabilitation works well in advance of work commencement (noting there may be a requirement to propagate certain plant species)
- Contact nursery/seed providers to ascertain the availability of seed and tube-stock for use in rehabilitation work
- Nursery/seed providers must provide proof of 'local providence' for all material. A record of providence will be maintained by the contractor undertaking the work. Local providence is considered to be within 100 km of Townsville and 100 km of Ayr

Specific hydromulch and tubestock requirements are detailed in Table 4.4, and suitable plant species are recommended in Table 4.5 (hydromulch) and Table 4.6 (tubestock). Further details on these methods are provided as follows.

4.2.3 Application of hydromulch

- Apply hydromulching material to revegetation areas (100% cover on areas to be revegetated) at the minimum application rate as per the nominated product requirements.
- Hydromulch shall not be applied under the following weather conditions:
 - Temperature is higher than 35°C
 - Winds exceed 15 km/hr
 - Where, in the opinion of the Superintendent the surface is too wet
 - During rain periods or when rain appears imminent,

4.2.4 Planting of tubestock

- Tube-stock will be planted a minimum of several months before the first wet season rains and irrigated, to maximise vegetation establishment before high velocity flows occur in watercourses and drainage features.
- At least 100 days will be allowed between germination of collected seeds and rehabilitation planting to ensure adequate tube-stock maturation.
- Tubestock shall have the following characteristics:
 - Tubestock to be minimum 50 mm diameter and 80 mm deep

- Tubestock height to be 200 mm when planted
- Plant stock is to be supplied in good health as demonstrated by the following:
 - Leaf colour and size
 - Absences of dieback
 - Absence of other plant stress indicators
 - Free from significant injury
 - Free from pests and diseases
- Tubestock planting methods will include:
 - **Identify the trunk flare.** The trunk flare is where the trunk expands at the base of the tree. This point shall be partially visible after the tree has been planted.
 - **Dig a shallow, broad planting hole.** Clear the hydromulch and dig a hole 2-3 times wider than the root ball, but only as deep as the root ball.
 - **Remove the containers or cut away the wire basket.** Inspect container tree root balls for circling roots. Straighten, cut, or remove them.
 - **Place the tree at the proper height.** Take care to dig the hole to the proper depth – and no more. If the tree is planted too deep, new roots will have difficulty developing because of a lack of oxygen.
 - **Straighten the tree in the hole.** Before backfilling, have someone view the tree from several directions to confirm it is straight.
 - **Fill the hole gently, but firmly.** Pack soil around the base of the root ball to stabilize it. Fill the remainder of the hole, firmly packing the soil to eliminate air pockets that may dry out roots. Further reduce air pockets by watering periodically while backfilling. Avoid fertilization at the time of planting.
 - **Stake the tree only if necessary.** Studies have shown that trees establish more quickly and develop stronger trunk and root systems if they are not staked at the time of planting.
 - **Mulch the base of the tree.** Mulch is organic matter spread around the base of a tree to hold moisture, moderate soil temperature extremes, and reduce grass and weed competition. Mulch is to be provided for 300 mm around planted tubestock to a depth of 100 mm
 - **Provide follow-up care.** Keep the soil moist, but not water-logged. Water trees at least once a week, barring rain, and more frequently during hot, windy weather.

Table 4.4 Hydromulch and tubestock requirements

Restored Regional Ecosystem	Hydromulch	Tubestock requirements		
		Tubestock planting rate at the following rates per stratum	Tube-stock species diversity requirements	Plant spacing requirements
11.3.25b <i>Melaleuca leucadendra</i> and/or <i>M. fluviatilis</i> ,	<ul style="list-style-type: none"> – Endemic grass species will be used with the goal of surface stabilisation through over-seeding the rehabilitation area with endemic grass species. – Seeding rate will be sufficient for germination and sustainable cover of approximately 1000 plants per hectare, per riparian zone. – A minimum of four different native grass species will be selected from Table 4.5. – Bonded fibre matrix to be provided at watercourse banks as a minimum. 6-month functional longevity, minimum application rate of 5000 kg/ha (500 g/m²) and minimum wet thickness of 5 mm. 	<ul style="list-style-type: none"> – 30 canopy trees per hectare. – 50 sub-canopy trees per hectare. – 60 shrubs per hectare. – 3,000 sedges and forbs per hectare. 	<ul style="list-style-type: none"> – A minimum of four different canopy species. – A minimum of three different sub-canopy species. – A minimum of five different shrub species. – A minimum of four different forb or sedge species. 	<p>Recommended plant spacing is as follows:</p> <p><i>Below the defining bank:</i></p> <ul style="list-style-type: none"> – Forbs and sedges can be planted in clumps of four with a minimum spacing of 1 m between clumps. – Plant canopy, sub-canopy and shrub species with a minimum spacing of 2 m (stream order 3 or higher watercourses) or with a minimum spacing of 3 m (stream order 1 and 2 watercourses). <p><i>Beyond the defining bank:</i></p> <ul style="list-style-type: none"> – Plant sub-canopy, shrub, and ground strata species with a minimum spacing of 2 m. – Plant canopy species with a minimum spacing of 3 m.
11.3.35 <i>Eucalyptus platyphylla</i> , <i>Corymbia clarksoniana</i> woodland on alluvial plains	<ul style="list-style-type: none"> – Apply hydromulching material to rehabilitation areas (100% cover on entire rehabilitation footprint) at the minimum application rate as per the nominated product requirements. 	<ul style="list-style-type: none"> – 25 canopy trees per hectare. – 35 sub-canopy trees per hectare. – 40 shrubs per hectare. – 3,000 grasses per hectare. 	<ul style="list-style-type: none"> – A minimum of two different canopy species. – A minimum of two different sub-canopy species. – A minimum of two different shrub species. – A minimum of four different grass species. 	<ul style="list-style-type: none"> – Plant sub-canopy, shrub, and ground strata species with a minimum spacing of 10 – 20 m – Plant canopy species with a minimum spacing of 10 – 20 m.

Table 4.5 Endemic grass species for hydromulch mix

Scientific name	Common name	RE 11.3.35	RE 11.3.25b	All other areas
<i>Alloteropsis cimicina</i>	Carpet Grass	-	-	X
<i>Dichanthium sericeum</i>	Queensland Bluegrass	X	X	X
<i>Enteropogon acicularis</i>	Curly Windmill Grass	-	X	X
<i>Heteropogon contortus</i>	Black Speargrass	X	X	X
<i>Heteropogon triticeus</i>	Giant Speargrass	X	-	X
<i>Panicum decompositum</i>	Native Millet	-	-	X
<i>Panicum effusum</i>	Hairy Panic		X	X
<i>Setaria surgens</i>	Pigeon Grass	X	X	X
<i>Themeda triandra</i>	Kangaroo Grass	X	X	X

Table 4.6 Suitable tubestock plant species for rehabilitation of DoR Vegetation Management Watercourses

Stratum	Lifeform	Species	Common name	RE 11.3.35	RE 11.3.25b
Canopy	Tree	<i>Casuarina cunninghamiana</i>	River She-oak	-	X
	Tree	<i>Corymbia tessellaris</i>	Moreton Bay Ash	X	X
	Tree	<i>Eucalyptus camaldulensis</i>	River Red gum	X	
	Tree	<i>Eucalyptus platyphylla</i>	Poplar gum	X	X
	Tree	<i>Eucalyptus raveretiana</i>	Black Ironbox	X	
	Tree	<i>Eucalyptus tereticornis</i>	Forest red gum	-	X
	Tree	<i>Euroschinus falcatus</i>	Cudgerie	-	X
	Tree	<i>Melaleuca fluviatilis</i>	River tea tree	-	X
	Tree	<i>Melaleuca leucadendra</i>	Weeping Paperbark	-	X
	Tree	<i>Nauclea orientalis</i>	Leichhardt Tree	-	X
	Tree	<i>Alphitonia excelsa</i>	Soap bush	-	X
Subcanopy	Tree	<i>Alphitonia excelsa</i>	Soap tree	-	X
	Tree	<i>Ficus racemose</i>	Cluster Fig	-	X
	Tree	<i>Geijera salicifolia</i>	Wilga	-	X
	Tree	<i>Lysiphyllum hookeri</i>	White Bauninia	-	X
	Tree	<i>Mallotus philippensis</i>	Kamala Tree	-	X
	Tree	<i>Melaleuca nervosa</i>	Firebark	X	X
	Tree	<i>Melaleuca viridiflora</i>	Broad-leaved paperbark	X	X
Shrub	Shrub	<i>Acacia holosericea</i>	Silky Wattle	X	X
	Shrub	<i>Alyxia ruscifolia</i>	Native Holly	-	X
	Shrub	<i>Breynia oblongifolia</i>	Coffee Bush	-	X
	Shrub	<i>Ficus opposita</i>	Sandpaper Fig	-	X
	Shrub	<i>Lophostemon 13randifloras</i>	Northern Swampbox	-	
	Shrub	<i>Macaranga tanarius</i>	Macaranga	-	X
	Shrub	<i>Planchonia careya</i>	Cocky Apple	-	X
Ground	Forb	<i>Commelina diffusa</i>	Scurvy Weed	-	X
	Forb	<i>Commelina ensifolia</i>	Scurvy Grass	-	X
	Forb	<i>Dianella caerulea</i>	Blue Flax Lily	-	X

Stratum	Lifeform	Species	Common name	RE 11.3.35	RE 11.3.25b
	Forb	<i>Eustrephus latifolius</i>	Wombat Berry	-	X
	Forb	<i>Lomandra longifolia</i>	Spiny-head Mat-rush	X	X
	Sedge	<i>Cyperus distans</i>	Slender Cyperus	-	X
	Sedge	<i>Cyperus javanicus</i>	Javanese Flatsedge	-	X
	Sedge	<i>Cyperus trinervis</i>	-	-	X
	Sedge	<i>Fimbristylis dichotoma</i>	Common Fringe Sedge	-	X
	Sedge	<i>Fimbristylis littoralis</i>	Lesser Fimbristylis	-	X

4.3 Fencing

Fencing shall be required as documented on the drawings and/or as directed by the Superintendent to protect rehabilitation areas from livestock as well as to control vehicle access, until the end of the Defects Liability Period (12 months).

4.4 Site maintenance

Maintenance of rehabilitation areas will be required to achieve Project objectives. The following maintenance obligations will be required:

- Establishment phase maintenance of rehabilitation areas
- Ongoing maintenance of rehabilitation areas

4.4.1 Establishment phase maintenance

After rehabilitation is established the following minimum maintenance tasks shall be undertaken for the first 12 weeks after completion of rehabilitation:

- Any combination of water truck, hand watering and/or temporary irrigation system shall be utilised to fully establish the plants and grass within the Project. Watering of tube-stock shall occur a minimum of twice a week for the 12 weeks following planting. Watering may be reduced if climatic conditions provide sufficient rainfall.
- Check the planted tube-stock weekly for mortality. If greater than 5% mortality (per stratum) occurs, replace any plant losses.
- Check for germination weekly and re-apply hydromulch in any areas where germination has not been achieved within one month or if established ground cover is less than the acceptance criteria. Ripping shall be undertaken prior to re-seeding if the surface has become compacted.
- Inspection for restricted invasive weed species under the *Biosecurity Act 2014* will be undertaken weekly by personnel experienced in weed identification. If any such species are detected, control will be undertaken using appropriate control techniques (e.g. in accordance with the Department of Agriculture and Fisheries (DAF) factsheets for the relevant species).
- Weekly inspection of erosion and sediment controls and immediate corrective action.
- Inspection of watercourses following any notable weather events to ascertain if degradation of the rehabilitation works has occurred, and undertake restoration works where required.
- Removal of any shrub or canopy species from the pipeline 10 m wide zone of influence.

4.4.2 Ongoing maintenance

Once established, the following site maintenance activities will be undertaken until end of the defect liability period (12 months):

- Watering of tube-stock shall occur a minimum of once every two weeks (unless climatic conditions provide sufficient rainfall)
- Check the planted tube-stock every four months for mortality. If greater than 5% mortality (per stratum) occurs, replace any plant losses.

- Check for ground cover dieback every four months and re-apply hydromulch in any areas where ground cover is less than the acceptance criteria. Ripping shall be undertaken prior to re-seeding if the surface has become compacted.
- Site inspection for restricted invasive weed species will be undertaken every four months by personnel experienced in weed identification and control will be undertaken as necessary using appropriate control techniques (e.g. in accordance with the DAF factsheets for the relevant species).
- Inspection of watercourses following any notable weather events to ascertain if degradation of the rehabilitation works has occurred, and undertake restoration works where required
- Removal of any shrub or canopy species from the pipeline 10 m wide zone of influence.

5. Monitoring

Monitoring will be undertaken by a separate representative appointed by the Principal and undertaken every four months until the end of the Defects Liability Period (12 months). Monitoring elements are detailed in Table 5.1. The rehabilitated vegetation is expected to be well-established by the end of this 12-month period, and will have been subjected to all seasonal conditions, such that this length of time is considered sufficient.

Table 5.1 Monitoring elements

Element	Description
Photographic points	Two photographic monitoring points for each intersected Vegetation Management Watercourse will be established and marked with star pickets. Photographs will be taken at each location facing north, south, east and west.
Soil stability	Assessed visually by observing each rehabilitated watercourse as well as the length of the pipeline for signs of erosion.
Groundcover	Groundcover establishment will be assessed by randomly placing five 1x1 m quadrat at each of the intersected Vegetation Management Watercourses, as well as at an additional 10 sites along the pipeline that have been hydromulched. The following will be recorded within each quadrat: <ul style="list-style-type: none"> – Species present and individual percent cover – Litter percent cover – Rock percent cover – Cryptogam percent cover – Bare earth percent cover.
Tubestock survival	At each of the intersected Vegetation Management Watercourses, tubestock survival rate will be assessed within two quadrats each measuring 2 x 10 m.

6. Acceptance criteria and corrective actions

Acceptance criteria have been developed for each of the two rehabilitation treatments and are provided in Table 6.1. Assessment of monitoring results against these criteria will serve as a trigger for implementation of corrective actions, which are also detailed in Table 6.1. If rehabilitation works do not meet the acceptance criteria at each monitoring period, corrective actions shall be implemented by the Contractor until the rehabilitation works achieve the required standard.

Table 6.1 Performance and completion criteria and corrective actions

Element	Criteria	Compliance	Potential corrective actions
Remnant vegetation within 400 m of a Vegetation Management Watercourse			
Landform	– Final landform is stable and land surface contours within riparian areas are consistent with the adjacent areas	At completion of rehabilitation maintenance period	– Installation or repair of erosion and sediment control measures where erosion or stabilisation issues are identified.
Restricted invasive weeds	– No presence of restricted invasive weeds	At completion of rehabilitation maintenance period	– Removal of restricted invasive weeds
Endemic groundcover	– Land is vegetated with endemic groundcover exceeding 70%	At completion of rehabilitation maintenance period	– Removal of restricted invasive weeds and any other species observed to be inhibiting endemic ground layer establishment – Re-application of hydromulch where bare patches persist
Tubestock survival	– >80% of plantings survived	At completion of rehabilitation maintenance period	– Replanting of tubestock – Modification of watering regime where plant health indicates insufficient or excess water has been received – Application of fertilizer where plant health indicates nutrient deficiency – Removal of weeds observed to be inhibiting tubestock establishment
Suitability	– Land is fit for purpose (i.e. supports an establishing ecosystem that will provide future habitat for black-throated finch, bare-rumped sheathail bat and koala habitat) – Safe for humans and wildlife	At completion of rehabilitation maintenance period	– All of the above
All other areas			
Landform	– Final landform is stable and land surface contours	At completion of rehabilitation maintenance period	– Installation or repair of erosion and sediment control measures where erosion or stabilisation issues are identified.
Restricted invasive weeds	– No presence of restricted invasive weeds	At completion of rehabilitation maintenance period	– Removal of restricted invasive weeds
Groundcover	– Land is vegetated with groundcover exceeding 50%	At completion of rehabilitation maintenance period	– Re-application of hydromulch where bare patches persist
Suitability	– Land is fit for purpose (grazing pasture, bank stabilisation and pipeline operation) – Safe for humans and wildlife	At completion of rehabilitation maintenance period	– All of the above

7. Completion inspections and reporting

7.1 Rehabilitation works completion

The Contractor is to notify the Superintendent immediately on completion of the works for inspection by a suitably qualified and experienced representative (e.g. environmental manager). A rehabilitation completion report with suitable records shall be provided to the Superintendent within five days following the completion of the rehabilitation works.

7.2 Rehabilitation maintenance period completion report

Following completion of the 12-month revegetation maintenance period (which shall correspond to the Contract Defects Liability Period), a rehabilitation completion report demonstrating compliance of the revegetation works against the acceptance criteria in Section 6 shall be developed by a suitably qualified ecologist engaged by the Contractor and submitted to the Superintendent.

The completion report will be submitted by the Principal to relevant Commonwealth/State government departments under conditions of approval.

8. Quality requirements

Table 8.1 identifies the required hold points and witness points.

Table 8.1 Hold points

Activity	Requirement	Notice for inspection	Level of inspection	Released by
Quality control	Submission of all quality control documentation including management plans and inspection and testing plans	10 working days	Hold Point	Superintendent
Revegetation	Submission of revegetation contractor qualifications	10 working days	Hold Point	Superintendent
Survey	Submission of proposed land to be revegetated	10 working days	Hold Point	Superintendent
Weed eradication	Submission of proposed method for weed eradication MSDS to be provided	10 working days	Hold Point	Superintendent
Seed Mix	Submission of seed mix for approval	10 working days	Hold Point	Superintendent
Trees and shrubs	Submission of details of vegetation and planting plan	10 working days	Hold Point	Superintendent
On site mark out	On site mark out of areas not to be revegetated (10 m clear zone over pipe)	10 working days	Witness point	Superintendent
Completion of the Works	Notify Superintendent & submit rehabilitation completion report	10 working days	Hold Point	Superintendent
Rehabilitation maintenance period	Watering	5 working days	Witness Point	Superintendent
Completion of 12 month rehabilitation maintenance period	Notify Superintendent & submit rehabilitation 12 month completion report	10 working days	Hold Point	Superintendent

Appendices

Appendix A

Revegetation extents



Legend

- Major Road
- Minor Road
- Railway

Revegetation Extents

- RE 11.3.25b tubestock revegetation
- RE 11.3.35 tubestock revegetation
- Hydromulch
- 4m wide permanent access track
- 10m wide pipeline zone of influence
- Vegetation Management Watercourse

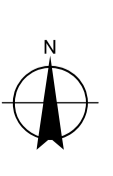
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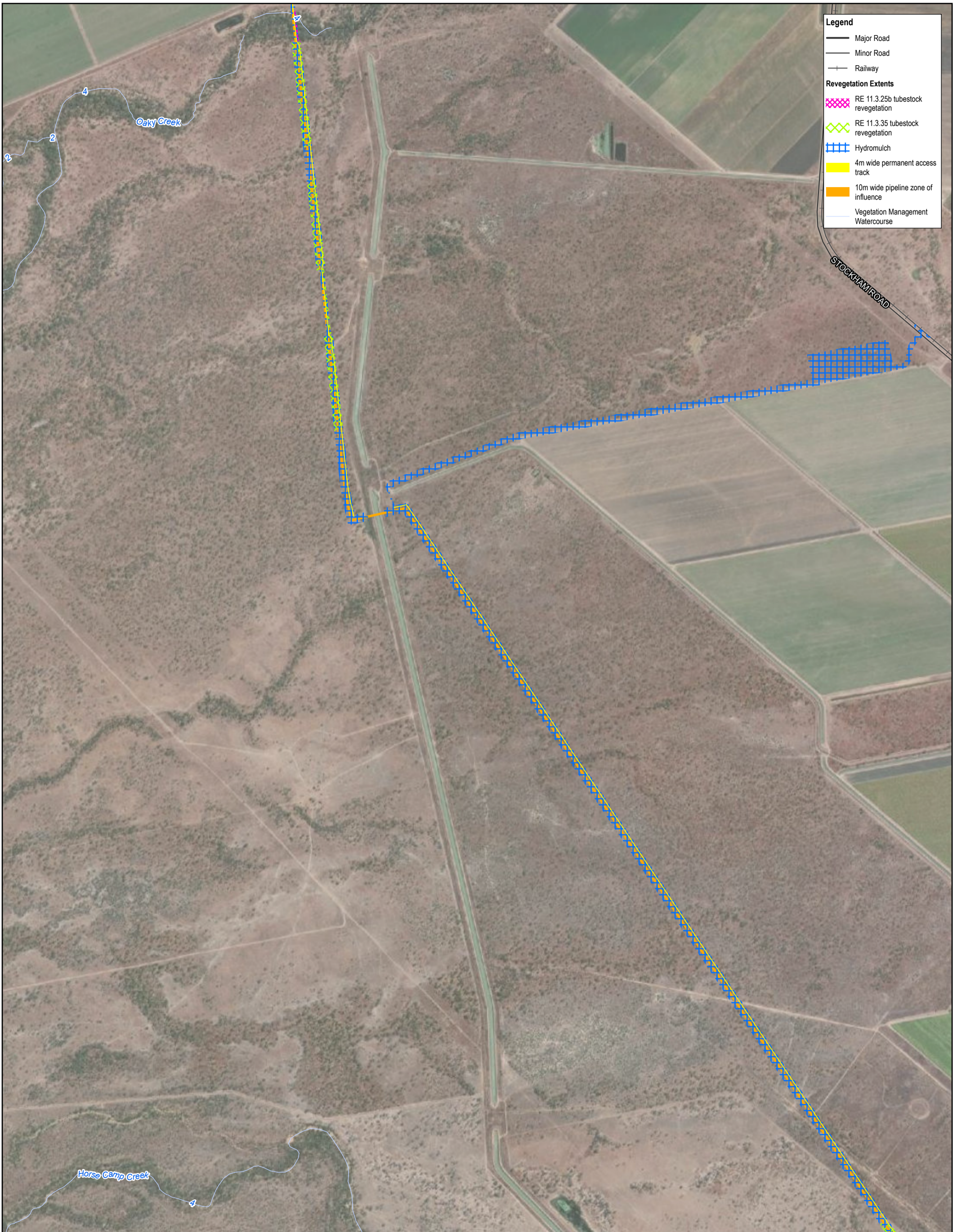


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Revegetation extents

Sheet 1 of 6
FIGURE 6



Legend

- Major Road
- Minor Road
- Railway

Revegetation Extents

- RE 11.3.25b tubestock revegetation
- RE 11.3.35 tubestock revegetation
- Hydromulch
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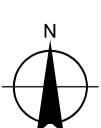
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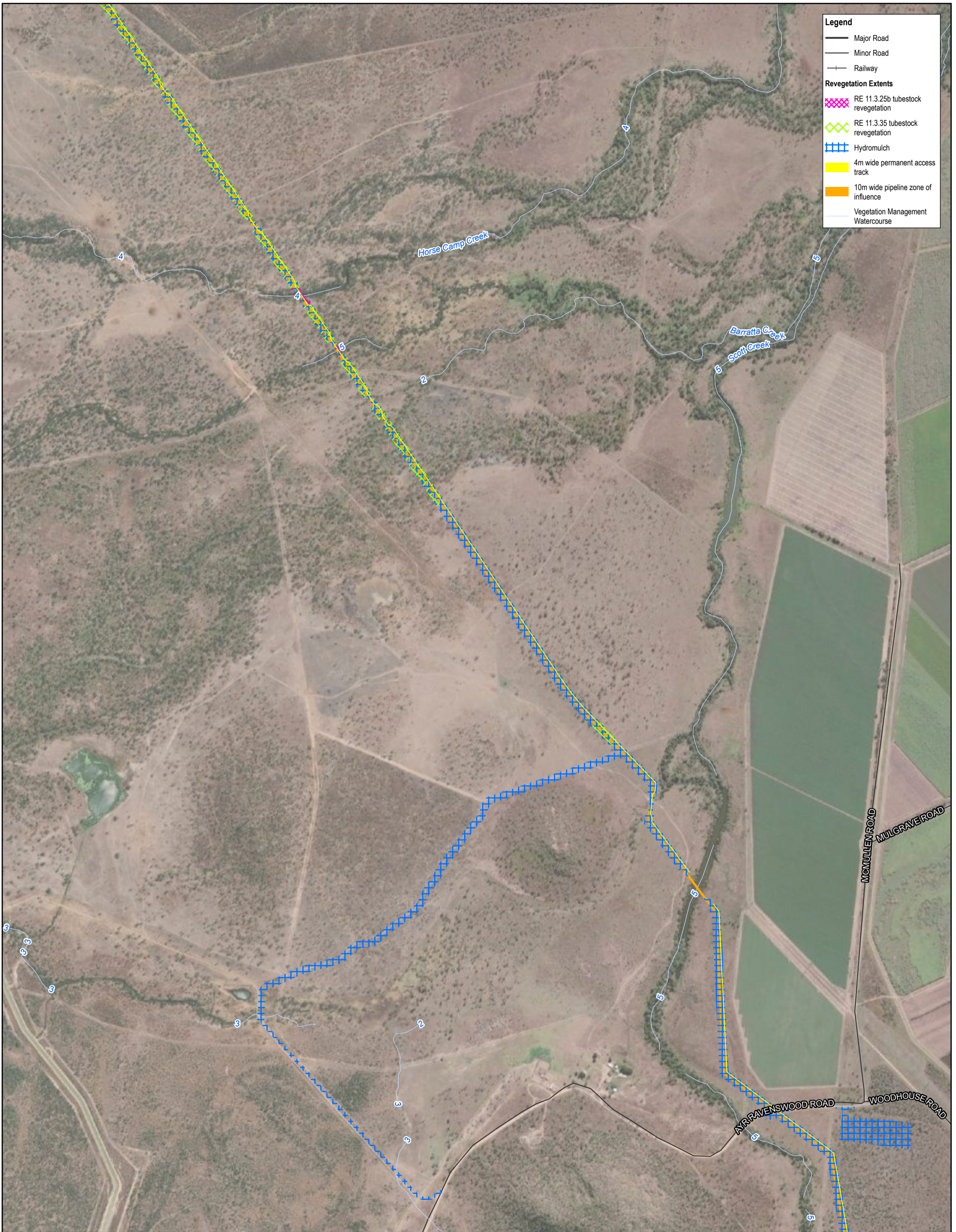


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Revegetation extents

Sheet 2 of 6
FIGURE 6



Legend

- Major Road
- Minor Road
- Railway

Revegetation Extents

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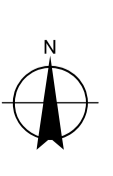
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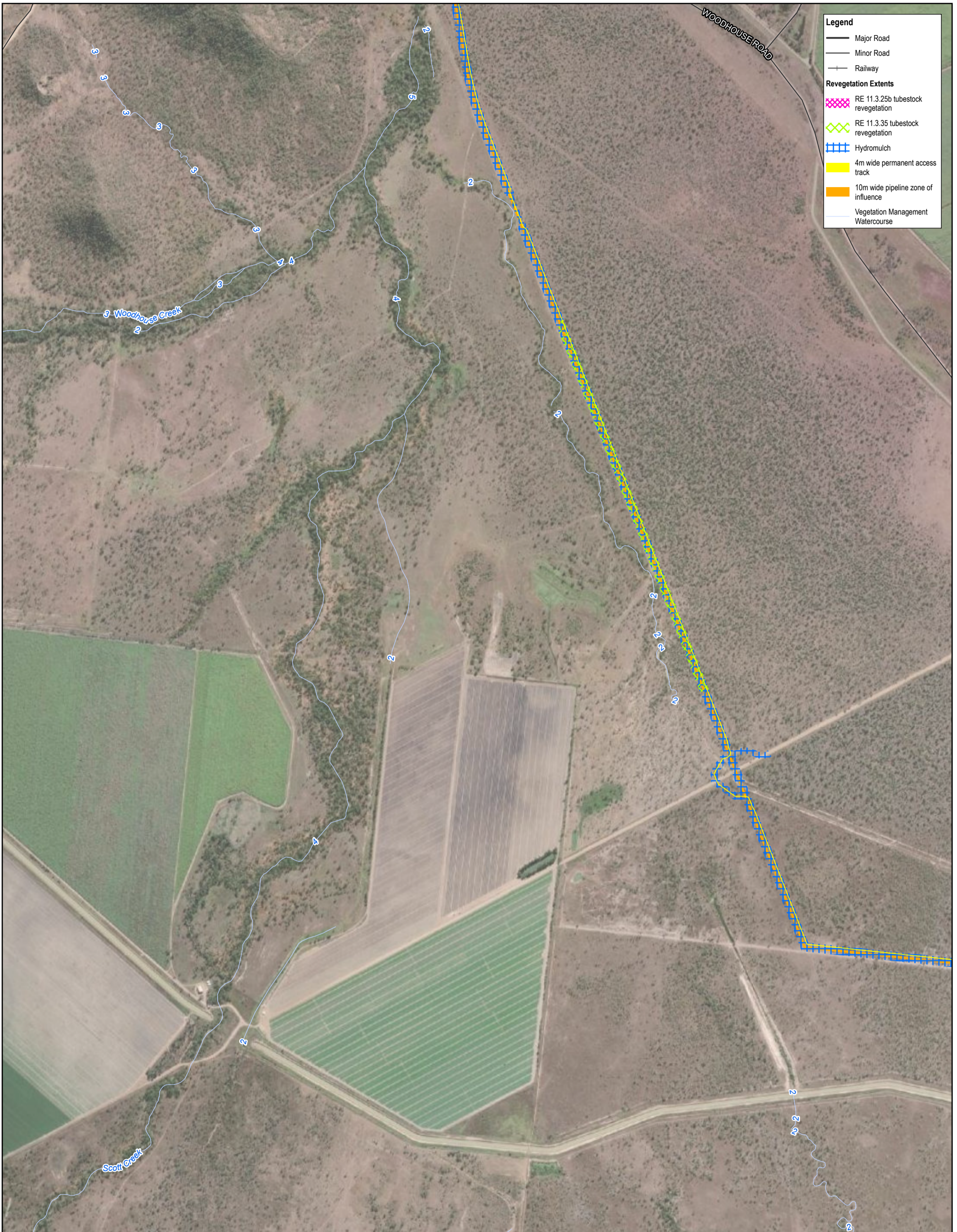


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Revegetation extents

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FIGURE 6



Legend

- Major Road
- Minor Road
- Railway

Revegetation Extents

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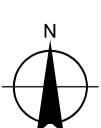
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Revegetation extents

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FIGURE 6



Legend

- Major Road
- Minor Road
- +— Railway

Revegetation Extents

- RE 11.3.25b tubestock revegetation
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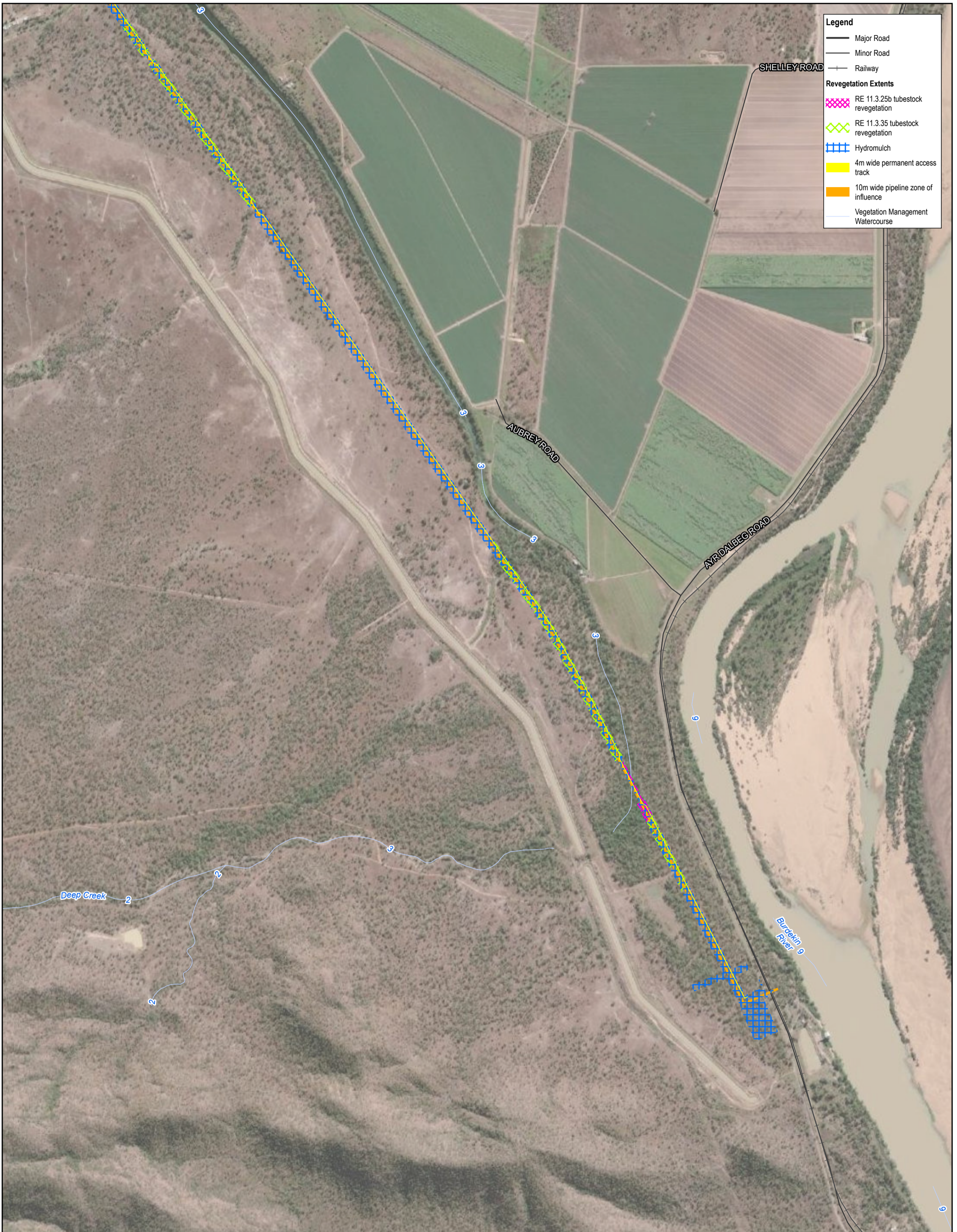


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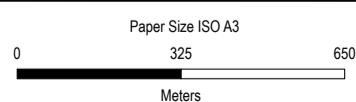
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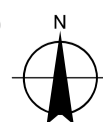
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FIGURE 6



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Revegetation extents

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FIGURE 6



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