

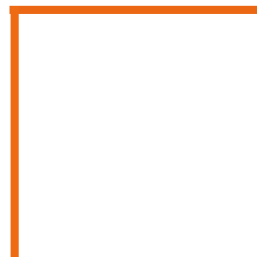
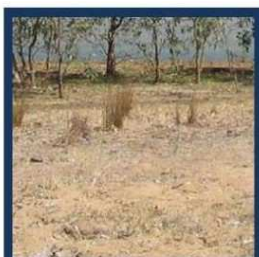
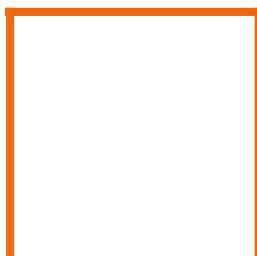


Hanson

ABN: 90 009 679 734

Wagga Wagga Quarry

REHABILITATION MANAGEMENT PLAN



Prepared in conjunction with:

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consulting engineers since 1989



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1 Rehabilitation Plan Wagga Wagga Quarry

1.1 Introduction

This plan involves a description of the general principles of the rehabilitation, a description of and plans for the rehabilitation staging, and a time line of the works. The primary objective is to rehabilitate the site as a wetland, grassland and revegetated riparian zone. It is unreasonable and not feasible to attempt to rehabilitate a site as replication of pre-project land morphology. This is particularly the case for extractive industries. The nature of the site application for extractive purposes means that an altered land formation will result upon post closure.

Ecological, hydrological and geomorphological constraints have determined the extent of the extraction on site. This rehabilitation plan accounts for these environmental constraints, as well as the reformed land characteristics, in its preparation and execution. This plan will be used for the rehabilitation of the site to satisfy WWQ Approval, Schedule 3, condition 25.

1.2 Rehabilitation Objectives

The objective of preparing a quarry rehabilitation plan is to address the key requirements of final land form design, revegetation, water drainage and the future sustainability of the site.

According to *Mine Rehabilitation- Leading Practice Sustainable Development Program for the Mining Industry* (Commonwealth of Australia):

“Rehabilitation is the process used to repair the impacts of mining on the environment. The long-term objectives of rehabilitation can vary from simply converting an area to a safe and stable condition, to restoring the pre-mining conditions as closely as possible to support the future sustainability of the site.”

There are a number of key considerations that need to be taken into account to assist in meeting the rehabilitation objectives, these include:

- Safety
- Legal requirements
- Key physical constraints
 - Climate
 - Location and topography
 - Size of the site
 - Soils
 - Availability of water and drainage
 - Community views
- Community views

Importantly the final land form must be stable and self-sustaining, or one where maintenance requirements are consistent with the agreed post-quarry land use.

“It should not be assumed that the objective of all rehabilitation is some form of natural ecosystem approximating what existed prior to mining” (Mine Rehabilitation- Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth of Australia) 2006:4)

Where ever feasible an approach to progressive rehabilitation should be considered to establish proven methodologies and suitable outcomes prior to quarry closure.

1.3 Rehabilitation Commitments

Table 1 replicates the requirements of Condition 25 of Schedule 3 of PA 07_0069 with regards to the preparation of a Rehabilitation Management Plan and includes reference to the section of this plan where each element is discussed.

Table 1
Requirements of Condition 25 of Schedule 3 – PA 07_0069

Requirement	Section
The Proponent shall prepare and implement a Rehabilitation Management Plan for the project to the satisfaction of the Director-General. This plan must be prepared in consultation with OEH, NOW and DRE and must be submitted to the Director-General for approval in conjunction with the Water Management Improvement Program. The plan must:	
a) consider the rehabilitation plans presented in the EA;	5
b) assess the quantity and availability of materials on site that can be applied to rehabilitation (including overburden, tailings, reject, existing levee banks and pit walls);	2.6
c) consider all options regarding the re-establishment of the pit wall and river bank in the vicinity of the breach which took place in December 2010;	2.7
d) consider likely flood behaviour and impacts on the landscape as proposed to be rehabilitated (including during each of the various rehabilitation stages);	2.9
e) consider available alternative landuses for the site, including for the exhausted quarry pits;	1.4, 2.12
f) review what parts of the site should be refilled to a level above standing groundwater, so as to manage flood behaviour and other longterm risks;	2.13
g) address the issue of fines disposal so as to prevent fines being eroded from the landscape during major flood events or being a source of dust emissions during dry periods;	3.3
h) develop clear rehabilitation objectives for the whole site, including the following: <ul style="list-style-type: none"> • stabilisation of disturbed areas to prevent the emission of dust following closure; • landscaping the site with native species endemic to the locality; and • minimising the total surface area of water bodies on the site; 	1.2, 2
i) consider opportunities to enhance wildlife habitat on the rehabilitated project site, in particular in and around artificial water bodies and wetlands;	2.8
j) develop clear, progressive rehabilitation staging for the whole site, including specific milestone dates for rehabilitation works and a program for monitoring progress against these dates;	4
k) address potential conflicts between the rehabilitation of the existing extraction pit and its proposed use as a settling pond;	3.2, 3.4
l) demonstrate that all reasonable and feasible measures have been applied to minimise the total surface area of water-filled voids on the site;	3.4
m) set completion criteria for the rehabilitation of the site;	5
n) describe in detail the measures that would be implemented over the next 5 years to rehabilitate and manage the landscape on the site;	4
o) describe how the performance of these measures would be monitored over time; and	6
p) provide for regular auditing of progress against rehabilitation outcomes and milestones, with reporting of progress to the Director-General and DRE.	6

In addition to the conditional requirements of PA 07_0069, the following rehabilitation outcomes are described in the Rehabilitation Plan that was included as Appendix C of the EA (Hanson, 2010).

- All pits re-graded and re-vegetated and filled with overburden or water to the identified standing water level of 168m AHD.
- Re-instatement of the land on the east currently under water, and stabilisation of the hole.
- Establish large open grassed areas, five water filled pits with vegetation around the perimeter of these lakes.

1.4 Consultation

In accordance with Condition 25 of Schedule 3 of PA 07_0069, a draft of this Rehabilitation Management Plan was provided to the Office of Environment and Heritage, Division of Resources and Energy (now Division of Resources and Geoscience) and the Department of Planning and Environment – Water (DPI Water). The following feedback was received from the various agencies.

- DRG does not assess or comment on management documents unless relation to the environmental aspects of quarries where the material being extracted is not a mineral under the *Mining Act 1992*.
- A draft of this plan was provided to the OEH on 11 November 2016 and comments were received from OEH on 10 January 2017 regarding species selection for revegetation, monitoring methods for rehabilitation performance measurement and recommended mitigation and management measures among other matters. An updated version of the plan was provided to OEH on 4 August 2017 that addressed all comments and included a justification for the approach taken. No response on the updated plan had been received from the OEH when this plan was finalised.
- A draft of this plan was provided to DPI Water on 11 November 2016 and comments were received from DPI Water on 9 December 2017 regarding water management in the final landform and possible flooding impacts. Additional correspondence regarding the DPI Water comments was sent on 22 June 2017 and a response email dated 30 June 2017 confirmed that DPI Water generally agreed with the proposed approach to addressing the original comments. An updated version of the plan was provided to DPI Water on 4 August 2017 that addressed all comments and included a justification for the approach taken. No response on the updated plan had been received from the OEH when this plan was finalised.

1.5 Priorities for Final Land Uses

As described in the EA (Hanson, 2010), it is envisioned that the rehabilitated Site will feature agricultural land, wetlands and woodland areas. **Figure 9** provides an indicative final landform that displays wetland areas and wooded areas in the vicinity of the former extraction cells and the existing extraction areas. Hanson is cognisant of the fact that during the operational life of the Quarry, preferences for land use and management of riparian areas may change. Therefore, it is proposed that the Company in consultation with Wagga Wagga City Council, the local community (through the Community Consultative Committee and relevant Government Agencies will progressively review options to develop the final landform. In order to provide a level of satisfaction that rehabilitation has been included in planning for the Site, the

rehabilitation proposed in this plan and as displayed in Figure 7 will be used for progressive rehabilitation of the Site. However, it is acknowledged that the final land use including areas to be dedicated to native vegetation and riparian corridor conservation would be determined during preparation of the Closure Plan for the Quarry, two years prior to expected Site closure.

In accordance with the EA (Hanson, 2010) and as displayed in **Figure 9**, it is expected that the Site will be rehabilitated for passive biodiversity conservation incorporating wetland areas with areas designated for minor grazing. No alteration of existing zoning will be necessary to permit the proposed development. The key considerations for final land use planning include:

- Minimising the visual impact of final landform.
- Establishing connectivity between the wetland areas, existing riparian vegetation and vegetation on adjoining properties.
- Maintenance of biodiversity values. The final landform includes the maintenance of key ecological features within retained quarry voids, the wetland near the site entrance and the riparian corridor (River Red Gum Woodland).
- Development of a safe and stable final landform to ensure the safety of any subsequent use of the quarry.
- The final landform should be non-polluting.
- Ensuring the feasibility of agricultural practices, consistent with surrounding land uses.
- Ensuring the compatibility of final land uses. Use of the land for agricultural purposes should not limit native vegetation conservation practices and vice-versa.

On the basis of these identified priorities, the proposed final land use is considered appropriate.

1.6 Water Licensing

1.6.1 Surface Water

The proposed final landform shall maintain levees surrounding quarry voids. These shall however be regraded to provide a small rise/bund (approximately 500mm above the floodplain surface) to maintain a zero catchment for voids/lakes (see Section 2.6.4).

As previously documented as part of operational documentation, and agreed with by NSW DPI Water, open voids that do not have a catchment (excluding direct rainfall) are exempt from harvestable rights calculations under the Farm Dams Policy (NSW Government Gazette 40; 31 March, 2006 pg. 1628 - 1631) and do not require a license under the Water Management Act 2000.

1.6.2 Groundwater

The site is to maintain a Water Access License (WAL) for groundwater 'take' resulting from net evaporation from window lakes. This shall be quantified 2 years prior to closure, based on the following procedure:

1. Groundwater monitoring data to be reviewed to determine which voids/lakes are connected to groundwater.
2. Obtain available rainfall and evaporation data.
3. Calculate net groundwater 'take' for each year of available rainfall and evaporation data and based on final lake/void surface area and catchment area.

The highest calculated groundwater take from the climate data will be used to establish the allocation attached to the Water Access Licence to be maintained in perpetuity.

1.7 Quarry Closure Plan

As described in Section 1.4, Hanson propose to establish final land use options through consultation and preparation of a Closure Plan that would be submitted to DPE for approval two years prior to closure of the Quarry. The Closure Plan will establish the preferred final land use, water licensing requirements and timing for the rehabilitation of the Quarry following completion of extraction.

It is also anticipated that final completion criteria for rehabilitation would be established at this time in order that DPE may be satisfied that rehabilitation liabilities have been resolved and relinquish the Rehabilitation Bond for the Quarry. Operations at the Quarry are anticipated to continue for an additional 20 years and therefore it is expected that vegetation management and restoration strategies and details, such as benchmarks for ecosystem establishment, will have changed. Therefore it is considered appropriate that these components of the closure plan be established at that time. In the interim, progressive rehabilitation will be undertaken in accordance with the rehabilitation objectives outlined in Section 1.2 and the staged rehabilitation activities described in Section 4.

As part of preparation of the Closure Plan, the Proponent shall ascertain which cells/voids are window lakes (i.e. groundwater connected), which levees will remain onsite, and therefore where flood obstructions are onsite. At that time the need for a Flood Work Approval under the Water Management Act 2000 will be considered when final landform and licensing requirements/conditions of the time are known. Further to this, any requirements in accordance with DPI Water's Floodplain Harvesting Policy will be considered.

Additionally, any voids/lakes that will remain connected to groundwater will constitute an *aquifer interference activity*. Therefore as for flood work approvals, consideration will need to be given to hold the relevant approvals as part of the Closure Plan. This is in addition to any WAL requirements, as outlined in Section 1.5.

2 Rehabilitation Principles

The following elements describe how it is proposed that rehabilitation will be achieved. These elements form part of the Rehabilitation Plan provided as Appendix C of the EA (Hanson, 2010).

2.1 Background

To attain the primary objectives will require planning, organisation and supervision. Throughout these phases, professional expertise will be sought as required and every effort will be made to incorporate the latest techniques available in the science of land rehabilitation.

2.2 Redundant Roads and Tracks

Upon cessation of extraction and processing all redundant roads and tracks will be removed and scarified to a minimum of 75mm depth and prepared for revegetation. The access road may remain open and sealed as an access to the site.

2.3 Bulk Earthworks

The re-shaping of the pit will include major earthworks to form the base for the final earth form. Slopes above the water table will be approximately 1:3 (vertical : horizontal). Material used in the rehabilitation will be overburden won from onsite. Machinery utilised for this purpose will include excavators and heavy dozers. At the end of the overburden backfilling the levee banks will be graded over the coarsely replaced material.

2.4 Sub-Soil Strata

Material suitable for the formation of sub-soil will be placed by a "loose tipping" procedure above the water table carried out when the material is in a friable condition. Depth will be to 150mm below final finished surface levels. The essence of this operation will be to avoid soil compaction that severely inhibits growth.

2.5 Surface Soil Layer

The soils to be disturbed [particularly topsoils] are highly structured and will be stripped without major structural damage. However, excessive handling of the materials during the stripping and stockpiling operation and handling when the soils are wet should be avoided to protect soil structure.

The stripping operation will be carried out using machines such as scrapers, excavators and bulldozers. Care will be taken also to ensure that topsoils and subsoils are not stripped when they are too moist, as greater damage will occur at this time. It is anticipated that much of the soil removed will be used in constructing and rehabilitating the bund along the Murrumbidgee River, however, there may be a need to place some of the material in stockpiles.

Separate stockpiles will be used for topsoil and subsoil material as defined above. Driving of machinery on any topsoil and subsoil stockpiles will be kept to an absolute minimum to maximise soil aggregation and prevent compaction, particularly when the stockpiles are moist. Ideally, the topsoil stockpiles should be 1 metre high but, if necessary, higher dumps can be used. These should not exceed about 2 metres in height. The subsoil stockpiles should not exceed 3 metres in height. These stockpiles would need to be positioned to prevent sediment-laden runoff from entering the Murrumbidgee River and its tributaries.

The naturally occurring surface soil in the area varies from 50-100mm in depth. Depth of soil will be 150mm. Material used will be available topsoil, stored onsite material and conditioning of subsoils.

The condition of stockpiled soil may vary over the project life. Should the soil be unsuitable for application on site due to weed (exceeding 15% as per completion criteria) Hanson will commit to a campaign of soil conditioning techniques which will be implemented at the time of inspection. These will include;

- weed killing;
- tilling;
- planting of a crop for soil structure; and/or
- another method approved by the DPE.

2.6 Quantity and Availability of Materials

2.6.1 Overburden

Availability: Overburden won from onsite activities will be used. It is anticipated that the quality of the overburden will have sufficient microbial and nutrient composition to support revegetation efforts. In the case that the soil is not of adequate quality, it will be supplemented with artificial nutrients and fertilizer

Quantity: As indicated in Section 5.1 of the WWQ EA, the drilling indicates a depth of up to 11 metres of overburden including poor quality sand and gravel on site. The percussion drilling in the alluvial plane area generally indicates a depth of 4 metres of overburden and clay and between 4 and 7 metres of silty sand quality material. This indicated there will be sufficient quantity of suitable materials to achieve the rehabilitation objectives.

2.6.2 Tailings

Availability: Tailings stored on site may contribute to the net soil contribution for use in bulk earthworks. Quality of tailings is suspected to be of adequate quality to support the creation of the final land form and subsequent revegetation effort.

Quantity: During operations tailings are re-used in road base and other products on site. Therefore, only small amounts will need to be stored on site as outlined above and it is unknown what exact quantity will be available for rehabilitation.

2.6.3 Pit Walls

Availability: The existing pit wall will be reshaped to create the final landform. The pit wall is predicted not to be of high nutrient quality. Due to the anticipated low nutrient composition of the pit wall, it will form the foundation for the earth works, and higher quality topsoil will be applied from the overburden or tailings. Pit walls will structurally remain in place and therefore do not support “available material” for rehabilitation works.

Quantity: Pit 1 and Pit 2 Pit walls will retain their walls which will be used for rehabilitation purposes. Cells will also retain “pit walls” for rehabilitation purposes. Cells 2-4 will retain levee banks (see below).

2.6.4 Levee Banks

Availability: Levee banks will be graded over the coarsely replaced material, maintaining a small rise/bund (approximately 500mm above floodplain level) to ensure former quarry voids/lakes maintain a zero catchment area. Levee banks are expected to be of adequate quality to support the revegetation effort. In the case that the levee bank substrate is not of adequate quality, it will be supplemented by overburden soil and/or artificial nutrients.

Quantity: Cells 2 – 4 will have levee banks graded and vegetation planted/seeded (or otherwise established) over the coarsely replaced material. See **Figure 1** for cell size.

2.6.5 Reject Materials

Reject materials are defined as mineral waste produced during the processing of quarried materials (excluding tailings and overburden) which are not processed into a product for sale.

There are no reject materials produced at the Quarry and therefore none would be available for rehabilitation. No assessment of availability and quantity is required.

2.7 River Bank Repair

The Proponent has completed the river bank repair under NOW issued Controlled activity approval-40 ERM2012/1012. The following options were seriously considered to repair the river bank;

- Filling and positioning of Elcorock Mega Containers. Various dimensions and positioning of containers was considered; and
- Site coffer dam construction.

2.8 Revegetation

The project seeks to recreate indigenous vegetation units similar to those on the surrounding area. It is proposed to match the existing vegetation in both the upper canopy and understorey species. The revegetation effort will seek to achieve a similar percentage of foliage cover, litter depth, microbial activity and ultimately canopy height. These species will replicate the surrounding habitat thereby extending the existing local ecosystem onto the site. A particular focus has been made to provide a diverse biotic habitat nearby artificial water bodies and wetlands.

It is intended that a groundcover of grasses, herbs and low shrubs would be applied to stabilise disturbed areas no longer required for extraction. Where non-native grass species are applied, these will be sterile and used only for stabilisation and mulching. Native grasses, herbs and low shrubs would be planted in the final landform with a species mix determined during planning for each rehabilitation stage and in consultation with OEH. The density and types of trees and scrubs used in the reclamation are shown on the post closure rehabilitation plan (**Figure 9**) and are intended to replicate the pre-quarrying landform and blend with the surrounding landscape. The plan contains a table of the species, their ultimate height and spread. A detailed plan of each stage will be prepared prior to works commencing that will provide the proposed planting density and justification. The design presented in **Figure 9** is based on consideration of the final height and spread of the species to be used so that and planning can avoid the need for additional plantings or thinning at a later date. Best practice information will be used when planning revegetation activities with the density and species selection confirmed in plans to be prepared prior to commencing each stage of rehabilitation.

Staging for rehabilitation activities is described in detail in Section 4. Figure 1 displays the area, density and species selection for Stage A of rehabilitation activities that are due to be completed by the end of 2020. Revegetation in this area will include planting of a minimum of 500 plants. This calculation is based on an average planting density of 6m with a contingency for additional plants to account for any dieback. Rehabilitation monitoring will ensure that any tubestock that have failed or are in poor condition are remediated or replaced (see Section 6).

2.9 Flooding

The site is prone to occasional flooding of the Murrumbidgee River. As part of the WWQ EA WMA water undertook a study of the impact on flooding by the quarry extension proposal.

The quarry will be developed in a series of stages that are distinct extraction pits or cells, and progressively rehabilitated. To mitigate the impacts of scouring and other damage caused by flood water inundation the WMA water flood assessment recommended that the quarry pit/cells be installed with two (2) fuse plugs. One fuse plug located on the upstream side of the pit/cell and another located on the downstream side. The downstream fuse plug is installed at a lower level/height to the upstream fuse plug. This results in the control flooding of the pit/cell, either active extraction, those either undergoing rehabilitation or those having completed rehabilitation

being filled with water initially fill by the slower backwater flooding thus minimising the potential for destructive scouring.

The rehabilitated slopes will be at a grade of 1v to 3 h and vegetated to provide additional stabilisation of the slope.

Protecting Areas undergoing Rehabilitation

Controlling the nature of flooding via fuse plugs assists in implementing controlled flooding in the applicable cells. A fuse plug is essentially a collapsible dam installed into spillways in dams, which allows rising flood water to enter into the Cell/lake in a controlled manner from the downstream side of each Cell. This prevents uncontrolled inundation in floods and will result in minimal flood impact on the Cells/lakes themselves and vice versa on the river and surrounding areas. Fuse plugs are commonly used for this application.

Management of water flow via fuse plug/s is considered the most effective way of protecting areas undergoing rehabilitation. Fuse plugs shall be maintained as part of the 500mm bund/levee to quarry voids/lakes. Additional water flow and sedimentation management works are implemented on site to manage standard water flow around the site.

Rectify any damage after a flood event

Actions undertaken will depend on the area and the rehabilitation completion criteria applicable to that particular location on site. However general measures include;

- Surveying damage including;
 - the amount of vegetation lost in the flood event
 - the spread of weeds
 - the coverage of top soil
- In the event that top soil has been washed elsewhere on site during the flood, additional topsoil will be sourced (either from onsite or imported to site) and applied to the area.
- Should vegetation not reach the completion status resultant of flooding, vegetation will be replaced.
- Should weeds presence exceed rehabilitation criterion limits then additional weed mitigation/management measures will be implemented until weed limits fall within completion criteria.

2.10 Bushfire Control

Effective 'bushfire control depends upon available fuel, control of ignition sources and good access and water supplies.

The possibility of bushfire ignition on the site is limited, however the following fire management procedures will be adopted to assist with problems on neighbouring sites and, reduce the likelihood of an event on the site:-

- Provision of access to strategic areas on the site.
- Provision of water from the sedimentation dams.
- Stockpiling of cleared vegetation with a minimum 10m cleared buffer zone.
- Creating suitable located fire breaks.

2.11 Environmental Monitoring

In conjunction with the high standard of safeguards to be incorporated in the design of the WWQ, the Company will carry out regular monitoring of air quality, water quality, and noise. The results will be made available to Authorities for inspection and auditing.

2.12 Alternative Land Uses for the Quarry

Consideration has been given to alternative land uses for the quarry, however the low lying nature of the site and the high potential for flooding, makes the area unsuitable for development, either residential or commercial. The majority of rehabilitation alternatives would require complete infilling of the quarry pit to elevate the site to acceptable flood levels. However this is deemed unreasonable and not feasible due to the following reasons;

- The low lying nature of the site, in addition to regional climatic conditions, would result in high flooding potential in the quarry pit sites.
- Increasing the landform height by artificially infilling the quarry pits with soil substrate will alter runoff and have carry on impacts on the natural waterways including the existing wetlands.
- Additional infilling of the quarry pit will require the importation of substrate which introduces contamination risks.
- The labour effort to infill the vast combined cubic area of quarry pits one and two is neither reasonable nor feasible.

Therefore, this rehabilitation plan, as depicted in the post closure illustration (**Figure 9**), is the most appropriate for the WWQ, accounting for topography, site characteristics, geomorphology and climatic conditions. Revegetating and reforming the site using overburden or water as fill is consistent with (but not identical to) pre-quarry landforms and will provide a suitable habitat for endemic flora and fauna

2.13 Back Filling Level

Regular ground water level monitoring of boreholes on the site has been conducted throughout 2014-2016 using data loggers set to sampling intervals of one (1) hour. The standing ground water levels are summarised in the **Table 2** below.

Table 2
Borehole groundwater data

Location (ID)	Easting (mMGA)	Northing (mMGA)	Elevation (m AHD)	Maximum groundwater	Minimum groundwater	Observed Range	Mean (mBGL)	Mean SWL
WG 0702	527538	6116795	175.8	7.29	9.11	1.83	8.36	167.44
WG 0704	528170	6117315	174.6	6.39	8.09	1.70	7.2	167.4
WG 0705	527830	6117046	177	10.13	11.88	1.75	11.24	165.76
WG 0707	527579	6116274	176.9	12.08	14.04	1.96	13.24	163.66

As can be seen from **Table 1** the current standing water level is between 163-167mAHD across

the site. As described in the Rehabilitation Management Plan included in the EA, Stages A -C involves the back filling of Cell 1 with overburden (not water) from Cell 1 and Cell 2 to an elevation of 168m AHD (see **Figure 1**). This will result in the final land form of Cell 1 being above the Standing Water Level.

It is not predicted that partial back filling of Cell 1 with overburden won from extraction in other cells will significantly influence flood behaviour. Adverse impacts of floodplain works are typically associated with obstructions such as levee banks and physical structures on the flood plain, these may result in flood flow redistribution and possible impacts on neighbouring properties. The presence of quarry voids on the floodplain does not generate such impacts. Indeed, the proposed works shall very significantly reduce the height of the approved levees around the cells, thus reversing any existing off-site flood flow impacts.

In the event of a flood where quarry voids are already water filled (from captured rainfall and/or previously detained flood flow), flood flow will flow 'over' the voids and no impact on flood behaviour will result. If voids are not already filled with water initial flood flow overtopping the retained low levee would enter the voids and be detained. Given the scale of the floodplain in the area this would have an overall negligible impact on flood behaviour and is not expected to have any adverse impacts (such as increased flood depth or flow velocity) on neighbouring properties or the local environment.

3 Rehabilitation of the Extraction Pits

The decision to utilise the quarry pit as a settling pond was made to enable both continued extraction from the remaining pit and progressive rehabilitation of the site. There are however potential conflicts that may arise between the rehabilitation of the existing extraction pit and its proposed use as a settling pond. These are identified below;

3.1 Ecosystem Development

The challenge of developing a habitat suitable for the inhabitation of endemic flora and fauna is not unique to this project. Each rehabilitation effort is focused on artificially constructing a habitat suitable and desirable to local biota. Site characteristics, regional climatic conditions and other localized factors affect species diversity and abundance in newly rehabilitated sites. Every rehabilitation effort is faced with the challenge of supporting the transition of species into the newly rehabilitated site.

The use of the extraction pit as a setting pond restricts the re-vegetation effort and consequently delays the establishment of complex habitat structural development for faunal colonisation. This conflict is proposed to be managed by progressively rehabilitating other areas of the site to enable the gradual and sequential development of stratified vegetation communities in these areas until such time as the pit can be in-filled and rehabilitated.

3.2 Fine particulates Increasing Turbidity Levels

Using the pit as an artificial water body has the potential to result in initially high turbidity in artificial water bodies during the infilling stage. This is to be managed by compacting the pit floor prior to infilling and the removal of any fines. Any turbidity increases are expected to settle upon complete infilling of the pit and water quality is expected remain consistent with that of the Murrumbidgee River.

3.3 Fines Disposal

Fine particulates have the potential to have a detrimental impact on site via dust generation in dry periods and erosion from the landscape during major flooding events. It is expected that the site will not contain a large volume of fine particles, however if large quantities of fines are found on site, they will be managed in accordance with the following;

- Compaction of soil during earthworks thereby reducing the loose soil surface exposed; and
- Vegetation plantation on exposed soil, thereby increasing the structural integrity of the soil and reducing the risk of erosion in both flooding events and dry periods.

The staged rehabilitation effort will be implemented in conjunction with continued quarrying activities. Dust monitoring devices including PM₁₀ and Dust Deposition gauges are deployed on site and generate an output reading for the dust levels on site. Any dust exceedance in rehabilitation zoned areas will be assessed and managed accordingly.

3.4 Use of Water-Filled Voids

Mitigation measures have been made to refill and infill the site to an AHD height to meet the rehabilitation objectives outlined in this plan. Riverbank re-establishment, refilling of extraction areas and plantation of vegetation on re-fill sites aim to return the site to pre-project land formation predominantly using overburden and fill from the site.

The Wagga Wagga Rehabilitation Plan is focused on producing a final landform consistent with that of the surrounding locality. The use of water filled voids acts as a transitional habitat between the Murrumbidgee River and the naturally occurring wetlands to the south of the site. The artificial water filled voids act as a habitat corridor for wetland inhabiting species, as well as supporting localised aquatic and terrestrial life in the site.

Additionally, artificial water bodies provide a catchment for overflow from the Murrumbidgee River. Thereby, water filled voids could potentially reduce the severity of floods on-site by capacitating water retention. Reducing the size of voids as depicted in **Figure 8**, will reduce the capacity of these voids to absorb overflow in the event of a flood. Therefore, it is expected that the water filled voids, as shown in **Figure 8**, are of satisfactory size to support a diverse range of localised endemic vegetation, and are of suitable size to act as a buffer in the event of a flood. Reducing the size of these voids could potentially decrease the ability for the rehabilitation plan to meet these objectives.

3.5 Plan Elements

The rehabilitation plan shows how, with the above principles and safeguards for the extraction area, the site will be rehabilitated. The plan shows how rehabilitation will occur progressively. The east site has a buffer of 100 metres to the top of the river bank. Section 4 below details identified elements to be completed within each stage.

4 Stage Description

Staging for extraction operations is described in Section 5.2.2 of the EA (Hanson, 2010) with extraction stages based on progress with development of the approved extraction cells. Progressive rehabilitation activities are dependent on the availability of completed extraction cells (i.e. the completion of extraction in those cells). As described in Section 5.2.2 of the EA, variations in the source, market demands, or other operational requirements may necessitate some changes in the timing for extraction scheduling and therefore the ability for progress with rehabilitation. The proposed timing for commencing and completing rehabilitation is based on current production levels and development planning. Progress with rehabilitation activities is reported annually and any changes to the proposed schedule for rehabilitation will be reported in the Annual Review. In addition, Hanson will review and update this Rehabilitation Management Plan at the completion of each stage of rehabilitation to ensure the document includes accurate milestone dates for rehabilitation works.

While extraction is planned in five stages, rehabilitation is proposed to occur in seven stages as follows.

- Stage A: Coincident with Stage 1 of Quarry operations (completed by 2020) and the early period of development in Cell 2 (Stage 2) of extraction operations. Stage A of rehabilitation will be completed by the end of 2022.
- Stage B: Coincident with the completion of Stage 2 and Stage 3 of Quarry operations. Stage B of rehabilitation will be completed by the end of 2030.
- Stage C: Coincident with Stage 4 of Quarry operations and extraction in Cell 3. This stage depends on completion of Cell 2 with rehabilitation activities are focused on landform development. Stage C of rehabilitation will be completed by 2035.
- Stage D: Coincident with Stage 5 of extraction operations and the early period of development in Cell 4. Stage D of rehabilitation will be completed by 2038.
- Stage E - F: Coincident with the completion of Stage 5 of Quarry operations. Stage E-F of rehabilitation will be completed by 2040.
- Stage G: Coincident with the closure of the Quarry and final rehabilitation activities with completion by 2042.

Each stage will not be deemed complete until all of the respective criteria have been satisfied. However, rehabilitation elements in the following stage may be commenced where the progressive task does not limit achieving the completion criteria in the current stage. For example, earthworks under Stage C may be commenced whilst maintenance of revegetated areas is being undertaken for in Stage B as long as these earthworks do not limit the success of maintenance activities.

It is noted that Condition 5 of Schedule 1 of PA 07_0069 permits quarrying operations until 31 December 2036, however based on the above extraction schedule a modification would be sought to extend the life of quarry in order to complete all stages of approved extraction operations. Regardless, the rehabilitation activities will continue until such time as the Secretary of the DPE is satisfied and the rehabilitation bond for the Quarry is returned to Hanson.

Table 3
Rehabilitation Management Stage A

Description	Comment
Repair river bank breach as per DA12/0533 and plans as amended.	
Works	<ol style="list-style-type: none"> 1. Upgrade of existing access track from quarry haul road to the failure site. Works shall include placement of site won or imported quarried products to provide a serviceable wearing surface to the track. 2. Initial filling to river water level using site sourced material. 3. Placement of compacted sand fill encapsulated in HDPE liner to form core for reconstructed bank. 4. Placement of site sourced non-cohesive fill within the failure to reinstate levels to standing water level. 5. Placement of well compacted, engineered clay fill from water level to design subgrade levels to reform river bank. 6. Construction of a new gabion lined spillway capable of passing flood flows safely into the quarry void. 7. Construction of a large- boulder energy dissipater on the quarry side of the levee. 8. Top soiling of reformed bank and rehabilitation and revegetation.
Materials Required	Site sourced sand, HDPE, clay, large boulders, top soil, plantings and seed. Earthmoving machinery.
Pit 2- bank establishment of slope 1:3 on east side.	
Works	Dozed to slope of 1v to 3h to pit water level.
Materials Required	Dozer.
Pit 2- Planting eastern bank – 500 plants.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.
Pit 2- Maintenance of tree planting west side for 2 years.	
Works	Remove dead trees and replant, remove weeds in plantation areas.
Materials Required	Auger, spade, tubestock and tree guards, weed spray.
Re-grade Cell 1 bank to 1:3 slope.	
Works	Dozed to slope of 1v to 3h to RL168mAHD.
Materials Required	Dozer/excavator.
Cell 1- fill with overburden to RL168m AHD	
Works	Commence filling Cell 1 with overburden.
Materials Required	Overburden from Stage 1 and Stage 2, earthmoving machinery.

Table 4
Rehabilitation Management Stage B

Description	Comment
Cell 1- establish groundcover	
Works	Prepare ground and sow grass seeds.
Materials required	Tractor, hydro-seeder or similar.
Pit 2- Planting south and southeastern banks.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.
Pit 2- Maintenance of rehabilitated banks.	
Works	Remove dead trees and replant, remove weeds in plantation areas.
Materials Required	Auger, spade, tube stock and tree guards, weed spray.

Table 5
Rehabilitation Management Stage C

Description	Comment
Re-grade Cell 2 bank to 1:3 slope.	
Works	Dozed to slope of 1v to 3h to RL168mAHD.
Materials required	Dozer/excavator.
Fill north end of Cell 2 extraction area to pre-existing surface to 100 metres south of extraction Cell 1.	
Works	Refill stage with overburden from extraction Cell 2 & 3.
Materials Required	Excavator and dump trucks.
Cell1- Maintenance of groundcover and weed control for 2 years.	
Works	Spray weeds in groundcover areas.
Materials required	Weed spray.
Allow Cell 2 to fill with water to SWL.	
Works	Check banks for erosion and slumping failure and repair as necessary.
Materials Required	Stormwater run-off, ground water.

Table 6
Rehabilitation Management Stage D

Description	Comment
Fill north end of Cell 3 extraction area to pre-existing surface to 100 metres south of extraction Cell 1.	
Works	Refill with overburden from extraction Cell 3.
Materials required	Excavator and dump trucks.
Re-grade Cell 3 bank to 1:3 slope.	
Works	Dozed to slope of 1v to 3h to RL168mAHD.
Materials Required	Dozer/excavator.
Planting of banks Cell 1 extraction area.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.
Planting of northern bank Cell 2 extraction area.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.

Table 7
Rehabilitation Management Stage E-F

Description	Comment
Allow Cell 3 to fill with water to SWL.	
Works	Check banks for erosion and slumping failure and repair as necessary.
Materials required	Stormwater run-off, ground water.
Planting of banks Cell 3 extraction area.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.
Planting of remaining banks of Cell 2 extraction area.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.
Tree maintenance for two years of stage D and E-F.	
Works	Replacement of trees as required.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.

Table 8
Rehabilitation Management Stage G or Post Closure

Description	Comment
Re-grade Cell 4 bank to 1:3 slope.	
Works	Dozed to slope of 1v to 3h to RL168mAHD.
materials required	Dozer/excavator.
Allow Cell 4 to fill with water to SW L.	
Works	Check banks for erosion and slumping failure and repair as necessary.
Materials Required	Stormwater run-off, ground water.
Extraction plant removal.	
Works	Removal of extraction plant, and preparation as per the method described above.
Materials Required	Cranes, cutting equipment, excavator, dozer for ripping plant area ready for re-vegetation.
Maintenance of quarry pit banks.	
Works	Check banks/walls for soaks and failure of newly placed material.
Materials Required	Excavator, haul truck and fill.
Planting of banks Cell 4 extraction area and balance of site.	
Works	Planting of trees and stabilisation of the bank with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.

Table 8 (continued)
Rehabilitation Management Stage G or Post Closure

Description	Comment
Establishment of wildlife corridor.	
Works	Planting of trees and stabilisation of the corridor with groundcover.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.
Plant maintenance for two years.	
Works	Replacement of trees as required.
Materials Required	Seed-mix, trees, tree guards, stakes, potting mix, mulch and digging tools.

5 Completion Criteria

The success of the rehabilitation effort will be assessed using the criteria presented in **Table 9**. Rehabilitation staging is presented in **Figure 1 to Figure 7**. These diagrams replicate the rehabilitation plans presented in the EA.

Table 9
Completion Criteria Table

Page 1 of 2

Stage	Element	Trigger / Response Category (Table 11)
A	Repair river bank breach as per DA12/0533 and plans as amended.	1
	Revegetate river bank breach	3
	Pit 2- bank establishment of slope 1:3 on east side.	2
	Pit 2- Maintenance of tree planting west side for 2 years.	4
	Re-grade Cell 1 bank to 1:3 slope.	2
	Cell 1- fill with overburden to RL168mAHD	2
	Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for native pasture grasses • Weed cover below 15% 	4
B	Cell 1 – establish groundcover	3
	Pit 2- Maintenance of rehabilitated banks.	4
	Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for native pasture grasses • Weed cover below 15% 	4

Table 9 (Cont'd) Completion Criteria Table

Stage	Element	Trigger / Response Category (Table 11)
C	Re-grade Cell 2 bank to 1:3 slope.	2
	Fill north end of Cell 2 extraction area to pre-existing surface to 100 metres south of extraction Cell 1.	2
	Cell1- Maintenance of grasses and weed control for 2 years.	4
	Allow Cell 2 to fill with water to SW L.	N/A
	Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for pasture grasses • Weed cover below 15% 	4
D	Fill north end of Cell 3 extraction area to pre-existing surface to 100 metres south of extraction Cell 1.	2
	Re-grade Cell 3 bank to 1:3 slope.	2
	Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for pasture grasses • Weed cover below 15% 	4
E-F	Allow Cell 3 to fill with water to SW L.	N/A
	Planting of banks Cell 3 extraction area.	3
	Planting of remaining banks of Cell 2 extraction area.	3
	Tree maintenance for two years of stage D and E-F.	4
	Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock. • Minimum 80% for ground cover for pasture grasses. • Weed cover below 15%. 	4
G or post closure	Re-grade Cell 4 bank to 1:3 slope.	2
	Allow Cell 4 to fill with water to SW L.	N/A
	Extraction and processing plant removal.	5
	Maintenance of all quarry pit banks.	2
	Planting of banks Cell 4 extraction area and balance of site.	3
	Establishment of wildlife corridor.	3
	Plant maintenance across entire site for two years.	4
	Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for pasture grasses • Weed cover below 15% 	4

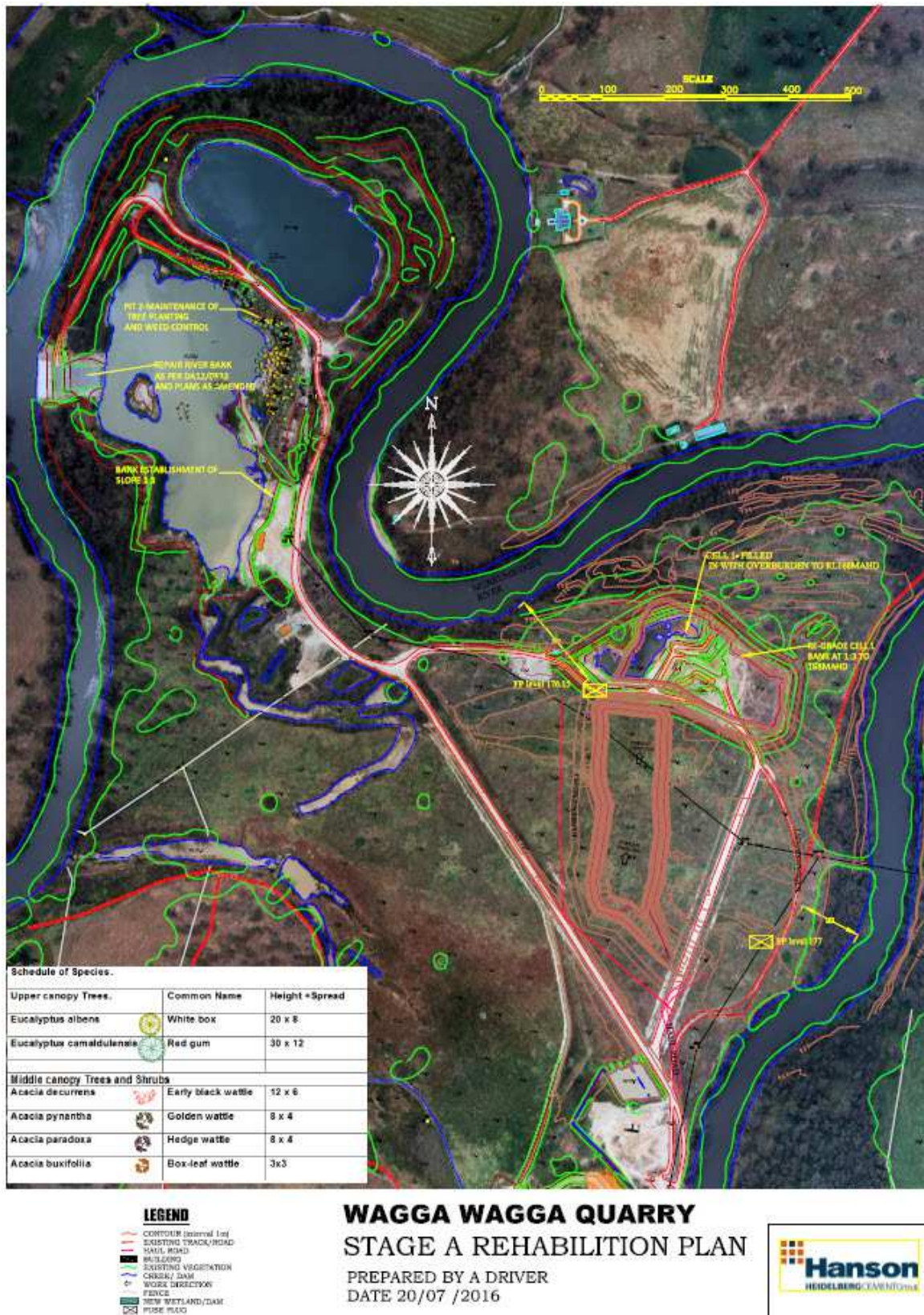


Figure 1 Stage A Rehabilitation

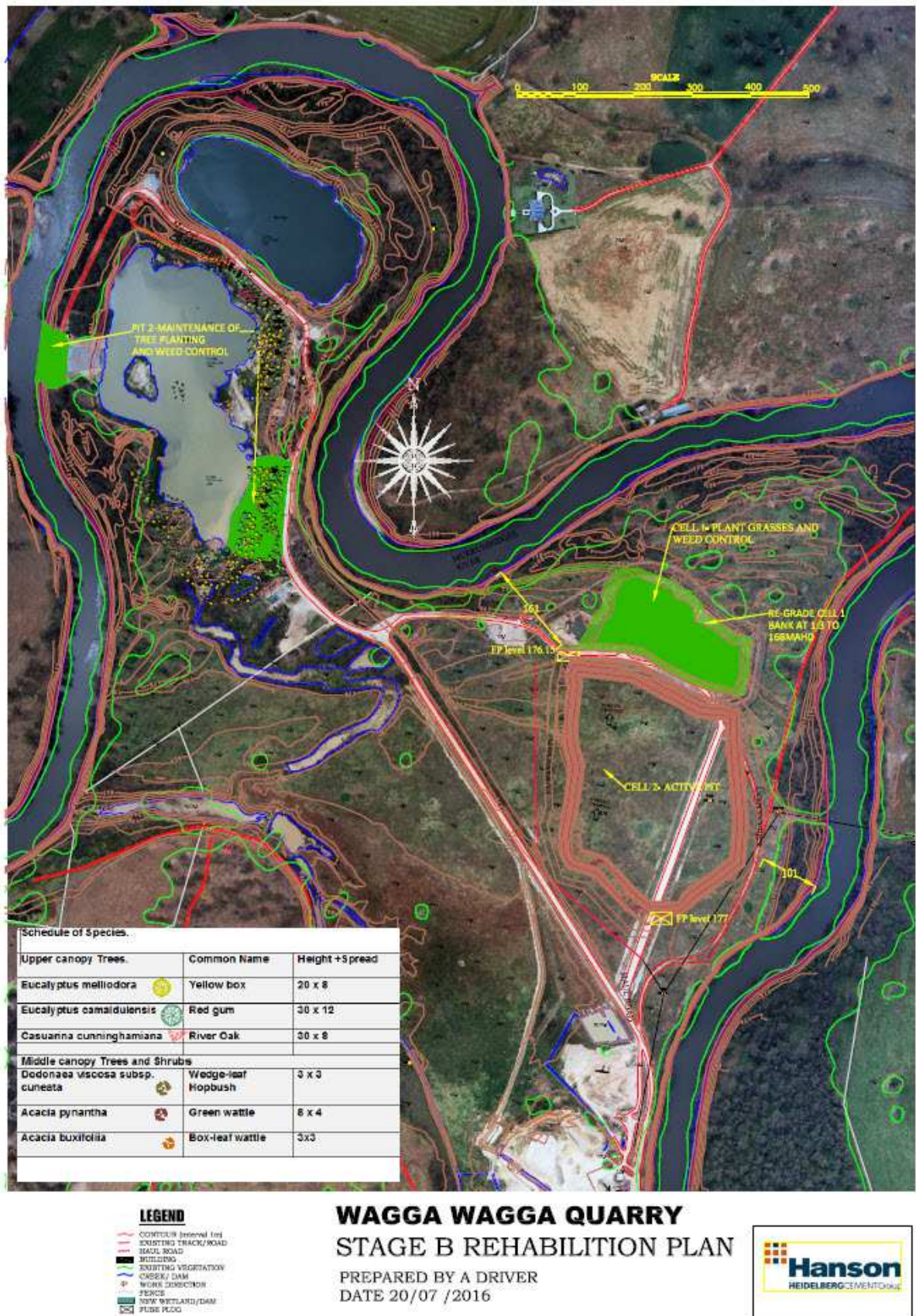


Figure 2 Stage B Rehabilitation

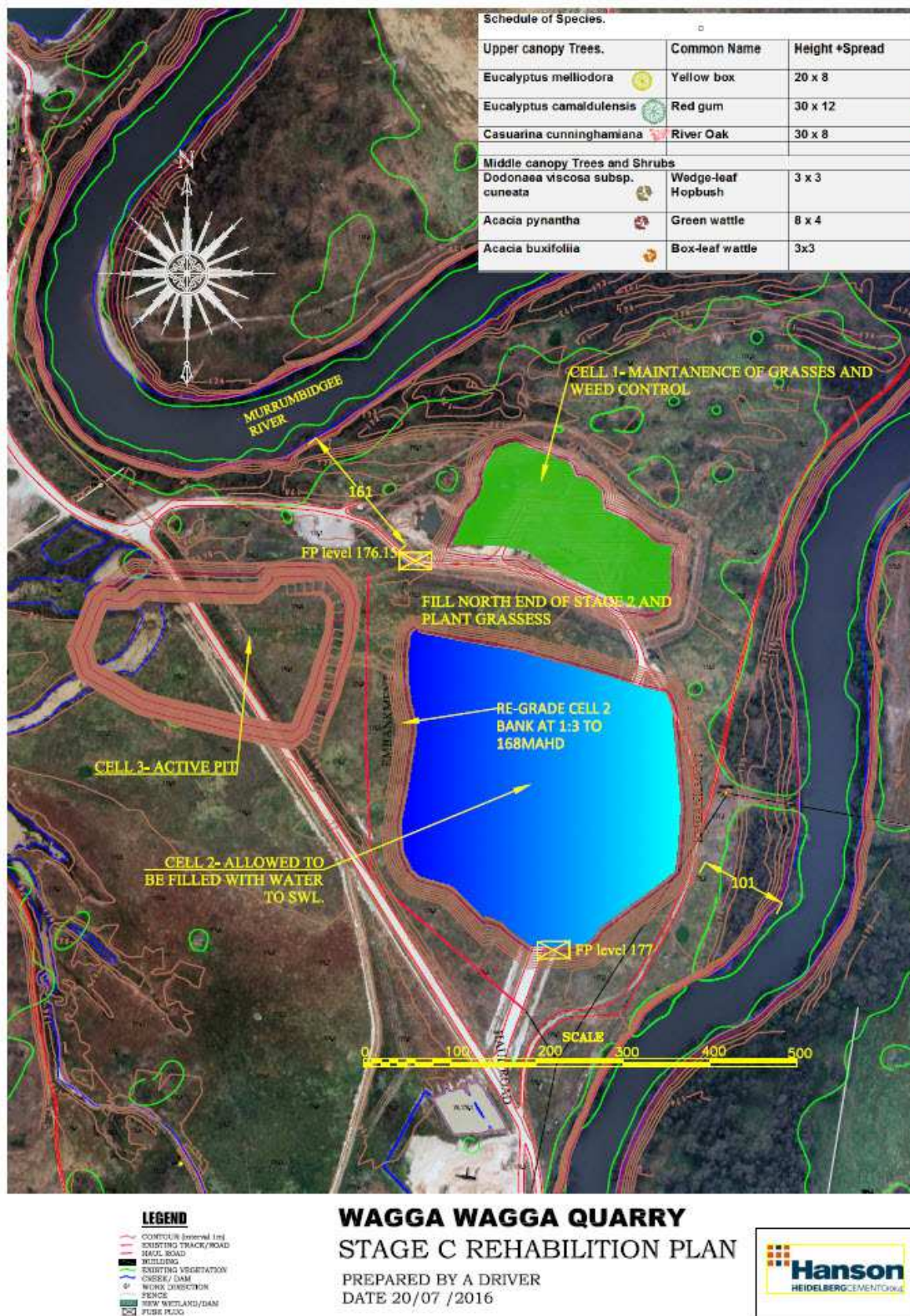


Figure 3 Stage C Rehabilitation

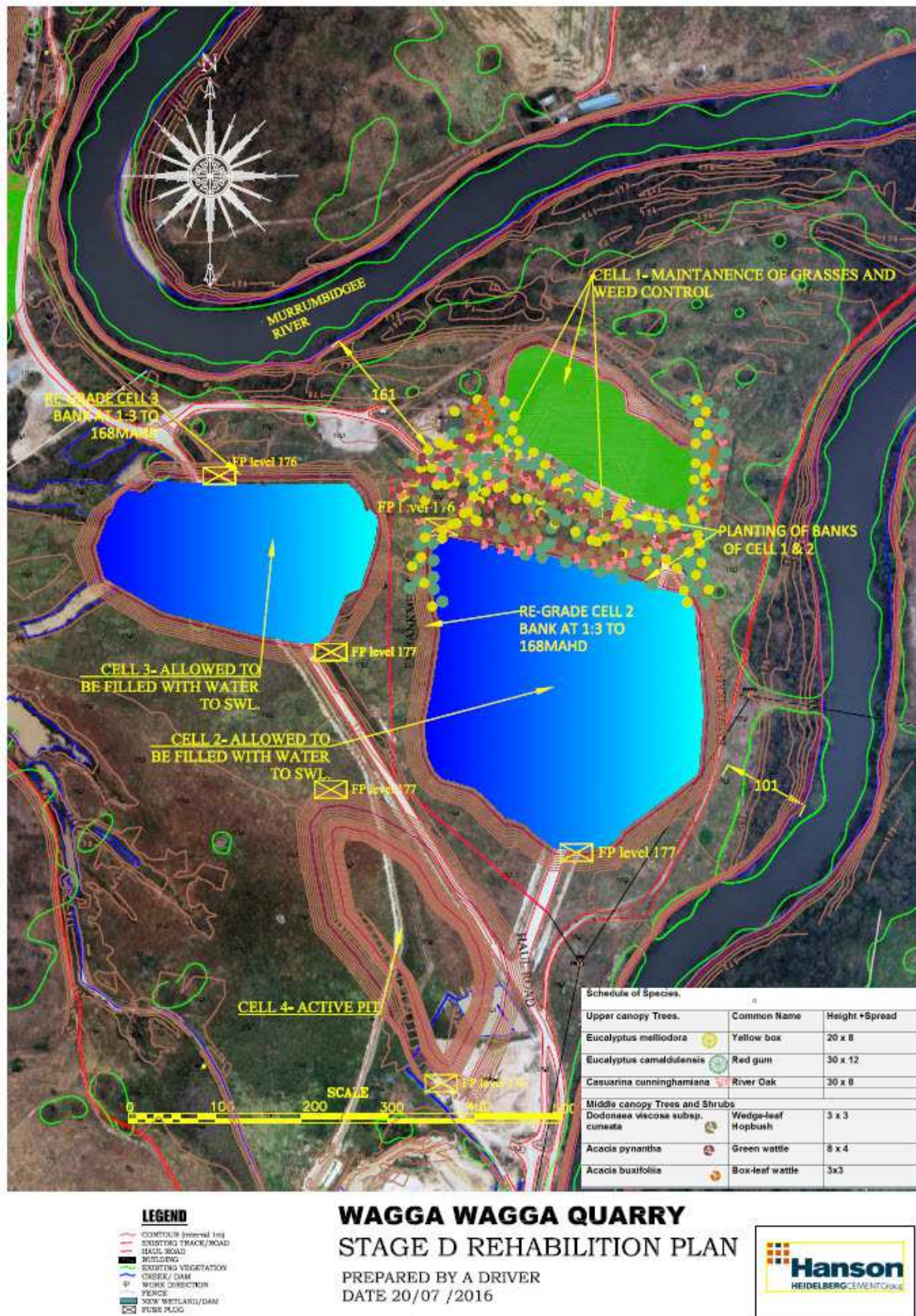


Figure 4 Stage D Rehabilitation

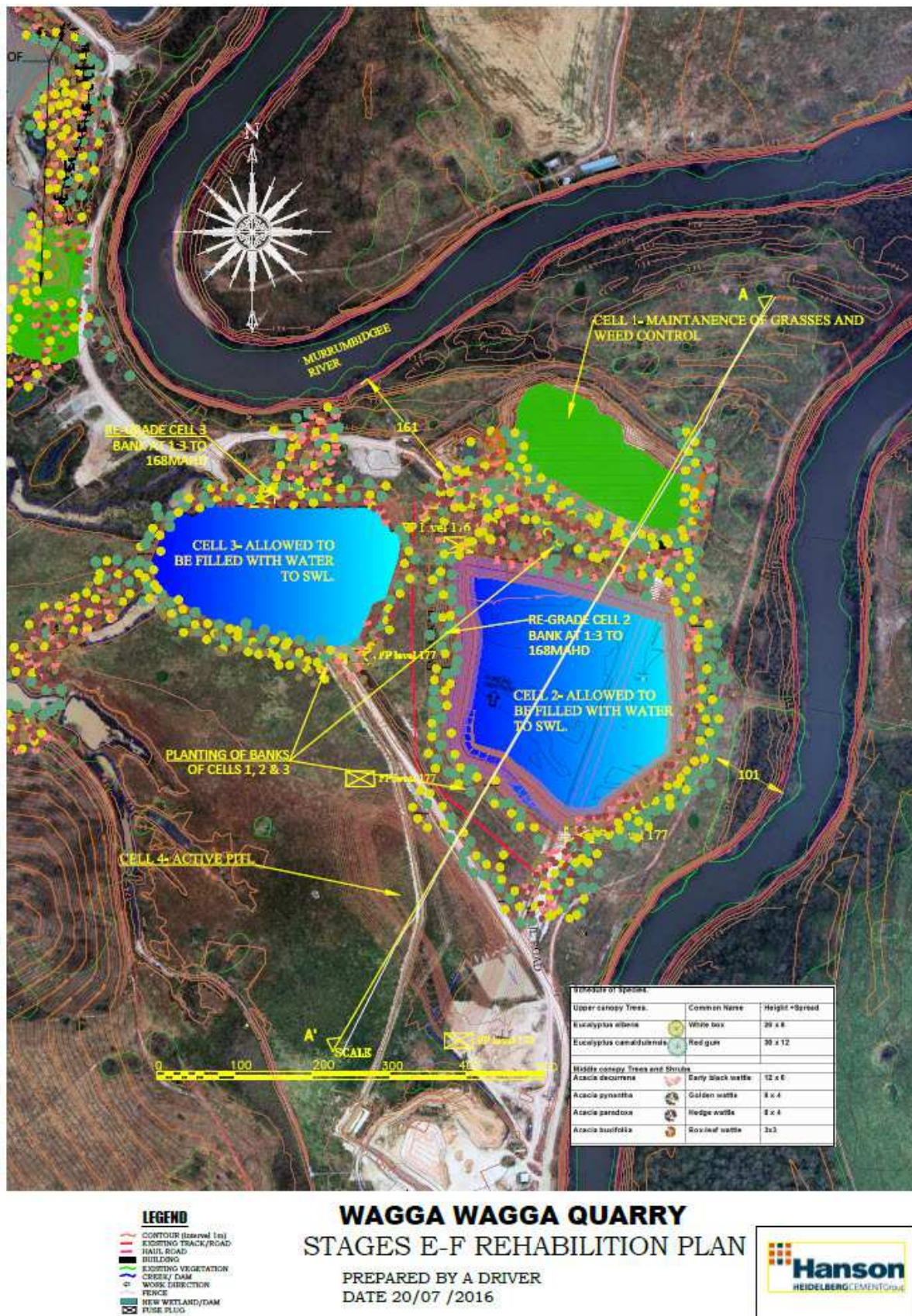


Figure 5 Stage E-F Rehabilitation

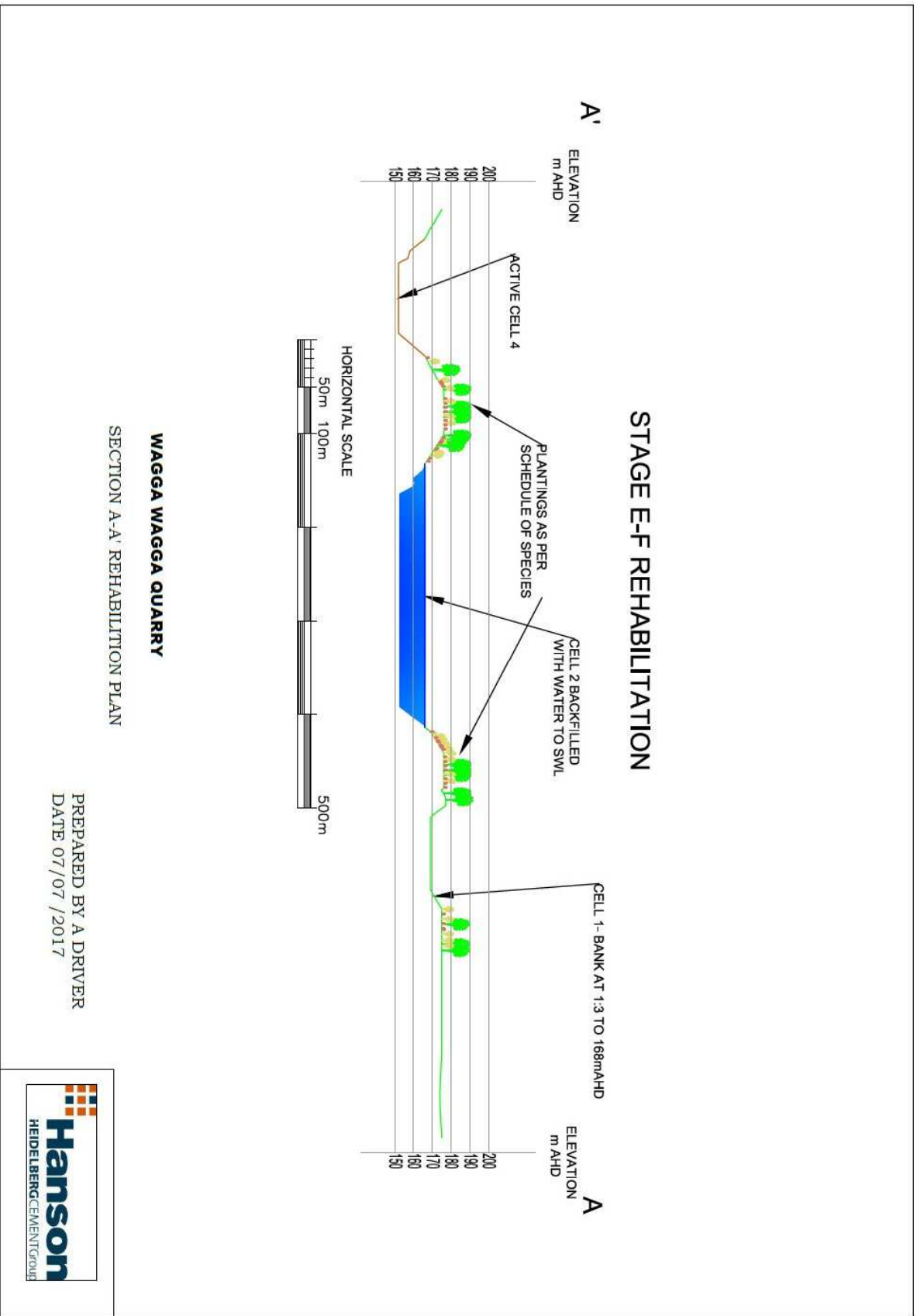
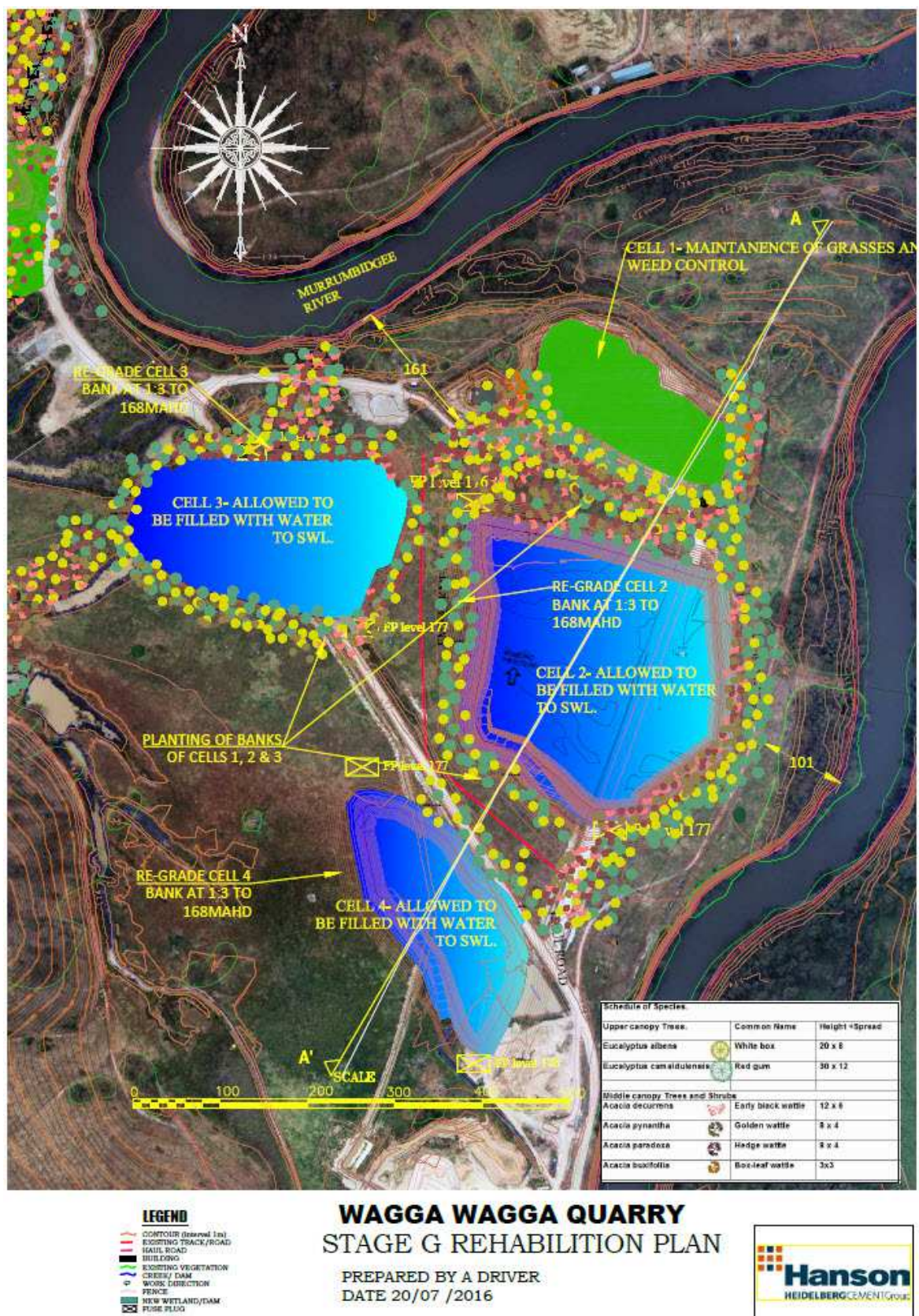


Figure 6 Stage E-F Cross Section A-A'



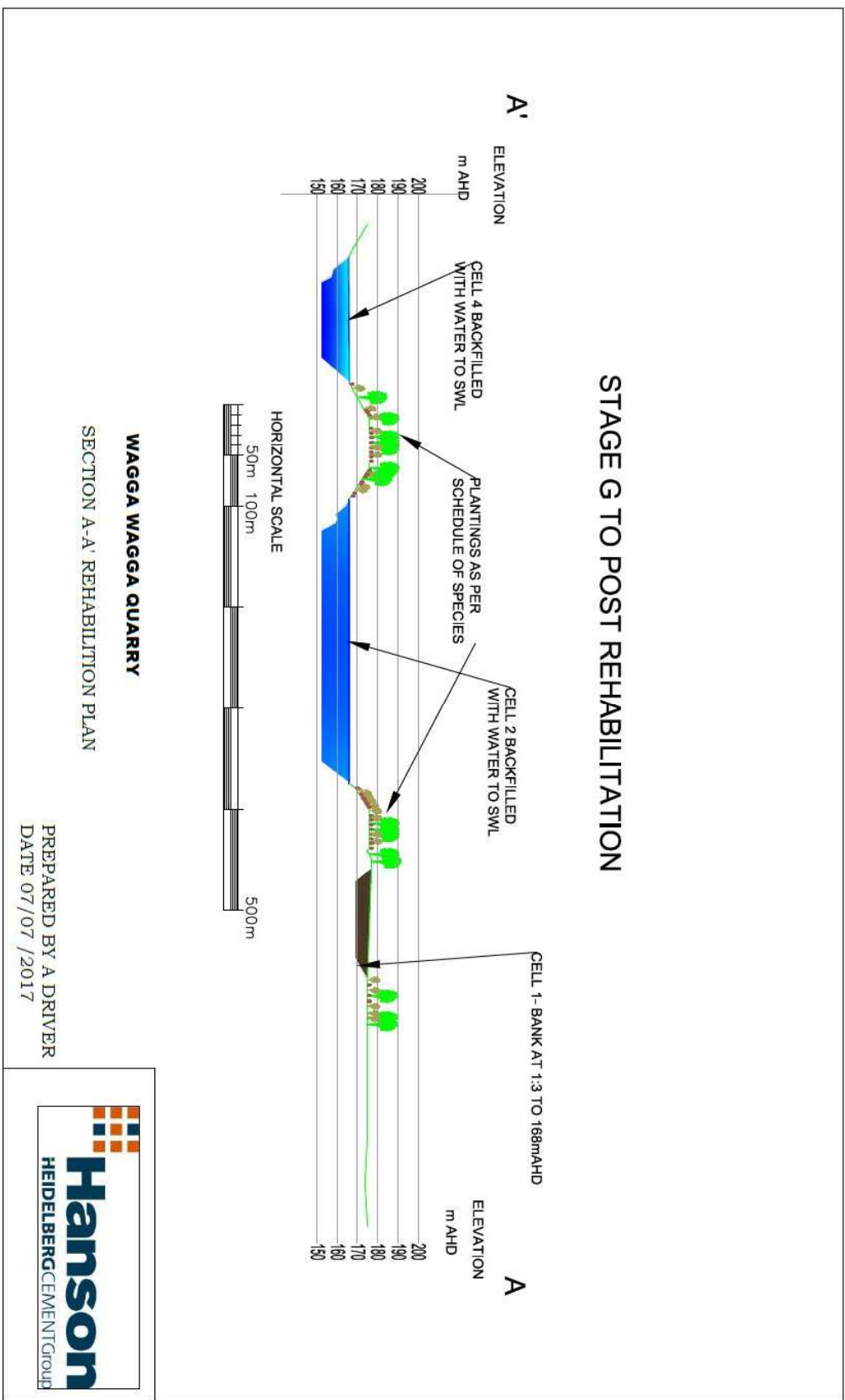


Figure 8 Stage G Cross Section A-A'

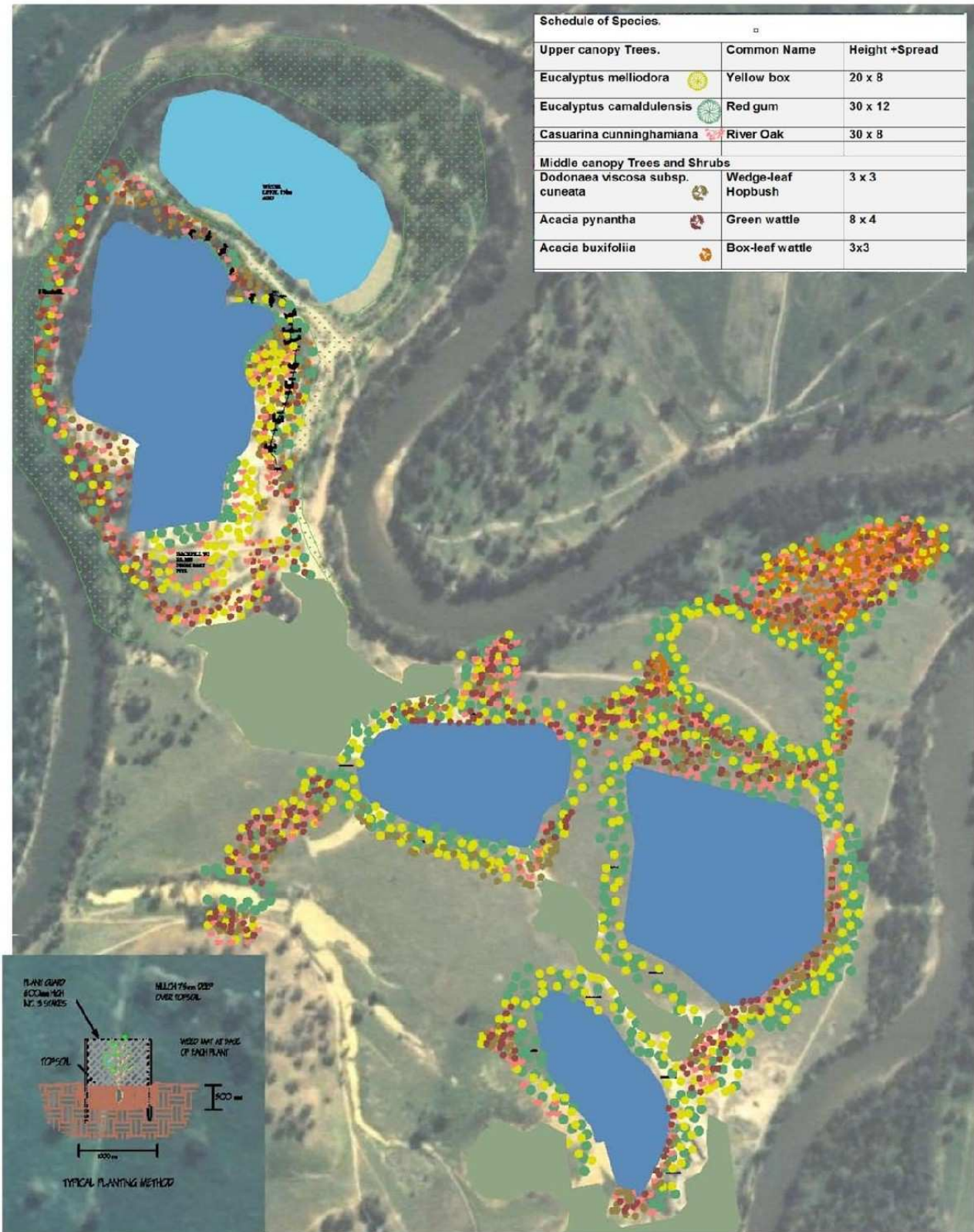


Figure 9 Post Closure Rehabilitation Plan

6 Monitoring and Reporting

Performance measures for the project will be continuously monitored by the site's quarry manager through quarterly visual inspections of the site. **Table 2 - Table 8** above will be used as a checklist to guide monitoring efforts. Any deviation or non-compliance from the staged rehabilitation effort will be raised in the company's IRMS database and DPE would be notified. Following investigation of the non-compliance a summary of proposed remedial actions would be submitted to DPE for review and approval prior to implementation. Any deviation or non-compliance from the staged rehabilitation effort will also be reported in the Annual Review. If the investigation concludes that the approved rehabilitation procedures should be modified, an updated Rehabilitation Management Plan would be submitted to DPE with no actions taken under the modified plan until this plan is approved by the Secretary of DPE. This includes any changes to the timing of rehabilitation staging.

At the end of each rehabilitation stage, Hanson will commission a suitably qualified professional to assess the completed works against the completion criteria. The assessment would involve review of the following.

- Assessment of bank stability and slope where wetlands have been established.
- Estimate of percentage foliage cover in revegetated areas.
- Identification and comparison of species composition against the Rehabilitation Plan for that stage.
- Estimate of percentage weed cover and identification of any noxious weeds requiring treatment.

The person undertaking the monitoring would be experienced in native flora and exotic species identification and methods for estimating foliage cover. A completion criteria check list will be prepared for each stage to ensure that all completion criteria have been satisfied at the end of each rehabilitation stage. Any incidences where an element is not completed or addressed, it will be remediated as soon as practically possible. Rehabilitation elements in the following stage may be commenced where completion an element does not limit commencing the next (i.e. earthworks in one area may be commenced in Stage C if revegetation requirements in Stage B are still to be satisfied for another location).

Failure to meet completion criteria would be used as a trigger for corrective actions as described in Section 7. If there is continued failure to satisfy tubestock survival and vegetation density criteria, a revised monitoring program will be developed that incorporates comparison of site conditions with suitable analogue vegetation plots. Monitoring at the end of each stage would be expanded to incorporate monitoring and data collection at analogue sites for comparison. Analogue sites would be chosen and plots established by a suitably qualified professional.

All rehabilitation activities will be summarized in the Annual Review and compared to the relevant stage management actions required for that stage including a review of proposed timing.

7 Trigger and Response Plan

Failure to satisfy completion criteria or other matters established in quarterly visual inspections or monitoring at the end of each rehabilitation stage would trigger corrective actions. **Table 11** provides a summary of the triggers and responses that would be implemented to resolve any identified rehabilitation issues.

Table 10
Trigger Response Plan

Trigger / Response Category	Trigger	Response / Corrective Actions
1	River Bank Repair Failure of river bank repair works including structural issues or vegetation dieback. Works not in accordance with DA 12/0533.	Notify DPE, OEH and EPA of structural failure requiring repair work within 50m of the watercourse. Develop repair strategy in consultation with relevant government agencies. If required, commission engineering or earthworks to be undertaken. Replace failed vegetation consistent with existing riparian vegetation.
2	Earthworks Failure to establish required slopes or backfill areas to standing water level (168m AHD).	Review existing landscape against completion criteria and landform indicated in Figure 7. Commission earthworks to satisfy slope and fill requirements. If insufficient material available for backfilling, import fill required to back fill Cell 1 and the north end of Cell 2
3	Revegetation Revegetation is not consistent with density and species selection indicated in rehabilitation plans.	Commission replanting and/or removal of vegetation so that rehabilitation is in accordance with the approved plan.
4	Monitoring and Maintenance Failure of groundcover, understory or canopy revegetation. Revegetated areas satisfy the following revegetation criteria. <ul style="list-style-type: none"> • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for pasture grasses • Weed cover below 15% Herbivore presence (native or exotic) limiting success of revegetation.	Investigate caused of vegetation failure or inability to satisfy criteria and prepare corrective action plan. Remove underlying cause of revegetation failure if possible (i.e. if cause is lack of water or the presence of herbivores). Where corrective action plan requires deviation from rehabilitation management described for that stage, discuss corrective action plan with Development Manager and OEH. Implement corrective actions as per the plan to replace vegetation. Soil condition assessments and amelioration may be necessary. Continued failure to be investigated through consideration of analogue vegetation plots in nearby vegetation of similar composition to that targeted for revegetation.
5	Decommissioning of Infrastructure Unauthorised infrastructure remains in the final landform.	Commission removal of remaining infrastructure and necessary earthworks and revegetation to complete rehabilitation in the identified location.

8 Plan Amendments

It is anticipated that the post closure plan will be implemented within the time frame discussed above. However, if fill does not come from the east side development an amendment to the post closure plan will be required to fulfil the obligation to backfill the small extension to natural surface.

Should any plan amendments be required, an updated plan would be provided to the Secretary of DPE for review and approval prior to any modified works taking place.

Appendix 1 Government Agency Consultation



**Office of
Environment
& Heritage**

Your reference
Our reference: DOC16/583353
Contact: Miranda Kerr
Ph. 02 6022 0607
Date: 10 January 2017

Ms Pip Cox
Graduate Environmental Manager
Hanson Australia

Via email: pip.cox@hanson.com.au

Dear Ms Cox

RE: Wagga Wagga Quarry Rehabilitation Management Plan

I refer to your email dated 11 November 2016 to the Office of Environment and Heritage (OEH) seeking our comments on the Wagga Wagga Quarry Rehabilitation Management Plan. This response is in regard to statutory matters relating to application of the *Threatened Species Conservation Act 1995*.

We have reviewed the plan against the conditions in Project Approval 07_0069, dated 22 November 2011 and the Project Environmental Assessment 2011. OEH has not contributed to or reviewed previous versions of the plan, which we understand was drafted in 2014. While the plan has clear stages and completion dates for rehabilitation works, as required by condition 25(h) and (j), ground cover species selection, rehabilitation monitoring and follow-up actions based on monitoring results are not adequately considered. Detailed comments are provided in Attachment A. In summary:

- The tree and shrub species selection is appropriate, however OEH does not support the planting of introduced grasses.
- Monitoring methods have not been clearly described. We recommend that monitoring methods for estimating percentage of ground cover species be specified, and completion criteria linked to pre-defined benchmarks or reference sites. The proposed completion criteria may be unrealistic in some seasons or during drought.
- A risk assessment outlining proposed actions in the event of revegetation failure is recommended.
- The Plan lacks details about site management that will maintain biodiversity values, such as stock exclusion fencing of wetland and riparian areas. We recommend that the plan further clarify the final land use and consider the potential impacts of stock grazing on the rehabilitated site.
- The plan does not consider specific measures for mitigating impacts to flora and fauna that are described in the Environmental Assessment 2011. Measures such as fencing riparian and wetland areas to exclude stock are directly related to success of rehabilitation works.

We do not have any issues with the Plan from a flooding impact perspective.

If you wish to discuss these matters further, please contact Miranda Kerr on 6022 0607 or by email miranda.kerr@environment.nsw.gov.au.

Yours sincerely

ANDREW FISHER
A/Senior Team Leader Planning, South West
Regional Operations
Office of Environment and Heritage

Cc: Lauren Evans, Planning Officer, Department of Planning and Environment (lauren.evans@planning.nsw.gov.au)
Enc. ATTACHMENT A – Detailed comments for the Wagga Wagga Quarry Rehabilitation Management Plan

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ATTACHMENT A – Detailed comments for the Wagga Wagga Quarry Rehabilitation Management Plan

Biodiversity

The Rehabilitation Management Plan lacks details about monitoring methods and site management that will maintain biodiversity values. The following documents provide guidance for well-designed rehabilitation programs:

Leading Practice Sustainable Development Program for the Mining Industry - Mine Rehabilitation: www.industry.gov.au/resource/Documents/LPSDP/LPSDP-MineRehabilitationHandbook.pdf

SERA (2016) National Standards for the Practice of Ecological Restoration in Australia. Society for Ecological Restoration Australasia. Url: www.seraustralasia.com/standards/contents.html

1.3 Priorities for final land uses (page 5)

The primary land use of the site is identified as "passive biodiversity conservation and maintenance of an agricultural/wetland". We recommend that the plan further clarify the final land use and consider the potential impacts of stock grazing on the rehabilitated site.

Riparian environments are particularly susceptible to impacts from stock grazing. Bank erosion and soil compaction (pugging) due to hard-hooved animals and changes to vegetation structure and ecosystem function from suppression or removal of grazing-sensitive plants are consistently reported in ecological studies of riverine vegetation (Lunt *et al.* 2007), such as River Red Gum woodlands and floodplain wetlands.

Strategic fencing may be appropriate to protect plantings during their establishment. Biodiversity conservation values are likely to benefit from fencing that excludes stock from the riverbank and wetland margins. Installation of strategic fencing is supported by sections 7.4.3 (page 106) and 7.5.3 (page 114) of the EA that describe mitigation measures for impacts to flora and fauna:

- Fence riparian areas and prevent any activity in these areas other than control of weeds
- Install rabbit-proof fencing without the use of barbed wire in revegetated sites outside of the quarry area, including the riparian vegetation along the Murrumbidgee River.

2.5 Surface Soil Layer (page 6)

Success of revegetation planting is closely related to the properties of topsoil. This section should link to mitigation measures for soil removal impacts as described in the operational section of the Environmental Assessment (7.2.2.3 Stripping, page 70), such as:

- Separate stockpiling of topsoil and substrata
- Avoiding excessive handling and compaction of soil during stockpiling, particularly when wet
- Appropriate stockpile positioning and management.

2.8 Revegetation (page 8)

Plant species selection

The tree and shrub species mapped in figures 1 to 7 are consistent with those recommended in the Flora Study (EA Appendix C, page 20), however the planting density of trees and shrubs has not been described or justified.

Tables 3 to 6 in Section 4 *Stage Description* (page 12) mention that grasses will be sown during planting. The species of grass is not prescribed, however a "minimum percentage cover for pasture grasses" is included as one of the completion criteria in Table 9 (page 18). It is therefore assumed that the proponent intends to include non-native grasses in the revegetated sites.

While the floristic survey found that the dominant vegetation type was a grassland of introduced pasture grasses, OEH recommend that native grasses, herbs and sub-shrubs be planted. Section 7.5.3 *Mitigation Measures* (for impacts to fauna) (page 114) of the EA specifies that revegetation should allow a natural regrowth of trees, shrubs and groundcovers, and that only species natural to river red gum forest/woodland should be planted. Introduced grasses will compete with native species, reducing the ability of the site to naturally regenerate. Consent condition 25(h) also requires landscaping of the site with native species endemic to the locality. OEH can assist with ground cover species selection if required.

Site management

There is no indication in the plan that the proponent has successfully undertaken similar revegetation projects within the region. It would be prudent to include a risk assessment listing issues that may arise during revegetation works and proposed actions for reducing their likelihood. For example, is it possible that 75% of trees planted around Pit 2 will die during the first season? If high mortality occurs, what actions will the proponent take to ensure that replacement trees have a higher survival rate?

Site management actions other than ground works and plantings have not been fully considered. 7.4.3 *Mitigation Measures* (page 106) of the EA recommends "incorporating management of the riparian areas in the site monitoring in the environmental management plan" as mitigation for impacts to native vegetation.

2.11 Environmental Monitoring (page 9)

The environmental monitoring described in this section does not directly relate to rehabilitation activities.

This section would ideally outline how the proponent will monitor the performance of site recovery using pre-identified indicators consistent with the objectives, preferably through accepted quantitative sampling methods supported by vegetation condition assessment. We recommend using repeatable, standardised methods to enable comparable monitoring over the life of the rehabilitation project.

The method for estimating grass and weed cover should be documented. For example, visual estimation of percentage cover in x number of random 1 m² sample plots within the planting zone of each cell or stage, or permanent points of a particular size within each cell or stage. The method would also include the frequency and approximate timing of monitoring surveys and personnel skills required, such as the ability to identify native from introduced grasses.

5 Completion Criteria (page 18) / 6 Monitoring of Performance Measures (page 28)

If the rehabilitation objective was a natural ecosystem, we would recommend that reference or benchmark parameters be identified for each vegetation type. This involves describing the species, structure and functional ecosystem attributes to be restored before the desired outcome has been achieved.

It may be appropriate to use reference sites or benchmarks as a target for the understorey and ground layer components of the River Red Gum forest and floodplain wetlands. Generic information on benchmark characteristics for NSW ecosystems is available through the NSW Vegetation Information System page on the OEH website:

<http://www.environment.nsw.gov.au/resources/bionet/150023-quick-guide-veg-cond.pdf>.

A minimum of 80% ground cover may not be achievable during times of drought. Growth of ground cover in dry environments is strongly dependent on climate cycles. One way to ensure that unrealistic targets are not being set is to select a reference site(s) and measure indicators at the same time as the treatment sites. Changes at the treatment sites can then be calibrated against annual or seasonal variability in the reference site(s).

Flooding Impacts

In the 2011 Project Assessment Report, DP&E highlight that the principal flood-related issue relating to the project is one of damage to the site itself, rather than significant off-site flooding impacts. While OEH has no concerns with the Plan with respect to impacts from flooding, we offer the following comments.

The area surrounding the Quarry site is primarily dedicated to primary production and largely devoid of residential properties. The site of the quarry is approximately 5 km downstream of the Wagga Wagga urban area, and downstream of the major hydraulic choke produced by the Gobbagombalin Bridge across the Murrumbidgee River floodplain. The quarry development includes the use of levees to protect active pits in times of flood up to the 5% Annual Exceedance Probability event level with a system of "fuse plugs" to facilitate the controlled inundation of these pits in larger flood events.

There appears to be some immediate flood impacts during major floods upstream of the quarry as a result of the levee structures surrounding active pits but this is restricted to the immediate vicinity and would not impact on the Wagga Wagga urban area.

It is understood that once the pits reach the end of their active lives they will be rehabilitated by removing the surrounding levees and restoring the pits to a wetland type environment thus removing any flood related impacts.

References

Lunt ID, Eldridge DJ, Morgan JW & Witt GB (2007). Turner Review No 13. A framework to predict the effects of livestock grazing exclusion on conservation values in natural ecosystems in Australia. *Australian Journal of Botany* 55: 401–415.



Contact: Tim Baker
Phone: 02 9841 7403
Mobile: 0428 162 097
Fax: 02 6884 0096
Email: tim.baker@dpi.nsw.gov.au

Mr Andrew Driver
Hanson Construction Materials Pty Ltd
Level 18, 2-12 Macquarie St
PARRAMATTA NSW 2150

Our ref: OUT16/48646

9 December 2016

Dear Mr Driver

**WAGGA WAGGA QUARRY EXTENSION –
AMENDED REHABILITATION MANAGEMENT PLAN (11112016)**

I refer to your letter dated 11 November 2016 providing DPI Water an opportunity to review the amended Rehabilitation Management Plan. It is understood this consultation and plan development is in accordance with Condition 25 of Schedule 3 of project approval 07_0069 for the Wagga Wagga Quarry Extension Project. DPI Water has reviewed the plan in light of the approval conditions, and comments and recommendations provided in previous correspondence (dated 18th August 2016). Further detailed comments and recommendations are provided as follows:

- Cross-sections of key areas showing final pit levels, adjacent floodplain levels, levees and their batter angles, groundwater and the river requested in previous correspondence have not been supplied. A further request is made for the inclusion of cross-sections depicting the landform prior to and following rehabilitation to assist in the assessment of proposed measures.
- Further attention should be given to ensuring that Figures and Tables accurately represent the work proposed during each rehabilitation stage and all symbols and shadings are represented in legends.
References to Tables and Figures throughout the text should also be checked for accuracy eg. reference is made, in section 2.6.4, to Cells 2-4 being shown in Figure 1 – these cells do not appear in Figure 1; text refers to Figure 8 – however, document does not contain a Figure 8; Figures do not depict complete filling of void in Cell 2.
- It is noted that the Rehabilitation Objective to minimise the total surface area of water bodies on the site has been removed.
- The maintenance of water filled voids at the site during and following the rehabilitation stages will need to address water licensing requirements for the site based on the rehabilitated landform. As previously advised key elements to be addressed in the WMP and referenced in the RMP include:

- Groundwater and surface water are managed under separate Water Sharing Plans at the site. Licence requirements for water take from surface and groundwater therefore need to be quantified and licensed separately.
- Quantify the ongoing groundwater take in the final voids and how this will be licensed in the relevant water source.
- Details on how the rehabilitated site needs to be considered under the harvestable rights provision of the *Water Management Act 2000* and the applicable Harvestable Rights Order, and how any surface water capture not considered under harvestable rights will be addressed.
- Upon completion of the rehabilitated landform and prior to the lapse of the SSD approval, consideration will need to be given to the need for a Flood Work Approval under the *Water Management Act 2000* to authorise the continued presence and maintenance of the levees; and approval requirements for aquifer interference activities associated with the remaining pits.

It is requested the proponent contact DPI Water at least six months prior to lapsing of the SSD approval to confirm approval requirements, and that the Rehabilitation Plan be amended to reflect an undertaking to make this contact.

- Flooding impacts of the final landform have been addressed to a limited extent. Further information is requested regarding the level of protection the levees are to achieve, their impact if different from what was in the original EA, and the long term management of fuse plugs. The concept of utilising the voids to capture floodwater raises the need to consider the role of DPI Water's Floodplain Harvesting Policy and potential licensing requirements. This policy can be accessed at the following link: <http://www.water.nsw.gov.au/water-management/law-and-policy/key-policies/floodplain-harvesting>

Should you have any further queries in relation to this submission please do not hesitate to contact Tim Baker on (02) 6841 7403.

Yours sincerely



Vickie Chatfield

Manager, Regional Water Regulation
Department of Primary Industries Water
NSW Department of Industry, Skills and Regional Development

From: Megan Kovelis <mkovelis@martens.com.au>
Sent: Thursday, 27 April, 2017 12:46 PM
To: Tim Baker (tim.baker@dpi.nsw.gov.au)
Cc: Driver, Andrew (Parramatta) AU <Andrew.Driver@hanson.com.au>
(Andrew.Driver@hanson.com.au); Andrew Norris; Nicholas Warren;
'lauren.evans@planning.nsw.gov.au'
Subject: 3330; OUT17/3204 Wagga Wagga Quarry - Rehabilitation Management Plan
Attachments: P1203330JC05V01 170427.pdf

Afternoon Tim,

The proponent has requested the Martens and Associates consult with DPI Water on the Rehabilitation Management Plan, as well as the Water Management reports for the Wagga Wagga Quarry application. In response to DPI Water consultation (9 December, 2016) we provide the attached response to each matter raised for your consideration and comment. Once DPI Water are satisfied with the intended approach in dealing with each matter, we will action as documented and provide the amended RMP for your review.

Please feel free to give me a call if you have any queries.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis
Environmental Scientist
BEnvSc (Hons1)

Office Hours: Tues - Thurs



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From: Tim Baker <tim.baker@dpi.nsw.gov.au>
Sent: Friday, 30 June 2017 11:03 AM
To: Megan Kovelis
Cc: Water Referrals
Subject: DPI Water comments - Wagga Wagga Quarry - Rehabilitation Management Plan - additional information

Hi Megan,

I've reviewed the table of responses to DPI Water's comments dated 9 December 2016. DPI Water is generally satisfied with the responses and proposed actions. The only additional comment is as follows:

- The response in d(iv) refers to no works related to aquifer interference activities, therefore no licensing required. DPI Water advises the pits that will remain intercepting groundwater will constitute an aquifer interference activity. Therefore as with the comments on flood work approvals, they don't require an approval when covered by the SSD approval, however after this approval lapses consideration will then need to be given to hold the relevant approvals once that exclusion no longer applies. Therefore your response in d(iv) is correct in part, however you will need to consider both flood work approvals and the relevant approval for an aquifer interference activity.

Please give me a call if you need to discuss further.

Regards

Tim

Tim Baker | Senior Water Regulation Officer
NSW Department of Primary Industries | Water
209 Cobra St | Dubbo NSW 2830 | PO Box 717, Dubbo NSW 2830
T: 02 6841 7403 | F: 02 6884 0096 | M: 0428 162 097 | E: Tim.Baker@dpi.nsw.gov.au
W: www.water.nsw.gov.au | www.dpi.nsw.gov.au

On 29 June 2017 at 11:17, Megan Kovelis <mkovelis@martens.com.au> wrote:

Good morning Tim,

We urgently need comment from DPI Water in relation to the attached and below emails. Can you please let me know when we can expect this?

Thanks,

Kind Regards,

From: Nicholas Warren
Sent: Friday, 4 August, 2017 9:04 AM
To: lauren.evans@planning.nsw.gov.au
Cc: Andrew Driver (Andrew.Driver@hanson.com.au); Megan Kovells; miranda.kerr@environment.nsw.gov.au; Tim Baker
Subject: 766 - Wagga Wagga Quarry - Rehabilitation Management Plan
Attachments: 76602_Wagga Wagga Rehabilitation Management Plan_FINAL.PDF; 76602_Rehabilitation Management Plan review_July 2017_20170731.docx

Good morning Lauren,

Please find attached the final draft Rehabilitation Management Plan for the Wagga Wagga Quarry. I have also included the a summary of previous comments on the draft plan received from DPE, OEH and DPI Water during consultation. The summary provides a brief response to these comments and indicates where modifications have been made in the document.

Please feel free to contact myself or Andrew Driver with any questions.

Regards,
Nick

Nick Warren

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Table 1: Hanson Response to OEH Comments 10 January 2017

OEH Comment	Hanson Response	Section of RMP
<p>The primary land use of the site is identified as "passive biodiversity conservation and maintenance of an agricultural/wetland". We recommend that the plan further clarify the final land use and consider the potential impacts of stock grazing on the rehabilitated site.</p>	<p>Section 1.4 has been modified with regards the final land use. It is considered appropriate (an consistent with the EA) that the final land use be determined in the Closure Plan to be developed two years prior to closure.</p>	<p>Section 1.4</p>
<p>Success of revegetation planting is closely related to the properties of topsoil. This section should link to mitigation measures for soil removal impacts as described in the operational section of the Environmental Assessment (7.2.2.3 Stripping, page 70).</p>	<p>Section 2.5 has been modified to reflect soil management practices.</p>	<p>Section 2.5</p>
<p>Plant species selection The tree and shrub species mapped in figures 1 to 7 are consistent with those recommended in the Flora Study (EA Appendix C, page 20), however the planting density of trees and shrubs has not been described or justified.</p>	<p>Rehabilitation plans for each stage of activities includes a table of species and indicates plant height and spread. This information will be used to establish a suitable density for planting.</p>	<p>Section 2.8</p>
<p>OEH recommend that native grasses, herbs and sub-shrubs be planted.</p>	<p>This comment is noted. The RMP has been updated to state that only native groundcover will be established in the final landform.</p>	<p>Section 2.8</p>
<p>It would be prudent to include a risk assessment listing issues that may arise during revegetation works and proposed actions for reducing their likelihood.</p>	<p>A trigger response plan has been included in Section 7 to guide reactive management of rehabilitation. This is considered to satisfy the OEH request for a risk assessment.</p>	<p>Section 7</p>
<p>The environmental monitoring described in this section does not directly relate to rehabilitation activities. This section would ideally outline how the proponent will monitor the performance of site recovery using pre-identified indicators consistent with the objectives, preferably through accepted quantitative sampling methods supported by vegetation condition assessment.</p>	<p>Section 6 has been updated to reflect the frequency of monitoring, matters to be considered and suitable experience of person involved. In summary, the Quarry Manager will undertake quarterly visual inspections of revegetation and areas that are undergoing rehabilitation. At the end of each rehabilitation stage, a suitably qualified person would be commissioned to undertake monitoring of the rehabilitated areas to ensure compliance of completion criteria. The methods to be applied during monitoring would be established upon commissioning.</p>	<p>Section 6</p>

<p>If the rehabilitation objective was a natural ecosystem, we would recommend that reference or benchmark parameters be identified for each vegetation type. This involves describing the species, structure and functional ecosystem attributes to be restored before the desired outcome has been achieved.</p>	<p>Revegetation activities do not aim to establish specific vegetation communities but establish a vegetation cover of endemic species. Therefore targets for revegetation will remain as follows.</p> <ul style="list-style-type: none"> • Species selection for revegetation activities in accordance with the Rehabilitation Plan. • Minimum 85% survival rate for tubestock • Minimum 80% for ground cover for pasture grasses • Weed cover below 15% of total foliage cover. <p>More detailed benchmarks and targets for revegetation would be established in the Closure Plan, prepared 2 years prior to closure of the Quarry. This approach would ensure that revegetation and rehabilitation planning are consistent with strategies and guidelines relevant at the time of closure.</p>	Section 5
<p>One way to ensure that unrealistic targets are not being set is to select a reference site(s) and measure indicators at the same time as the treatment sites. Changes at the treatment sites can then be calibrated against annual or seasonal variability in the reference site(s).</p>	<p>This comment is noted and monitoring of analogue plots of vegetation has been included as a contingency measure within the monitoring program.</p>	Section 6

Table 2: Hanson Response to DPI Water Comments 9 December 2016

Rehabilitation Management Plan DPI Water Comment	Response	Section of Report
<p>a. Cross-sections of key areas showing final pit levels, adjacent floodplain levels, levees and their batter angles, groundwater and the river requested in previous correspondence have not been supplied. A further request is made for the inclusion of cross-sections depicting the landform prior to and following rehabilitation to assist in the assessment of proposed measures.</p> <p>b. Further attention should be given to ensuring that Figures and Tables accurately represent the work proposed during each rehabilitation stage and all symbols and shadings are represented in legends.</p> <p>References to Tables and Figures throughout the text should be checked for accuracy.</p> <p>c. It is noted that the Rehabilitation Objective to minimise the total surface area of water bodies on the site has been removed.</p> <p>d. The maintenance of water filled voids at the site during and following the rehabilitation stages will need to address water licensing requirements for the site based in the rehabilitated landform. As previously advised key elements to be addressed in the WMP and referenced in the RMP include:</p>	<p>Cross sections will be prepared as requested and provided as an attachment to the RMP.</p>	<p>Section 5</p>
	Noted	Throughout
	Noted	NA
	The WMP has been prepared to be an operational document, which will cease to apply once operations are completed. The RMP addresses post-operational management and is therefore independent of the WMP. Water management for progressive rehabilitation will be in accordance with the WMP. DPI Water's matters raised below shall be addressed in the RMP without the need to refer back to the WMP.	NA
<p>i. Groundwater and surface water are managed under separate Water Sharing Plans at the site. License requirements for water take from surface and groundwater therefore need to be quantified and licensed separately.</p>	<p>The voids will maintain a zero catchment (excluding direct rainfall) and so the site will have no licensable surface water take (see iii for further details).</p> <p>The site is to maintain a Water Access License (WAL) for groundwater 'take' resulting from net evaporation from window lakes. This shall be quantified 2 years prior to closure, based on the following procedure:</p> <ol style="list-style-type: none"> 1) Groundwater monitoring data to be reviewed to determine which voids/lakes are connected to groundwater. 2) Obtain available rainfall and evaporation data. 3) Calculate net groundwater 'take' for each year of available rainfall and evaporation data and based on final lake/void surface area and catchment area. 	<p>Section 1.5</p>

<p>ii. Quantify the ongoing groundwater take in the final voids and how this will be licensed in the relevant water source.</p> <p>iii. Details on how the rehabilitated site needs to be considered under the harvestable rights provision of the Water Management Act c2000 and the applicable Harvestable Rights Order, and how any surface water capture not considered under harvestable rights will be addressed.</p>	<p>4) The highest calculated groundwater take from the climate data should be used as the WAL required to maintain in perpetuity.</p> <p>As above</p> <p>The levees shall be generally re-graded as documented in the RMP, however a small rise/bund shall be retained (approximately 500mm above floodplain surface level) to maintain a zero catchment for voids/lakes. Therefore, as documented in the WMP and previously agreed with DPI Water, open voids that do not have a catchment are exempt from harvestable rights calculations under the Farm Dams Policy (NSW Government Gazette 40, 31 March, 2006 pg. 1628 - 1631) and do not require a license under the Water Management Act 2000.</p> <p>Two years prior to closure, the proponent shall ascertain which cells/voids are window lakes (i.e. groundwater connected), which levees will remain onsite, and therefore where flood obstructions are onsite. At that time the need for a Flood Work Approval under the Water Management Act 2000 will be considered. We recommend that this assessment is not made until this time as:</p> <ol style="list-style-type: none"> 1) The final landform of the site cannot be confirmed prior to this. 2) Licensing requirements/conditions etc may be different on closure of the site (i.e. in 25-30 years' time) to what it is now. <p>We understand that DPI Water have suggested this is completed 6 months prior to the lapsing of the SSD. We do not believe that this will allow enough time for assessment of license requirements, availability and the process/procedures at the time.</p> <p>It is noted that no works are proposed at the rehabilitation stage that would constitute 'aquifer interference' and so no licensing requirements apply under current policy.</p> <p>As discussed in point (i), a WAL will be maintained in perpetuity to account for net groundwater 'take' resulting from evaporation off window lakes.</p>	<p>Section 1.5</p> <p>The RMP will be amended to reflect this change in levee rehabilitation and document requirements under the harvestable rights provisions.</p> <p>See Section 1.5 and Section 2.6.4</p> <p>Section 1.6</p>
<p>iv. Upon completion of the rehabilitated landform and prior to the lapse of the SSD approval, consideration will need to be given to the need for a Flood Work Approval under the Water Management Act 2000 to authorise the continued presence and maintenance of the levees; and approval requirements for aquifer interference activities associated with the remaining pits.</p> <p>It is requested that the proponent contact DPI Water at least 6 months prior to lapsing of the SSD approval to confirm approval requirements, and that the Rehabilitation Plan be amended to reflect an understanding to make this contact.</p>		

<p>2 Flooding impacts of the final landform have been addressed to a limited extent. Further information is requested regarding the level of protection the levees are to achieve, their impact of different from what was in the original EA, and the long term management of fuse plugs. The concept of utilising the voids to capture floodwater raises the need to consider the role of DPI Water's Floodplain Harvesting Policy and potential licensing requirements.</p>	<p>As per Point 1(d)(iv), two years prior to closure licensing requirements for the final landform in accordance with DPI Water's Floodplain Harvesting Policy will be considered. Regarding fuse plugs, these will be maintained as part of the 500mm bund/levee to window lakes. Batters will be designed to prevent erosion and scour during flood events.</p>	<p>Section 1.6 and Section 2.9</p>
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