

Lynwood Quarry

Rehabilitation and Landscape Management Plan

May 2018





LYNWOOD QUARRY REHABILITATION AND LANDSCAPE MANAGEMENT PLAN

Revision 2

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Holcim (Australia) Pty Limited

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1.0 Introduction

Holcim (Australia) Pty Lid (Holcim) was granted development consent in December 2005 (DA 128-5-2005) (Development Consent) by the then NSW Minister for Planning for the construction and operation of a hardrock quarry known as Lynwood Quarry west of Marulan in the Southern Tablelands region of NSW (refer to **Figure 1.1**). There have been 5 modifications approved to the Development Consent under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) since 2005. This Rehabilitation and Landscape Management Plan (RLMP) has been prepared in accordance with Condition 44 of Schedule 3 of the Development Consent (refer to **Appendix 1**).

1.1 Overview of the Project

Holcim has approval to carry out quarrying operations until 1 January 2038. The quarry pit is shown on **Figure 1.1**, including the locations of overburden and excess product emplacement areas and project infrastructure. The quarry has existing Development Consent approval to produce up to 5 million tonnes per annum (Mtpa) of saleable quarry product until 2038. The target resource has an expected life in excess of 90 years. Some of the material extracted as part of the quarrying process are not suitable for processing and sale, consequently emplacement areas are required. The locations of these emplacement areas is shown on **Figure 1.1**.

1.1.1 RLMP and Lynwood Operations

The key aspects of the Lynwood Operations pertaining to the RLMP are:

- the backfilling of the Approved Pit (ignimbrite pit)
- quarrying of the granite pit
- construction of an amenity bund to the west of the granite pit
- the construction of the southern and Lynwood overburden emplacement areas.

The location and extent of the ignimbrite pit as well as the granite pit is shown in **Figure 1.1**.

1.2 Objectives of the Rehabilitation and Landscape Management Plan

The objectives of this RLMP are to:

- provide the framework for site rehabilitation of Lynwood Quarry in accordance with the Development Consent
- outline the implementation procedure for the Habitat Management Area and identify ongoing management requirements
- define management requirements for riparian areas, including management of specific work sites within riparian areas to be disturbed within the five year period 2016 – 2021
- describe the strategies for management of remnant vegetation, habitat values and property management issues
- outline the landscaping strategy for Lynwood Quarry.

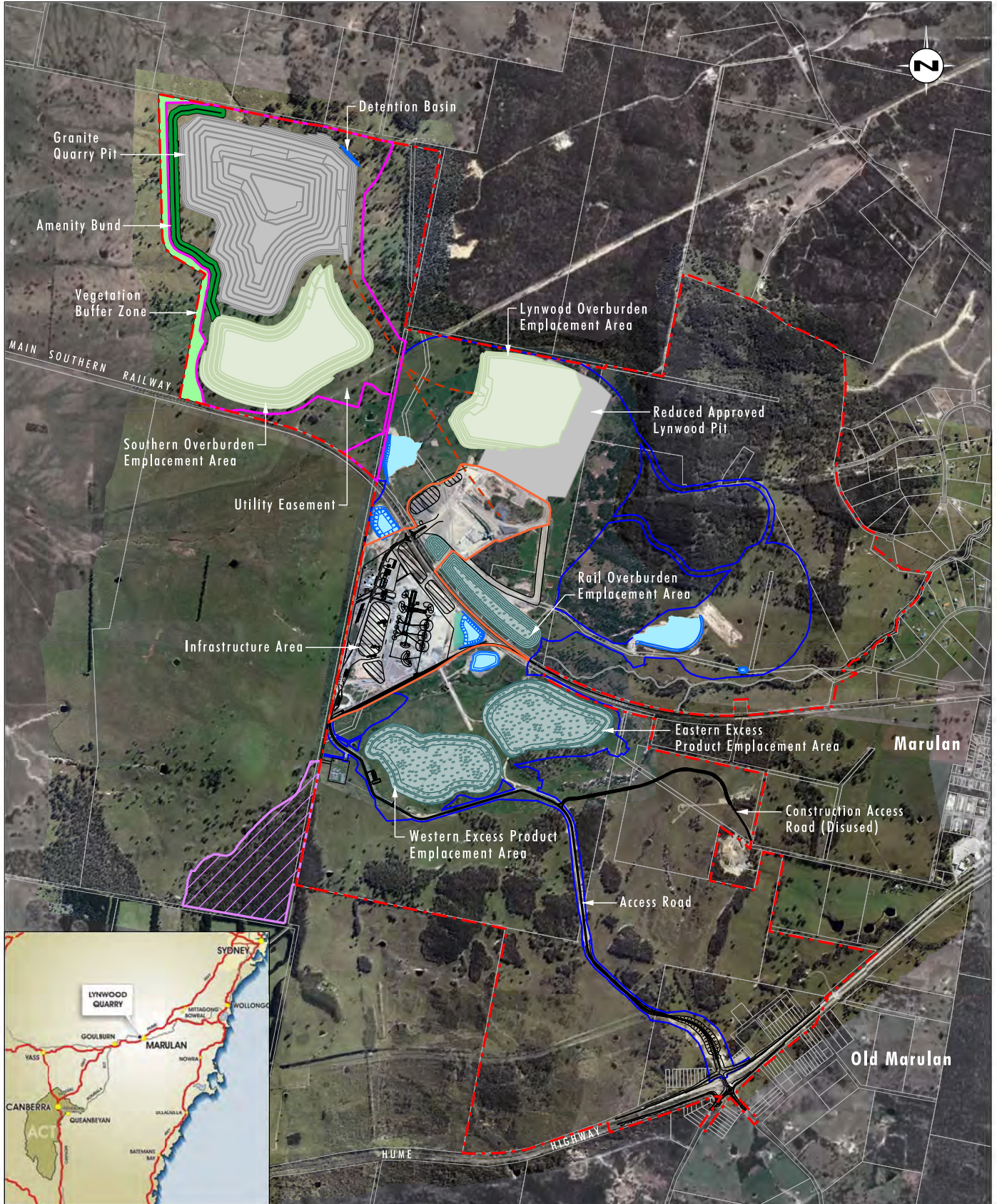


Image Source: Google Earth (2012), Holcim (2012, 2014)
 Data Source: LPI (2014), Holcim Australia (2015)

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- | | | |
|-----------------------------------|-----------------------------|-----------|
| Approved Project Area | Quarry Pit | Haul Road |
| Lynwood Infrastructure Area | Emplacement Area | |
| Approved Disturbance Footprint | Dam | |
| Granite Pit Disturbance Footprint | Overburden Emplacement Area | |
| Lynwood Infrastructure Layout | Vegetation Buffer Zone | |
| Habitat Management Area | Amenity Bund | |

FIGURE 1.1

Overview of the Modification Project

1.2.1 Existing Visual Character and Impacts

The visual landscape is dominated by the Hume Highway and associated service centres, residential areas, the Main Southern Railway, light industrial areas and developing rural residential areas surrounded by primarily cleared low rolling hills and valleys with minor drainage lines and patches of remnant vegetation. The scenic quality is considered to be low-moderate in the areas surrounding the Hume Highway and service centres, moderate in the township and surrounds and moderate to moderate– high in surrounding areas primarily unaffected by infrastructure and with remnant native vegetation.

Views of the granite pit area are shielded by topography to the east and north, however, there are external views of this area from the north-west, west, south-west and south. The granite pit area consists of primarily cleared grazing land with scattered trees and some small patches of native vegetation.

Overall, the area in the vicinity of the granite pit is considered to be of moderate scenic quality.

Due to potential visual amenity impacts affecting the Towrang community to the west of the site, a number of additional commitments to manage these impacts were included within a letter from Holcim to the Towrang community. This letter was attached to the Lynwood Quarry Extraction Area Modification Environmental Assessment (Umwelt, 2015) and commitments from this letter are provided in **Section 3.5.2**.

2.0 Consultation

In accordance with Condition 44 of Schedule 3 of the Development Consent this RLMP has been provided to the Office of Environment and Heritage (OEH), Department of Primary Industries Water (DPI Water) and Goulburn Mulwaree Council (Council) during 2016 for review. Comments on the RLMP Version 1 provided by Council during September 2016 have been incorporated into RLMP Version 1 prior to the plan being submitted to the secretary of DPE. This Version 2 document has addressed comments provided by DPE and OEH following the submission of Version 1.

A summary of the consultation undertaken is included in **Table 2.1** below.

Table 2.1 Agency Consultation

Version	Agency	Consultation Summary
1 (Oct, 2016)	DPE 2016	Draft V1 RLMP submitted to DPE. Comments from DPE to be addressed in revised RLMP with the RLMP to then be distributed to agencies for comment.
2 (May, 2018)	DPE May 2018	Comments on RLMP V1 received by OEH and DPE have been addressed in this revised RLMP.

3.0 Rehabilitation and Landscape Management

3.1 Rehabilitation during Years 2016 - 2021

As with all quarry operations, the progression of the quarry pit will be based on market demand and will therefore be subject to change. The progression of the rehabilitation of the site is therefore also subject to market demand.

The rehabilitation efforts will be focused on three areas over the first 5 years of operations; these are the haul road construction area, the western amenity bund and the southern edge of the overburden emplacement area. An additional rehabilitation focus will be the upper benches of the granite pit, particularly those benches on the eastern side of the pit to reduce visibility of the quarry to the west.

It is intended that overburden will be placed in the following priority order:

- haul road construction
- western amenity bund and southern edge of overburden emplacement area
- top faces of ignimbrite pit
- remainder of overburden emplacement area
- in-pit storage.

The general staging of the rehabilitation of the site for the first 5 years is shown on **Figure 3.1**. Short, medium and long-term measures to be implemented to achieve rehabilitation goals and objectives for the site are detailed in **Section 3.1.1** to **3.1.3**.

3.1.1 Short-term Measures

Pre-clearance Surveys/Tree Felling

Where it is necessary to disturb areas of native vegetation, a pre-clearance survey will be undertaken. Where felling of habitat trees is required the tree felling procedure outlined in this section will be implemented.

Pre-clearing requirements involve the completion of a pre-clearing survey by a suitably qualified person (e.g. an ecologist). Any recommendations or mitigation measures suggested as a result of pre-clearance surveys will be implemented as necessary to minimise impacts to habitat. This survey will identify any key fauna habitat features (e.g. tree hollows, hollow logs etc.) that need to be managed as part of the clearing process. Such features will be marked and the clearing procedure outlined below followed. Where no such key features are identified, clearing can proceed without the need to implement this procedure.



Image Source: Google Earth (2012), Holcim (2012, 2014)
 Data Source: LPI (2014), Holcim Australia (2015)

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|-----------------------------------|------------------------|-----------------------------------|
| Approved Project Area | Emplacement Area | Priority Areas for Rehabilitation |
| Lynwood Infrastructure Area | Dam | Overburden Emplacement Area |
| Approved Disturbance Footprint | Vegetation Buffer Zone | Amenity Bund |
| Granite Pit Disturbance Footprint | Amenity Bund | Haul Road |
| Lynwood Infrastructure Layout | | |
| Quarry Pit | | |

FIGURE 3.1

Extraction Area Modification Project
 Conceptual Stage 1

The clearing of vegetation will be undertaken in accordance with the following procedure:

- all wombat burrows will be identified and cleared using a one way gate, cages and then progressing digging using an ecologist and excavator prior to any activity being undertaken within a 50 metre (m) radius of a burrow entrance.
- nests and hollows will be inspected with an Elevated Work Platform (EWP) and suitably qualified person. Any active hollow or nest will be assessed and a plan will be put in place to relocate the wildlife prior to felling. Where hollows and nests are unable to be reached for inspection, care will be taken when felling the tree with the machinery operator pushing the tree over as slowly as possible, so as to minimise the intensity of impact when hitting the ground
- once the tree has been felled, the qualified person will inspect the tree (particularly tree hollows) for signs of any trapped or injured fauna.
- any injured fauna will be carefully captured by the qualified and experienced person, and taken to a wildlife carer or veterinary clinic
- cleared vegetation is proposed to be either mulched or placed on rehabilitation areas to assist in habitat re-establishment and
- The extent of vegetation clearance will be minimised to that associated with the next 12 months of operations.

3.1.2 Medium-term Measures

Weed Control

Weed species could inadvertently be brought into Lynwood Quarry with imported materials, machinery, or allowed to establish naturally through removal of native vegetation. A weed control program will be implemented to limit the spread and colonisation of noxious and environmental weeds at the Lynwood Quarry, and includes:

- Weed and seed free inspections will be undertaken for all machinery entering the quarry
- Annual inspections of the Quarry area to clarify any potential weed infestations
- Training of all personnel on the identification of weeds species.
- Every 4 years a comprehensive weed survey of all areas will be completed. This information will inform weed management strategies considered for the site and will assist in the decision making processes for weed control. Any weeds identified under local or state legislation as noxious or declared will be controlled and if possible eradicated as a primary focus. Environmental weeds will be a secondary priority for control
- the implementation of weed management in accordance with the *Pesticides Act 1999* when favourable conditions prevail. Weed control and eradication techniques will be suited to the species, location, environmental considerations within the area and as per the control measures recommended by the relevant local and state government advisory organisations and/or bodies.

Chemicals to be used on site for the purposes of weed control will be evaluated by review of their Material Safety Data Sheet and chemical label to determine their registration for control of target species, as well as the safety and environmental requirements during their use. Chemical spraying will be undertaken in accordance with the *Pesticides Act 1999*. A summary of the weed management activities undertaken on site will be reported in the Annual Review.

Pest Control

Feral fauna at Lynwood Quarry may impact native fauna species through predation and competition for resources such as food, shelter, and breeding sites. Feral animals can also have a detrimental effect on regenerating areas as well as soil stability.

An ongoing feral animal control program will include inspections for the presence of significant populations of feral fauna species. Feral animal control programs will be completed as required. The details of feral animal control actions will be reported in the Annual Review.

Erosion and Sediment Control

Appropriate erosion and sediment control works will be undertaken by Lynwood Quarry within the development area. Erosion and sediment controls will also be installed, where necessary, on rehabilitated areas. The erosion and sediment control measures that will be implemented to minimise risks associated with potential erosion and sediment impacts will be undertaken in accordance with the Lynwood Quarry Water Management Plan (Umwelt, 2018).

Bushfire Management and Onsite Fire Fighting Capacity

Water for use in fire-fighting is provided for by the site water management system. On-site storage is adequate to ensure that there is sufficient water available on site for bushfire fighting purposes. Fire-fighting equipment will continue to be provided at all infrastructure areas and mobile equipment maintained in accordance with Australian Standards and work, health and safety guidelines.

Lynwood Quarry will continue to implement the appropriate measures to reduce the risk of fire ignition and the spread of bushfire across the site in consultation with the NSW Rural Fire Service (RFS).

An annual fire load assessment will be undertaken in key locations throughout the area managed by Holcim to determine whether controlled burns are required. Asset protection zones in the form of hardstand areas, lawns or bare earth will be established and maintained around the quarry's permanent infrastructure to reduce bushfire risk at these locations. These areas will be maintained as fuel reduced areas throughout the life of Lynwood Quarry.

Holcim operate two water carts which will be used for fire fighting as required. These water carts together with graders, loaders and bulldozers used for quarrying, will provide effective bushfire fighting capability. In addition, emergency preparedness training for quarry personnel will include bushfire control techniques.

Additional fire services, such as fire hydrants, extinguishers and hose reels are provided and maintained in accordance with WHS guidelines at project infrastructure. Fire fighting equipment is also provided on mobile equipment and light vehicles operated at Lynwood Quarry. Water for use in fire fighting will be made available from the site water management system, which will ensure there will always be sufficient water available for on site bushfire fighting purposes.

3.1.3 Long-term Measures

Salvage of Environmental Resources

Where feasible, the salvage and relocation of hollow logs, fallen timber and boulders will be undertaken to augment habitat complexity within any areas to be rehabilitated (if this area has low occurrences of such habitat resources). The purpose of this will be to increase habitat complexity in these areas, to make them more habitable for native species.

Habitat features suitable for salvage will be identified and marked in the field as part of pre-clearance surveys. The procedure for salvaging and reinstating habitat features is as follows:

- salvage hollow bearing trees identified as part of the pre-clearance surveys, where practical and safe to do so
- Fencing off areas under rehabilitation and excluding cattle from primary habitat areas
- Removal of barb wire throughout the site
- Rehabilitation of the emplacement areas and amenity bund
- hollow bearing trees can be stockpiled in unused areas, if necessary, until able to be reinstated
- identify suitable areas to reinstate hollow bearing trees
- carefully reinstate hollow bearing trees to identified area and
- hollow logs can be placed in small piles to increase habitat complexity, while others can be placed individually in post-quarrying rehabilitation areas.

Visual

Lynwood Quarry will implement reasonable and feasible measures to minimise the visual and off-site lighting impacts of the development. Where practical, this may include:

- minimising night lighting impacts on the surrounding community by ensuring that lighting plants are positioned such that lighting is directed towards work areas and not towards private residences
- maintenance of light screen
- ensure switches are installed across the plant for conveyors above the light screen
- ensure infrastructure is built within the infrastructure footprint
- all buildings and infrastructure potentially visible to the public to be coloured in suitable natural tones and
- progressive rehabilitation of disturbed areas to reduce visual impacts where already identified.

Rehabilitation Review and Maintenance

Progressive rehabilitation, both completed and planned works, will be reported in the Annual Review. Planning details for final landform and decommissioning will be submitted to DPE and other relevant stakeholders closer to the end of the life of the quarry operations.

Maintenance of rehabilitated areas will be undertaken until a stable vegetative cover is achieved. If establishment is unsuccessful, application rates will be reviewed as necessary.

3.2 Construction Phase Rehabilitation

During the construction phase of the Modification Project, the following rehabilitation strategies will be implemented:

- the construction disturbance footprint will be kept within the 12 month projected footprint
- all disturbed areas not required for ongoing use will be rehabilitated in as timely a manner as possible

- areas to be rehabilitated, including road and earthworks batters, will be topsoiled and seeded with a cover crop and grass species
- erosion and sediment controls will be implemented in disturbed areas and prior to any disturbance in accordance with the Lynwood Quarry Water Management Plan until rehabilitation is complete
- rehabilitated areas will be monitored during construction and watering or remediation works undertaken as required
- rehabilitated areas will be monitored on an annual for the first three years of operations with rectification works implemented as required.

3.3 Quarry Rehabilitation

Progressive and timely rehabilitation of both quarrying areas will be undertaken throughout the Lynwood Quarry operations, particularly focussing on rehabilitation of the out-of-pit emplacement areas (refer to **Section 3.2.2**). The extraction stages and the conceptual final rehabilitation of the Lynwood Quarry operations are shown on **Figures 3.1 to 3.4**. Stages are used as opposed to years as the progression of the quarry pit will depend on the market demand for quarry materials which will fluctuate from year to year. Where practical, progressive rehabilitation of final benches in the quarry pit will also be undertaken. Due to the extent of the resource, the rehabilitation of final benches will not be undertaken in the initial 30 year period. Current areas of the site available for rehabilitation are limited. It is acknowledged that more detailed 'implementation' plans will be required to be developed for each rehabilitation area over the life of the quarry to meet the requirements of this RLMP. These details will be specific to each rehabilitation area and will continue to evolve over the life of the quarry. Annual progress with rehabilitation targets will be reported in the Annual Review so that progress is demonstrated.

The rehabilitation of the amenity bund and the outer faces of the overburden emplacement areas are a key element of the visual impact mitigation strategy (refer to **Section 3.2.1.1**).

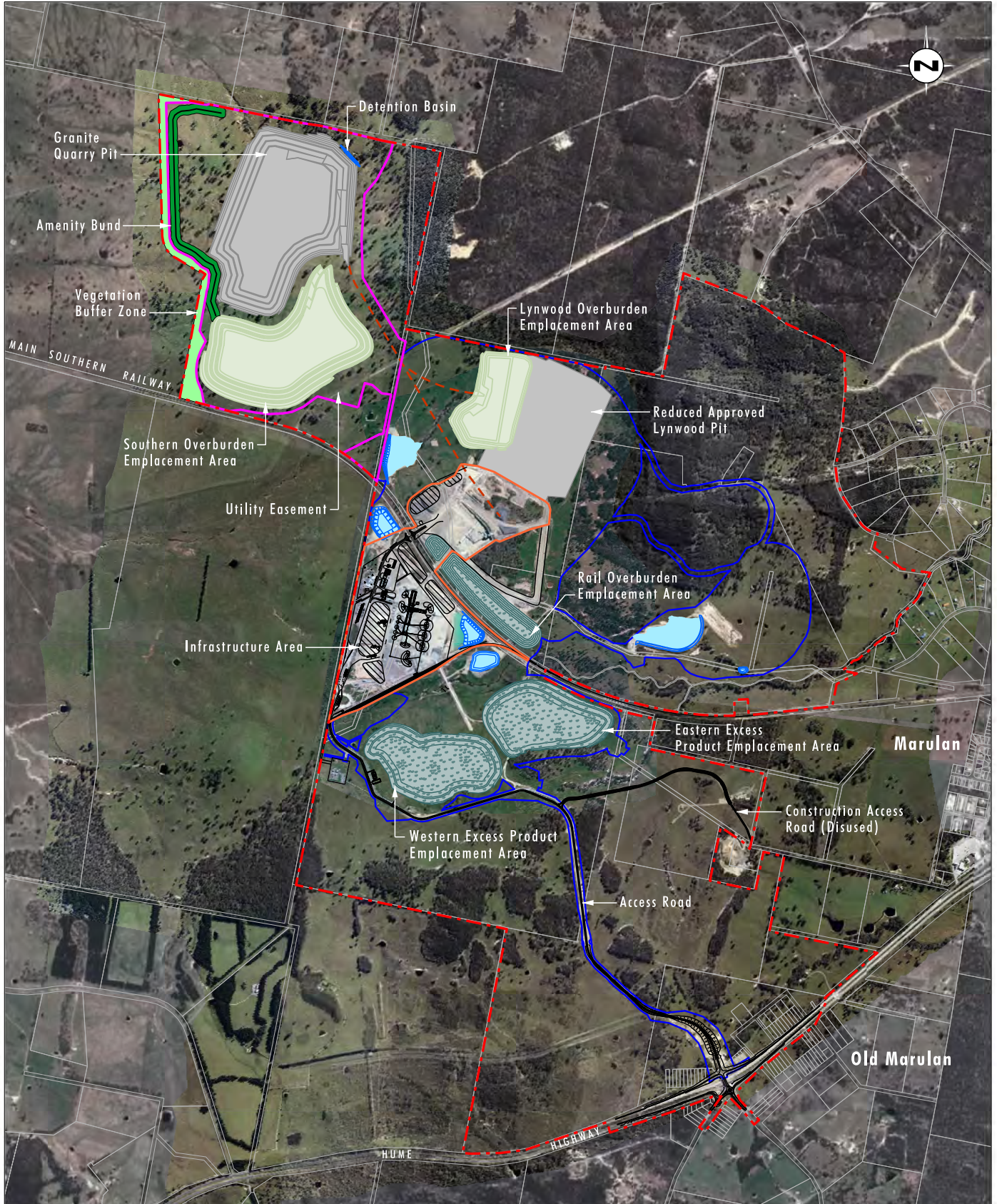


Image Source: Google Earth (2012), Holcim (2012, 2014)
 Data Source: LPI (2014), Holcim Australia (2015)

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Legend

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|--|---|
| - - - Approved Project Area | Emplacement Area |
| Lynwood Infrastructure Area | Dam |
| Approved Disturbance Footprint | Overburden Emplacement Area |
| Granite Pit Disturbance Footprint | Vegetation Buffer Zone |
| Lynwood Infrastructure Layout | Amenity Bund |
| Quarry Pit | Haul Road |

FIGURE 3.2

**Extraction Area Modification Project
 Conceptual Stage 3**

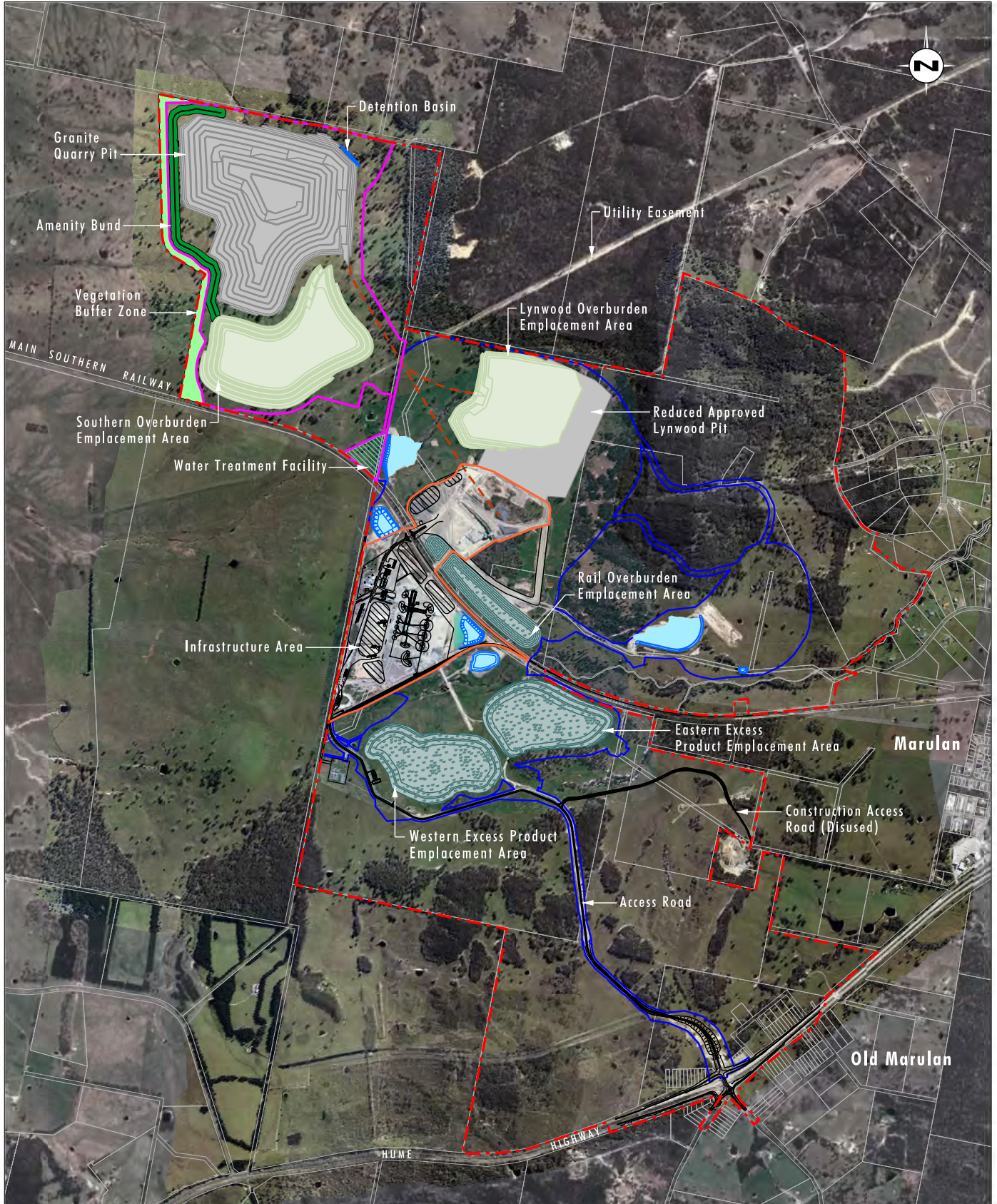


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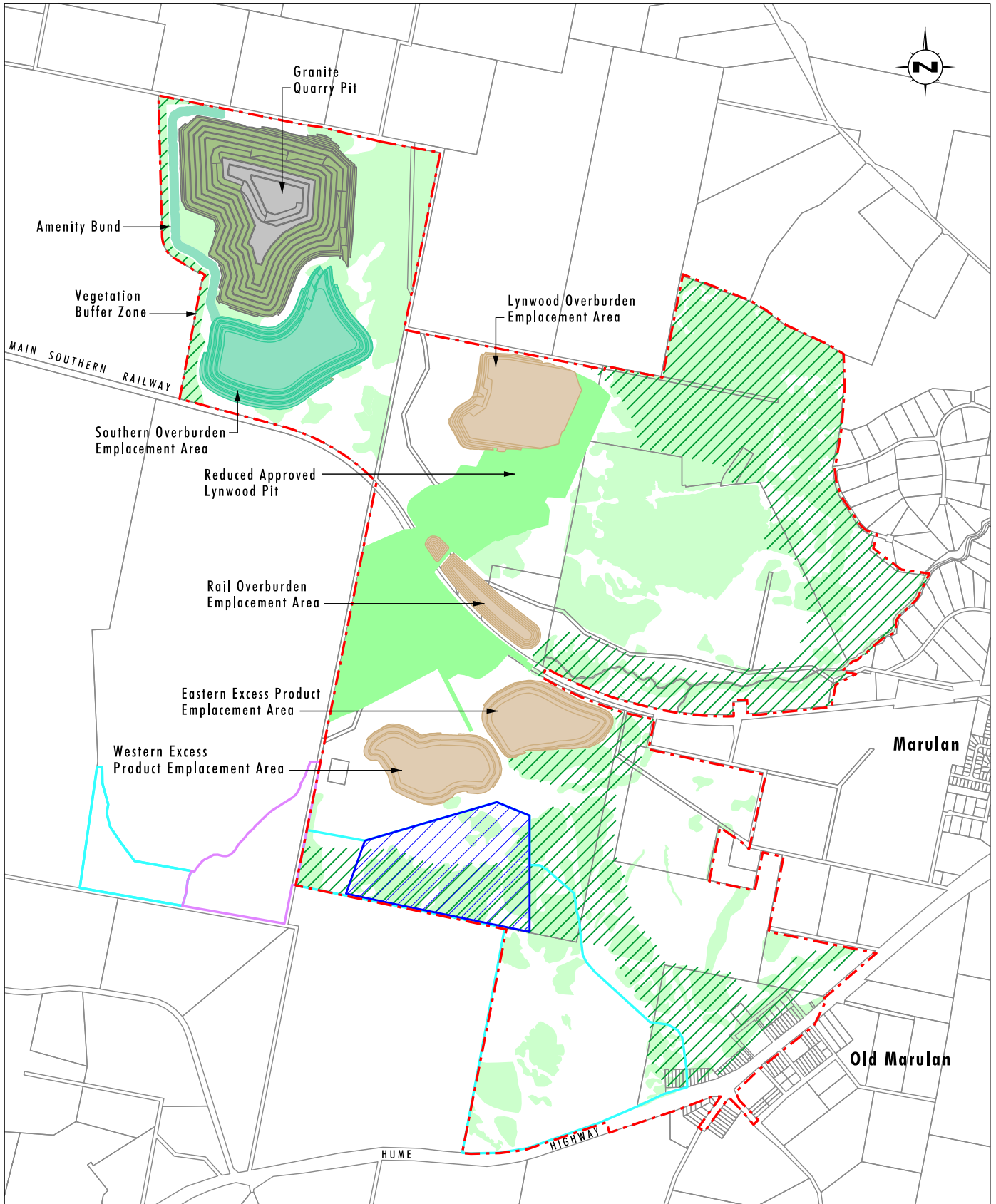
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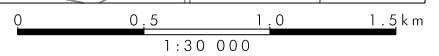
- | | |
|-----------------------------------|-----------------------------|
| Approved Project Area | Water Treatment Facility |
| Lynwood Infrastructure Area | Dam |
| Approved Disturbance Footprint | Overburden Emplacement Area |
| Granite Pit Disturbance Footprint | Vegetation Buffer Zone |
| Lynwood Infrastructure Layout | Amenity Bund |
| Quarry Pit | Haul Road |

FIGURE 3.3

**Extraction Area Modification Project
 Conceptual Stage 6 (Life of Project)**



Data Source: LPI (2014), Holcim Australia (2015)



Legend

- - - Approved Project Area
- Biodiversity Offset Area
- Habitat Management Area
- Cultural Heritage Management Zone
- Existing Vegetation
- Rehabilitated Area - Biodiversity Values or Grazing
- Rehabilitated Area - Biodiversity Values
- Rehabilitated Area - Grazing
- Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (PCT 1330)
- Rehabilitated Quarry Batter
- Assisted Natural Regeneration

FIGURE 3.4

Conceptual Final Rehabilitation

The key elements of the rehabilitation strategy include:

- the early, timely and progressive rehabilitation of disturbed areas.
- the surface of the southern overburden emplacement area and the Lynwood overburden emplacement area will be shaped in a generally irregular landform to resemble a natural surrounding landform wherever possible.
- stripped topsoil will be placed in stockpiles no greater in depth than 3 m and will be seeded with a cover crop if they are to remain in place for longer than six months.
- shaped areas will be covered with topsoil, seeded with a native species and cover crop mix with intent of achieving mixed grassland and woodland native vegetation communities.
- selected surface habitat features consisting of large rocks, logs and trees from clearing undertaken will also be placed across the rehabilitated area. These features will provide potential fauna habitat and will aid in achieving a stable landform.

3.3.1 Quarry Pit Rehabilitation

Ignimbrite Pit Rehabilitation

The remaining ignimbrite pit void will be filled with overburden emplacement from the new granite pit. The granite pit will have a void at closure. The staging of rehabilitation of the emplacement areas shown conceptually on the **Figures 3.1 to 3.4** with detailed annual plans for the emplacement included within the Annual Review. Works considered for the rehabilitation of the granite are discussed below.

Granite Pit Rehabilitation

The granite pit will be progressively rehabilitated where practicable, as quarrying progresses and final benches are established. Rehabilitation of the granite pit will be achieved by battering back the upper benches to remove the bench and achieve a more stable sloping landform. This battering back of only the upper bench is practical. It is not possible for lower benches as the rock is harder and there is insufficient space. Once the battering back of this upper bench is complete, the shaped area will be topsoiled and seeded with a native species.

Rehabilitation of the remaining quarry benches will be completed by placing an approximately 1 m thick layer of overburden on the quarry bench. A bund will be created on the outer edge of the quarry bench to act as a safety barrier and to make the bench internally draining, ensuring any rain captured will be retained and be available for vegetation. The overburden will be covered with topsoil excluding an access track established along the entire bench. Topsoil will be spread to a depth of approximately 0.1 m. A reduced extent of topsoil depth is considered appropriate for the quarry benches as these areas will not be subject to grazing pressure (by either native animals or domestic stock) and there is limited potential for erosion impact.

Once topsoil placement has been completed, the benches will be seeded with a native tree species mix and a grass species mix also used on the safety bund. Sub-drilling and impacts by quarry equipment will result in an approximately 1 m depth of cracking of the bench floor. This combined with approximately 1 m depth of overburden will achieve acceptable levels of tree stability through root extension.

The progressive rehabilitation of the emplacement areas is shown on **Figures 3.1 to 3.3** with the conceptual final Year 30 rehabilitation progress shown on **Figure 3.4**. The conceptual final land use for the majority of the Lynwood Quarry is to provide areas of native vegetation and native fauna habitat. The rehabilitated area will be suitable for managed low intensity grazing; however, the area will be managed predominantly for its habitat values, particularly the area north of the Main Southern Railway.

The quarry pit itself will be rehabilitated through the establishment of trees on the final quarry benches. Rehabilitation of the Ignimbrite Pit will also be progressed, with each of the benches treated and seeded with native trees as discussed in **Section 3.2.2**.

3.3.2 Emplacement Area and Amenity Bund Rehabilitation

Overburden and Excess Product Emplacement Areas

Once bulk dumping and reshaping has occurred, the surface of the all overburden and excess product emplacement areas will be shaped to allow for rehabilitation.

As a priority, recently stripped topsoil will be used and the areas will be seeded with native species listed in **Appendix 2** to achieve a woodland/open forest vegetation community. The excess product emplacement areas to the south of the Main Southern Railway are expected to be seeded with species from the Tableland Low Woodland vegetation community while the overburden emplacement areas to the north of the Main Southern Railway are expected to be seeded with a mixture of Tableland Grassy Box-Gum Woodland and Western Tablelands Dry Forest vegetation communities (refer to **Appendix 2**). Locally sourced seed will be used wherever practicable for rehabilitation works.

The overburden emplacement areas will typically be constructed in 2 m lifts by emplacement of material by truck and spreading and track rolling by dozer. A 5 to 10 m high outer shell will be maintained on the western, southern and northern edge of the Southern Overburden Emplacement Area during its construction to reduce potential noise impacts and to reduce the duration of visibility of working equipment as the dump nears its maximum height.

The completion of timely rehabilitation, particularly on the western face of the amenity bund, and the western, southern and northern faces of the southern overburden emplacement area are a key part of the visual impact mitigation strategy. The face of each 'lift' of the southern overburden emplacement area will be constructed and then rehabilitated as the first priority. This will allow rehabilitation to progress whilst the remainder of that lift is being emplaced (refer to **Figure 1.1**). This will also reduce the total extent of disturbed area and the visual impact of the quarry operations.

Rehabilitation of the Southern Overburden Emplacement Area is provided conceptually on **Figure 3.4**. Rehabilitation of this area will aim to establish PCT1330 Yellow Box – Blakely's Red gum grassy woodland on the tablelands, South Eastern Bioregion which aligns with a plant community type (PCT) that occurs naturally in the locality. The species mix that will be considered as part of this conceptual rehabilitation approach will aim to include the characteristic species outlined for PCT1330 in OEH's Vegetation Information System (VIS) (OEH 2018). If a Year 30 closure occurs, the remaining sections of emplacement areas not yet rehabilitated will be revegetated. Vegetated corridors will be established to connect these areas to rehabilitated infrastructure areas and surrounding remnant vegetation. Native woodland vegetation with a primarily native grass groundcover will be established on the rehabilitated emplacement areas and decommissioned infrastructure areas.

Amenity Bund

Adjacent to the western boundary and along the northern boundary of the granite pit a 12 m high amenity bund will be constructed (see **Figure 1.1**). The northern section will terminate before it intersects with the tributary flowing from the northern extent of Lynwood Quarry. At spot locations the bund may be extended to 14 m in height if required.

Rehabilitation of the amenity bund is provided conceptually on **Figure 3.4**. Rehabilitation of this area will aim to establish PCT1330 Yellow Box – Blakely’s Red gum grassy woodland on the tablelands, South Eastern Bioregion which aligns with a plant community type (PCT) that occurs naturally in the locality. The species mix that will be considered as part of this conceptual rehabilitation approach will aim to include the characteristic species outlined for PCT1330 in OEH’s Vegetation Information System (VIS) (OEH 2018).

Species selection will ensure a thick, evergreen, robust screen can be achieved. These species have been identified and are included in **Appendix 3**. All bund vegetation will be appropriately maintained, watered, fertilized and where required, replaced or replanted from time to time to ensure the objective of the bund and vegetation is achieved.

3.3.3 Topsoil Management

Topsoil will be stripped in all areas to be disturbed for infrastructure and quarry activities. Topsoil stripping will be managed to ensure maximum recovery of topsoil, protect its quality and enhance rehabilitation outcomes. Where possible, as the granite pit development occurs, topsoil will be in demand for the amenity bund, ignimbrite and Southern Overburden Emplacement Area. It is intended that works will be coordinated to ensure stripping will coincide directly with topsoil emplacement in these areas. This will reduce the deterioration of the topsoil by reducing movement. Quick successive and progressive rehabilitation will be a part of the works program.

Initial topsoil derived from the first stages of granite pit and haul road development will need to be stored for a period of time as rehabilitation activities will have not yet begun.

All topsoil stockpiles will be shaped and grassed immediately, have a 3:1 slope and be no taller than 3 m. All stockpiles will be signposted to ensure they are clearly identified. All topsoil managed through windrows, shaped areas and haul roads will be grassed within 6 weeks of being established. Across all topsoil areas noxious weeds will be managed. Appropriate erosion controls will be installed at the base of stockpiles to prevent sedimentation issues in the receiving environment. Erosion controls may include construction of earthen banks upslope of stockpiles to divert water around the stockpile and the utilisation of sediment fencing down slope of the stockpile. Temporary stockpiles can be protected from erosion via the use of geofabric with longer term stockpiles to be revegetated with a cover crop.

A topsoil stripping plan will be implemented for each individual package of construction works for the site. Following stripping of topsoil, soil characterisation will take place to determine the topsoils suitability for its use in rehabilitation. To enable topsoil to be utilised within rehabilitation works, Holcim may import local topsoil or a topsoil alternative to assist with the rehabilitation at Lynwood Quarry. Thorough soil testing in accordance with legislative requirements will be undertaken prior to any foreign soil material being imported to site. In addition, a weed free certificate will be provided.

3.4 Conceptual Decommissioning Plan

Lynwood Quarry is planned to continue beyond the initial 30 year approval period. Should an extension not be granted, the quarry will be decommissioned and closed in 2037. Upon closure of the quarry:

- unless an alternative use of the quarry infrastructure is identified, the infrastructure will be removed and the areas containing the surface infrastructure will be re-contoured. The reshaped areas will then be seeded with a native species and cover crop mix with the intent of achieving mixed grassland and woodland native vegetation communities
- the haul roads will be removed and water management controls either removed or modified to assist in stabilisation of the final landform and to capture any sediment runoff from the rehabilitated areas. The final decision on whether or not specific roads will remain in place will be determined as part of the closure process. This includes the sealed access road, however, it is noted that at this point in time Holcim considers it likely that the sealed road would be left in place to provide appropriate access for future land uses.

3.5 Visual Amenity Controls

3.5.1 Environmental Assessment Commitments

The following additional landscaping and visual controls will also be implemented:

- Amenity Bund – an approximately 12 m high amenity bund (and 14 m in spot locations, as required) is proposed to be constructed along the western boundary of the granite pit area.
- Lighting – there will be no fixed lighting in the granite pit area.
- Lighting – quarry operations on the surface including topsoil stripping, overburden extraction and overburden emplacement will be daytime operations only and therefore do not have any potential to result in lighting impacts.
- Lighting – quarrying within the granite pit will occur in the evening period (up to 10 pm) but will be managed so that extraction activities are undertaken in areas that are not visible from the potential viewing locations to the west (i.e. on lower benches or on the western face of the quarry), with mobile lighting plant kept low and pointing down, facing away from western residences and kept to the minimum needed for operational safety.
- Lighting – a bund will be constructed along the western and southern faces of the haul road from the granite pit to the infrastructure area. The purpose of this bund will be to seek to screen the headlights of vehicles operating on the haul road during the evening period (6 pm to 10 pm). The bunding will be approximately 5 m high.
- Overburden emplacement – these activities will be daytime only. Holcim Australia will seek to construct the outer edges of the overburden emplacement areas first, creating an approximate 5 to 10 m high bund behind which overburden emplacement activities will continue.
- Overburden emplacement – emplacement areas will be rehabilitated as soon as practicable after final shaping, with progressive rehabilitation to be undertaken over the life of the quarry so that the externally visible disturbed area is kept as small as practicable. Revegetation will be undertaken to result in mixed grassland and woodland vegetation that will be similar in visual character to the surrounding natural landscape.

- Overburden emplacement – the surface of the southern overburden emplacement area and the Lynwood Overburden Emplacement area will be shaped to have swales, small drainage hollows and a locally irregular landform to resemble, where practicable, the natural surrounding landform (it is noted that the bulk emplacement landforms are shown on the EA figures and that the detailed design of the emplacement areas will be more variable as per this commitment).
- Quarry operations – the upper western facing benches of the granite pit (which are in overburden material) will be shaped and rehabilitated progressively as the quarry progresses. These areas will be visible from a small number of elevated properties in Towrang and so will be rehabilitated as soon as practicable to reduce visibility.
- Maintenance – Holcim Australia will maintain the amenity bund and its vegetative cover so that it remains effective for the duration of the quarry operations.

Collectively these visual impact mitigation measures contribute to reducing the visual impacts of the granite pit area.

3.5.2 Towrang Community Commitments

A number of commitments were also made as a part of the Lynwood Quarry Extraction Area Modification (Umwelt, 2015) to minimise visual impacts of the construction of the granite pit and associated infrastructure on the Towrang Community. The list of commitments are included in Appendix 11 of the Development Consent and include but are not limited to:

- the construction of an amenity bund adjacent to the western boundary of the site and vegetation of the bund (as described in **Section 3.5.1** above)
- revegetation of the granite pit eastern overburden bench
- the use of semi permanent visual screens to shield overburden removal activities
- the construction of bunding on the southern and western faces of the haul road to screen movement of vehicles
- construction of a light-proof fence along the western boundary of the car park access road and car park
- minimisation of height of light fittings to 8.5 m in height in the car park and car park access road
- specifications regarding the type of lighting for the conveyor system and other specifics regarding light angles and brightness as per the 'Webb lighting report' discussed in Appendix 14 of the EA (Umwelt, 2015).

3.6 Riparian Area Management Plans

Riparian Area Management Plans (RAMPs) have been prepared for the Marulan, Lockyersleigh and Joarimin Creeks catchments (included as **Appendices 4, 5 and 6**). The RAMPs include the management of works within protected lands and waters as defined by the *Water Management Act 2000* (WMA Act) that were approved as part of the project.

3.7 Property Management

Management of all non-quarrying land use activities within the project area will be the responsibility of the Senior Environment and Community Liaison. Key property management issues include:

- grazing management
- erosion and sediment control
- management of weeds and feral animals
- bushfire management
- identification and protection of other key values of the project area (e.g. historic heritage values).

3.7.1 Grazing Management

In the event that grazing is undertaken, stock levels will be maintained at low levels to ensure that good ground cover is retained and regenerating woodland areas are not significantly adversely affected. Grazing activity will be focussed outside of protected and project infrastructure areas.

The Senior Environment and Community Liaison (or their delegate) will undertake regular inspections of areas with grazing activity to ensure the local environment is not being adversely impacted. A grazing management plan will be developed and identify control measures to be implemented by the Senior Environment and Community Liaison. The management plan will consider sedimentation and erosion, grass cover, fencing riparian areas, off stream watering points, native pastures, rehabilitation and the protection of environment and cultural heritage considerations.

3.8 Ecological Management

Ecological management strategies to be implemented at Lynwood Quarry will include:

- establishment of a Habitat Management Area
- rehabilitation of riparian corridors (refer to **Section 3.4**)
- enhancement of arboreal habitat, including enhancement and protection of squirrel glider habitat
- management of remnant woodland.

Further details of the management strategies are included in the following sections.

3.8.1 Maintenance of Habitat Management Areas

Holcim has established and maintains a Habitat Management Area (HMA) to offset the loss of vegetation within the quarry footprint. The HMA will be established in the northeast of Lynwood Quarry and is managed for the conservation of ecological values (**Figure 3.5**). In accordance with the Development Consent, Holcim will implement the HMA unless it is incorporated into a conservation area subject to a biobanking agreement.

The HMA is approximately 130 hectares (ha), of which 105 ha is presently vegetated. This is extended to 8.7 ha HMA along Joarimin Creek (the Joarimin Creek Corridor) which also protects Aboriginal cultural heritage values.

The HMA's are fully fenced and exclude cattle. Barbed wire from old fences will be progressively removed to limit the potential to impact on all native animals, but particularly glider species. Signs identifying the area's as a HMA are to be erected around the perimeter.

Through assisted regeneration and plantings, Holcim will establish an additional area of approximately 25 ha of native vegetation within the HMA. The success of natural regeneration will be monitored annually for the first five years after the commencement of quarry operations (refer to **Section 4.0**).

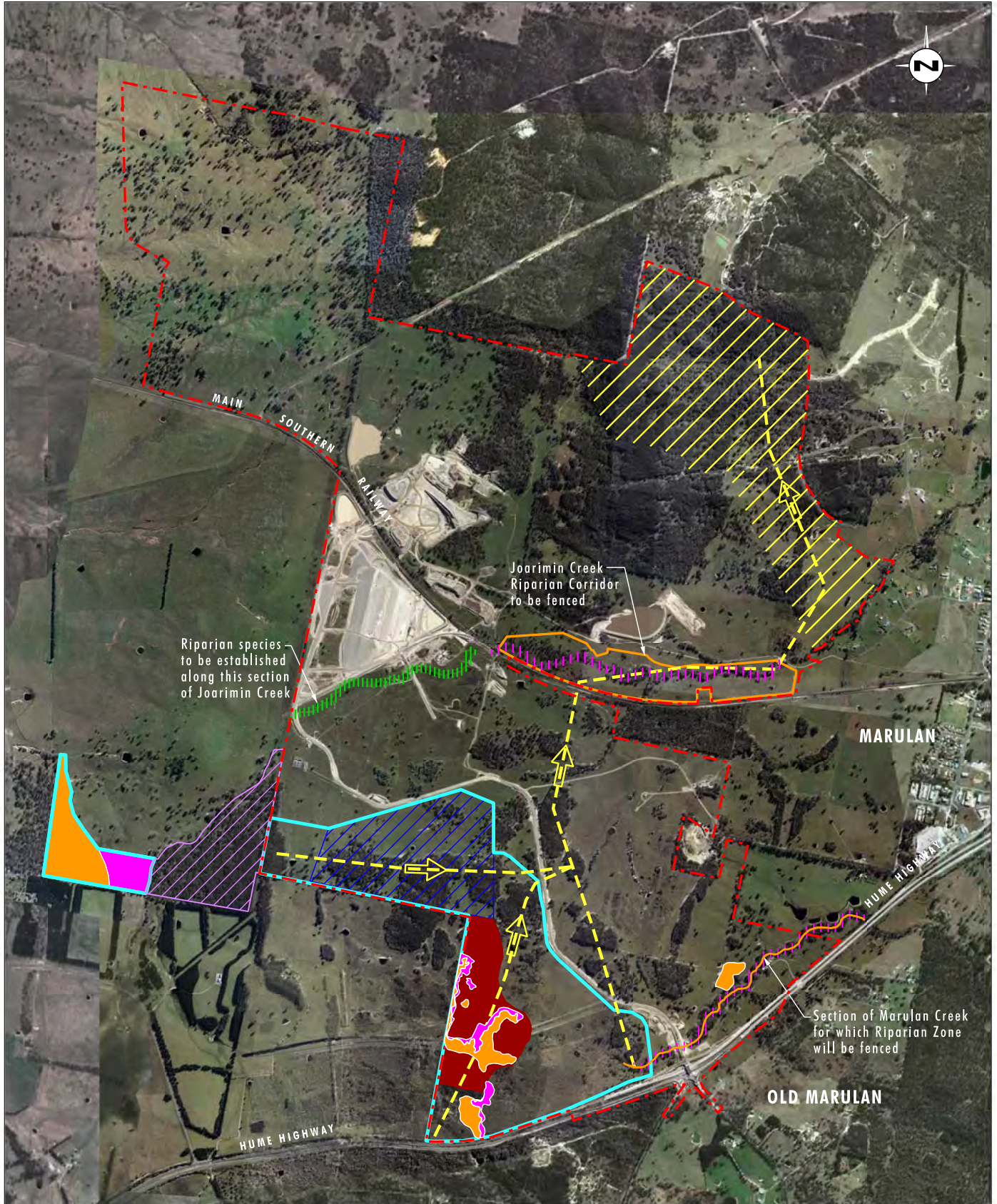
If natural regeneration does not occur by the third year of annual monitoring, then supplementary planting or seeding will be undertaken. Species established will represent the existing vegetation communities within the HMA, being Western Tablelands Dry Forest, Tableland Grassy Box-Gum Woodland and Tableland Low Woodland. The riparian species to be established along the creek line will also include *Acacia mearnsii* and *Acacia dealbata* (refer to **Appendix 2**).

3.8.2 Enhancement of Arboreal Habitat

Tree hollows are an important habitat feature providing roosting and nesting habitat for a range of fauna species including the threatened squirrel glider which was identified in the project area. Some tree hollows will be lost due to clearing associated with the project with strategies therefore planned to replace the arboreal habitat affected.

The maintenance and replacement of arboreal habitat is achieved through the relocation of tree hollows salvaged during clearing operations or the establishment of nest boxes. Holcim will replace cleared hollow bearing trees with durable and appropriate nest boxes that reflect the type, size, usability and condition of the hollows to be cleared. To ascertain the need to relocation of tree hollows or nest box erection, an ecologist will undertake a pre-clearing inspection to identify hollow resources. An inspection will also be undertaken of a target hollow erection area to identify its habitat enhancement needs (e.g. existing hollow resources, consideration of carrying capacity for target species etc.) and advice provided on the number and type of hollows that need to be erected.

The details of the height, aspect, design, location and timing of placement of nest boxes will be recorded, with the results of next box monitoring (refer to **Section 4.4.4**) to be reported in the Annual Review. If nest boxes are required to be installed, representative nest box monitoring will be undertaken annually for a period of 5 years. After the first 5 years, condition inspections of nest box condition will be undertaken once every 4 years.



Source: LPI 2010, Holcim Australia (Aerial Photo May 2012), Google Earth (2011)

0 0.5 1 1.5km
1:30 000

Legend

- Approved Project Area
- Existing Approved Habitat Management Area
- Existing Approved Core Riparian Corridor
- Existing Approved Cultural Heritage Management Zone
- Stepping-Stone Corridor
- Box Gum Woodland Derived Native Grassland (CEEC)
- Box Gum Woodland (CEEC)
- Biodiversity Offset Area
- Box Gum Woodland CEEC Regeneration
- Habitat Management Area

FIGURE 3.5

Existing Lynwood Quarry Conservation and Management Areas

3.8.3 Management of Remnant Woodland

Measures for the management of remnant woodland within the HMA and in riparian zones have been discussed above in **Sections 3.4.1** and **3.6.1**. The remaining remnant woodland occurring within the project area that is outside the quarry footprint, will also be managed during the life of the project to maintain its ecological values. Strategies will include management of grazing impacts, weed and feral animal control, sediment and erosion control and encouragement of natural regeneration.

One of the aims of remnant woodland management is to improve connectivity of remnant vegetation patches within the project area to provide improved habitat corridor function. The general path of this habitat corridor is shown on **Figure 3.5**. The core corridor area will be north of the Main Southern Railway linking the core riparian zone of Joarimin Creek through the HMA to the vegetated areas to the north. The section of the habitat corridor south of the Main Southern Railway will form a 'stepping stone' corridor, as it will be crossed by infrastructure in several locations and separated by areas of pasture. Despite this, it will form a movement corridor able to be utilised by more mobile species including bats and birds.

4.0 Monitoring

The ecological monitoring schedule for Lynwood Quarry is detailed in **Table 4.1**. Information regarding the monitoring to be undertaken is included in **Appendix 7**.

Table 4.1 Ecological Monitoring Schedule

Monitoring	Description	Frequency
Vegetation Screens	Monitoring to be undertaken for plant health and to ensure the vegetation is healthy and trending towards criteria as defined in Section 5 .	Annually for 4 years from start of project.
Cladding	Cladding of buildings to be monitored to ensure that the painted natural tones have not been damaged by exposure.	Annually after 8 years from start of project.
Retained Vegetation	Monitoring undertaken at HMA, along Joarimin Creek north of the Main Southern Railway and in the Cultural Heritage Management Zone.	Year 1 of Project and then every three years. If monitoring is positive for 3 consecutive periods, it can be extended to once every 10 years.
Revegetated Areas	Monitoring to be undertaken for plant health and to determine whether any remedial actions are required to be undertaken in revegetated areas.	Annually for first 3 years following seeding/planting of revegetated areas.
Fauna monitoring	Fauna monitoring at Lynwood Quarry.	Year 1 of Project and then every three years thereafter. If monitoring is positive for 3 consecutive periods, it can be extended to once every 10 years.
Nest Box monitoring	Representative nest box monitoring will be undertaken annually with all nest boxes monitored after 5 years, as required following nest box installation. Following initial 5 year period nest box monitoring will include condition assessments only.	Representative monitoring annually for first 5 years. After the first 5 years, condition inspections of nest box condition will be undertaken once every 4 years.

Note: Aquatic monitoring included in RAMPs.

5.0 Completion Criteria

Completion criteria have been established for the key rehabilitation works required by this RLMP and for the HMA. The completion criteria are designed to ensure that the required works are completed in accordance with this plan and achieve relevant rehabilitation and biodiversity management objectives.

Revegetated Areas

The completion criteria to be applied to revegetated areas, including vegetation screens established as part of the landscaping strategy are identified in **Table 5.1**.

Table 5.1 Revegetated Areas Preliminary Completion Criteria

Area	Objective / Performance Indicator	Preliminary Completion Criteria	Timing
Planting or direct seeding areas	Vegetation has been established at the revegetation area and there are no additional works required to be undertaken to assist to meet the requirements of the rehabilitation management plan or any other management plan.	Ground cover comparable to surrounding environment and the establishment of revegetation is such that it no longer requires attention to assure its successful development (>3 years of growth).	Monitor annually until condition criteria achieved.
Amenity Bund and emplacement areas	Rehabilitated areas are stable.	Areas of exposed soils are revegetated to achieve cohesive ground cover using a native plant species mix compatible with the surrounding environment and erosion has stabilised and resembles natural processes	Monitor annually until condition criteria achieved.
Natural areas	The site is managing significant weed or feral animal infestations	No increase in weed and feral pest populations and monitoring indicates the absence of or decline in weed species. Weeds comprise no more than 15%.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken. .
Planting or direct seeding areas	The rehabilitated community is representative of the targeted vegetation community being PCT1330 - Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion.	Revegetation is progressing towards a sustainable ecosystem and only requires maintenance that is consistent with the intended final land use. More than 56% of established trees are healthy and growing and the rehabilitation is recognisable as PCT 1330.	When monitoring indicates revegetation has established on disturbed areas and stratum has reached more than 56% established, healthy trees (1.5 to 2m in height) or approximately 10 years from planting.

Area	Objective / Performance Indicator	Preliminary Completion Criteria	Timing
Habitat areas devoid of habitat features and accessible for log and rock placement.	Use cleared trees and boulders to create habitat features in accessible habitat management areas	All logs and boulders available for relocation have been placed in habitat areas that are accessible by machinery.	Monitor every 2 years with the intent to achieve completion within 10 years of clearing activities.
Areas where assisted natural regeneration is primary activity	Monitoring has indicated that natural regeneration is occurring.	Signs of seeding occurring and signs of recruitment in all stratum. Or evidence to demonstrate that the ecosystem will progress towards recruitment.	When monitoring indicates natural regeneration is establishing itself and weed coverage is <15% of the area to be regenerated.
Fencing, exclusion and protection works	Rehabilitated areas signposted and fenced off from active quarry operations to prevent access.	All fences are in place, no barb wire exists in the internal fencing, signs are in place and gates are secured and operational. Internal fences that are no longer required are removed.	As completed and monitored annually for maintenance purposes.

Habitat Management Area

Completion criteria for the HMA are identified in **Table 5.2**:

Table 5.2 Habitat Management Area Preliminary Completion Criteria

Objective/Performance Indicator	Preliminary Completion Criteria	Timing
The boundary of the HMA has been fenced and internal fencing has no barb wire.	HMA signposted and fenced off from active quarry operations to prevent access. Barb wire completely removed from internal fencing	Within 5 years of implementing the Rehabilitation and Landscape Management Plan.
Cattle have been excluded from the area and appropriate signage erected.	Installation of fencing around the perimeter of the HMA to exclude cattle.	Within 6 months of implementing the Rehabilitation and Landscape Management Plan.
Nest boxes have been established, monitored and are being maintained.	Nest boxes are being utilised or show signs of use by native species. Each nest box installed should be in good structural condition and functioning in the landscape	Completed within 5 years of clearing activities
The site is managing significant weed or feral animal infestations with a demonstrable reduction pre construction.	Weed and pest inspections show no increase in weed population and monitoring indicates the absence of or decline in weed species.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken. .
Natural regeneration is occurring.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing and are recognisable as PCT 1330.	When monitoring indicates revegetation has established and no longer requires assistance.

Core Riparian Corridors

Completion criteria for the core riparian corridors are identified in **Table 5.3**

Table 5.3 Core Riparian Corridors Preliminary Completion Criteria

Objective / Performance Indicator	Preliminary Completion Criteria	Timing
The required areas have been fenced to exclude cattle where required.	Installation of fencing around the perimeter of the corridor to exclude cattle	Within 6 months of implementing the Rehabilitation and Landscape Management Plan
Revegetation works have occurred along Joarimin Creek south of the Main Southern Railway.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing.	When monitoring indicates revegetation has established on disturbed areas and stratum has reached more than 56% established, healthy trees (1.5m to 2m in height) or approximately 10 years from planting.
Nest boxes along Joarimin Creek have been established, monitored and are being maintained.	Nest boxes are being utilised or show signs of use by native species. Each nest box installed should be in good structural condition and functioning in the landscape	Completed within 5 years of clearing activities
The site is managing significant weed or feral animal infestations with a demonstrable reduction pre construction.	Weed and pest inspections show No increase in weed population and monitoring indicates the absence of or decline in weed species.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken.
Monitoring has indicated that natural regeneration is occurring.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing and are recognisable as PCT 1330.	When monitoring indicates any revegetation has established and stratum has reached more than 56% establishment or approximately 10 years from any revegetation works.

6.0 Responsibilities

The Quarry Manager is responsible for providing sufficient resources to ensure the effective implementation of this plan. The Senior Environment and Community Liaison is responsible for the effective implementation of this plan, including management of rehabilitation works, landscaping works, riparian zones and woodland habitats.

The Senior Environment and Community Liaison is responsible for the regular review, and update as necessary, of this plan.

7.0 Reporting and Review

The Senior Environment and Community Liaison will report on activities required by this plan in the Annual Review including:

- revegetation activities
- establishment and function of the HMA
- nest box installation
- property management activities including weed and feral animal control
- monitoring.

The Annual Review will be made available to the public through the CCC and the Lynwood Quarry web site.

This plan will be reviewed, and revised as necessary, in accordance with Condition 5 of Schedule 5 of the Development Consent. If any significant changes are made to the plan as part of one of these reviews, the Senior Environment and Community Liaison will consult with OEH, DPI Water and Council regarding the changes and will provide the revised plan to DPE for approval prior to implementation.

8.0 References

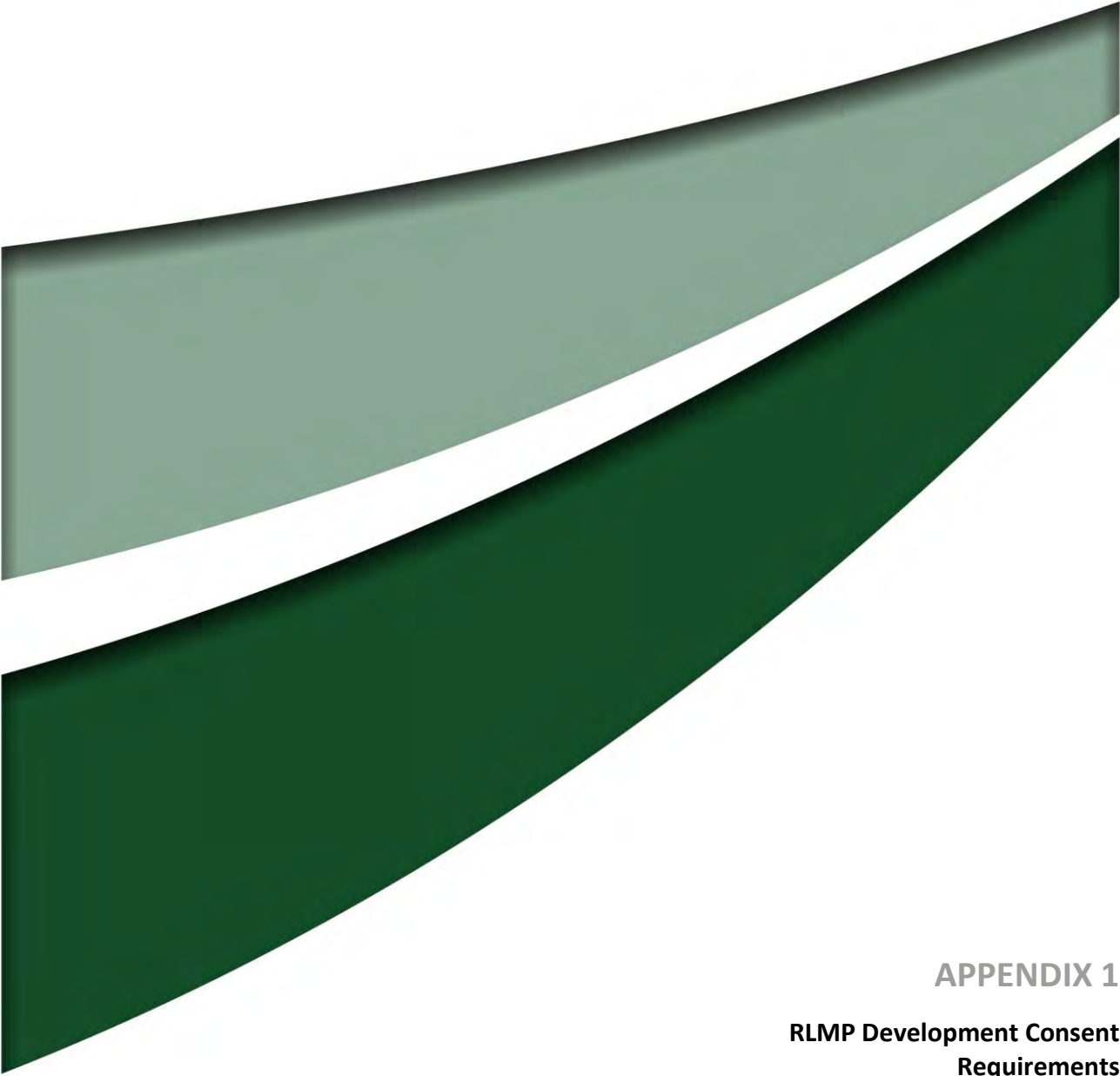
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Umwelt (Australia) Pty Limited 2015, Environmental Assessment Lynwood Quarry Extraction Area Modification. Prepared for Holcim (Australia) Pty Limited.

Umwelt (Australia) Pty Limited 2016, Lynwood Quarry Water Management Plan. Prepared on behalf of Lynwood Quarry.



APPENDIX 1

**RLMP Development Consent
Requirements**

This RLMP has been prepared to satisfy Condition 44, Schedule 3 of the Lynwood Quarry Development Consent as outlined in Table 1.

Table 1 – Development Consent Conditions

Schedule 3	Section
<p>Rehabilitation and Landscape Management Plan</p> <p>44. Within 6 months of this consent, the Applicant must prepare (and following approval implement) a Rehabilitation and Landscape Management Plan for the development, in consultation with OEH, DPI Water, and Council, to the satisfaction of the Secretary. This plan must:</p>	<p>Entire document. Consultation discussed in Section 2.0.</p>
<p>a) describe in general, the short, medium and long-term measures that would be implemented to:</p> <ul style="list-style-type: none"> • rehabilitate the site • implement the Habitat Management Area (Shown conceptually in Appendix 9), unless this area is incorporated into a conservation area subject to a Biobanking agreement • replace cleared hollow bearing trees with durable and appropriate nest boxes that reflect the type, size, usability and condition of the hollows to be cleared • manage the remnant vegetation and habitat on the site • landscape the site to mitigate any visual impacts of the development 	<p>Sections 3.1.1, 3.1.2, 3.1.3</p> <p>Section 3.2</p> <p>Section 3.8.1</p> <p>Section 3.8.2</p> <p>Section 3.8.3</p> <p>Section 3.1.3</p>
<p>a) include Riparian Area Management Plan/s (see condition 45) for those riparian areas to be disturbed in the next 5 years, excluding areas within quarry pits or emplacement areas as agreed with the Secretary;</p>	<p>Appendices 4, 5 and 6.</p>
<p>b) describe in detail the measures that would be implemented over the next 5 years to rehabilitate and manage the landscape on the site;</p>	<p>Sections 3.1, 3.2 and 3.3</p>
<p>c) describe how the performance of these measures would be monitored over time;</p>	<p>Section 4</p>
<p>d) set completion criteria for the rehabilitation of the site.</p>	<p>Section 5</p>



APPENDIX 2
Rehabilitation Species Mix

Family/Subfamily	Scientific Name	Common Name	Tableland Grassy Box-Gum Woodland	Tableland Low Woodland	Western Tablelands Dry Forest	Riparian Gum-Box-Apple Woodland	Camden Woollybutt Low Open Woodland
JUNCACEAE	<i>Juncus usitatus</i>	a rush				X	
LOMANDRACEAE	<i>Lomandra longifolia</i>	spiny-headed mat-rush				X	
LOMANDRACEAE	<i>Lomandra obliqua</i>	twisted mat-rush	X				
POACEAE	<i>Aristida ramosa</i>	wire grass	X	X	X	X	X
POACEAE	<i>Austrodanthonia laevis (syn. Danthonia laevis)</i>	a wallaby grass	X	X	X	X	X
POACEAE	<i>Austrodanthonia racemosa var. racemosa (syn. Danthonia racemosa var. racemosa)</i>	white top	X	X	X	X	X
POACEAE	<i>Austrodanthonia tenuior (syn. Danthonia tenuior)</i>	a wallaby grass	X	X	X	X	X
POACEAE	<i>Austrostipa scabra subsp. falcata (syn. Stipa scabra ssp. falcata)</i>	speargrass	X	X	X	X	X
POACEAE	<i>Austrostipa scabra subsp. scabra (syn. Stipa scabra ssp. Scabra)</i>	corkscrew grass	X	X	X	X	X
POACEAE	<i>Cynodon dactylon</i>	couch	X	X	X	X	X
POACEAE	<i>Dichelachne micrantha</i>	shorthair plumegrass	X	X	X	X	X
POACEAE	<i>Echinopogon caespitosus var. caespitosus</i>	tufted hedgehog grass	X	X	X	X	X
POACEAE	<i>Elymus scaber</i>	wheatgrass	X	X	X	X	X
POACEAE	<i>Entolasia marginata</i>	bordered panic		X			
POACEAE	<i>Eragrostis brownii</i>	Brown's lovegrass	X	X	X	X	X
POACEAE	<i>Microlaena stipoides var. stipoides</i>	weeping grass	X	X	X	X	X
POACEAE	<i>Poa sieberiana</i>	snow grass	X	X	X	X	X
POACEAE	<i>Themeda australis</i>	kangaroo grass	X	X	X	X	X
XANTHORRHOEACEAE	<i>Xanthorrhoea glauca subsp. angustifolia</i>			X			
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)							

Family/Subfamily	Scientific Name	Common Name	Tableland Grassy Box-Gum Woodland	Tableland Low Woodland	Western Tablelands Dry Forest	Riparian Gum-Box-Apple Woodland	Camden Woolly-butt Low Open Woodland
ASTERACEAE	<i>Olearia viscidula</i>	wallaby weed	X	X	X		
CASUARINACEAE	<i>Allocasuarina littoralis</i>	black sheoak	X	X	X		
CHENOPODIACEAE	<i>Einadia trigonos</i>	fishweed	X	X	X	X	X
DILLENiaceae	<i>Hibbertia obtusifolia</i> complex	hoary guinea flower	X	X	X		
EPACRIDACEAE	<i>Leucopogon muticus</i>	blunt beard-heath	X	X	X		
EPACRIDACEAE	<i>Lissanthe strigosa</i>	peach heath	X	X	X		
EPACRIDACEAE	<i>Melichrus erubescens</i>	ruby urn heath	X	X	X		
EUPHORBIACEAE	<i>Phyllanthus virgatus</i>	a spurge	X	X	X	X	X
FABACEAE - FABOIDEAE	<i>Hardenbergia violacea</i>	false sarsaparilla	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	<i>Acacia brownii</i>	prickly Moses	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	<i>Acacia decurrens</i>	black wattle	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	<i>Acacia dealbata</i>	Silver / blue wattle	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	<i>Acacia mearnsii</i>	black wattle	X	X	X	X	X
FABACEAE - MIMOSOIDEAE	<i>Acacia obtusata</i>			X			
FABACEAE - MIMOSOIDEAE	<i>Acacia stricta</i>	straight wattle			X		
GERANIACEAE	<i>Geranium solanderi</i> var. <i>solanderi</i>	native geranium	X	X	X	X	X
GOODENIACEAE	<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	ivy goodenia	X	X	X	X	X
MYRTACEAE	<i>Eucalyptus agglomerata</i>	blue-leaved stringybark	X	X	X	X	
MYRTACEAE	<i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i>	cabbage gum				X	
MYRTACEAE	<i>Eucalyptus blakelyi</i>	Blakely's red gum	X				

Family/Subfamily	Scientific Name	Common Name	Tableland Grassy Box-Gum Woodland	Tableland Low Woodland	Western Tablelands Dry Forest	Riparian Gum-Box-Apple Woodland	Camden Woollybutt Low Open Woodland
MYRTACEAE	<i>Eucalyptus bridgesiana</i>	apple box				X	
MYRTACEAE	<i>Eucalyptus cinerea</i>	Argyle apple		X		X	
MYRTACEAE	<i>Eucalyptus dives</i>	broad-leaved peppermint					X
MYRTACEAE	<i>Eucalyptus eugenioides</i>	thin-leaved stringybark			X		
MYRTACEAE	<i>Eucalyptus globoidea - eugenioides</i>				X		
MYRTACEAE	<i>Eucalyptus goniacalyx</i>	bundy	X	X	X		
MYRTACEAE	<i>Eucalyptus macarthurii</i>	Camden woollybutt					X
MYRTACEAE	<i>Eucalyptus macrorhyncha</i>	red stringybark	X	X	X	X	X
MYRTACEAE	<i>Eucalyptus mannifera</i> subsp. <i>mannifera</i>	brittle gum		X			
MYRTACEAE	<i>Eucalyptus melliodora</i>	yellow box	X			X	
MYRTACEAE	<i>Eucalyptus moluccana</i>	grey box				X	
MYRTACEAE	<i>Eucalyptus ovata</i>	swamp gum				X	
MYRTACEAE	<i>Eucalyptus radiata</i>	narrow-leaved peppermint				X	
MYRTACEAE	<i>Eucalyptus rossii</i>	inland scribbly gum				X	
MYRTACEAE	<i>Kunzea parvifolia</i>		X	X	X		
MYRTACEAE	<i>Leptospermum polygalifolium</i>	yellow tea tree				X	
MYRTACEAE	<i>Leptospermum trinervium</i>	flaky-barked tea tree	X	X	X	X	
PITTOSPORACEAE	<i>Bursaria spinosa</i> subsp. <i>spinosa</i> (syn. <i>B. spinosa</i> var. <i>spinosa</i>)	blackthorn	X	X	X	X	
PROTEACEAE	<i>Persoonia linearis</i>	narrow-leaved geebung	X	X	X		
ROSACEAE	<i>Acaena novae-zelandiae</i>	bidgee-widgee	X	X	X	X	X
SANTALACEAE	<i>Exocarpos cupressiformis</i>	native cherry	X	X	X	X	
SCROPHULARIACEAE	<i>Veronica plebeia</i>	trailing speedwell	X	X	X	X	X

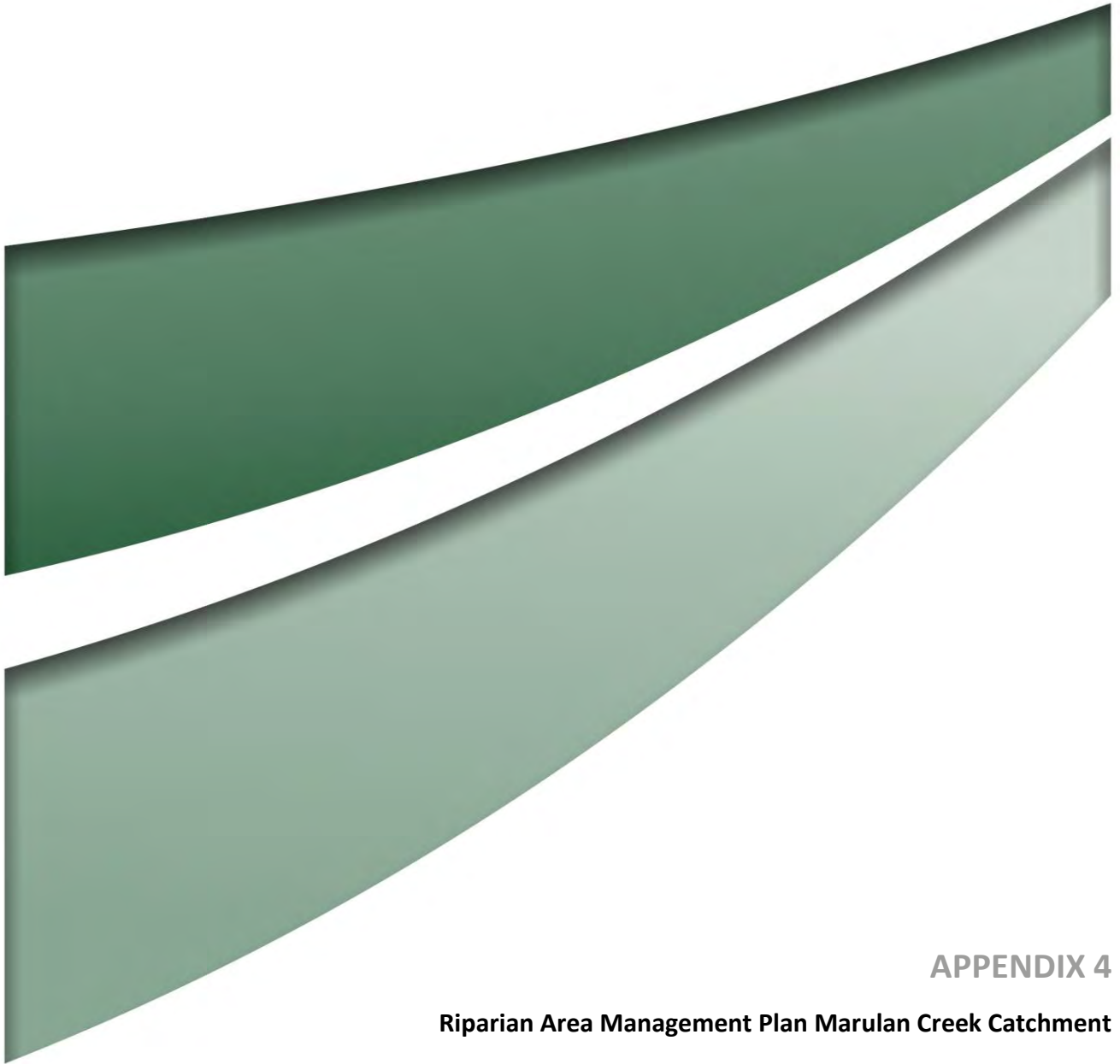


APPENDIX 3

Species to be utilised in Amenity Bund Landscaping

Appendix 3 – Amenity bund rehabilitation species list

Family/Subfamily	Scientific Name	Common Name
Myrtaceae	<i>Eucalyptus melliodora</i>	Yellow Box
Myrtaceae	<i>Eucalyptus bridgesiana</i>	Apple Box
Myrtaceae	<i>Eucalyptus blakelyi</i>	Blakely's Red Gum
Myrtaceae	<i>Eucalyptus dives</i>	Broad-leaved Peppermint
Myrtaceae	<i>Eucalyptus macrorhyncha</i>	Red Stringybark
Myrtaceae	<i>Eucalyptus rubida</i> subsp. <i>rubida</i>	Candlebark
Myrtaceae	<i>Eucalyptus pauciflora</i>	Snow Gum
Myrtaceae	<i>Eucalyptus mannifera</i>	Brittle Gum
Myrtaceae	<i>Eucalyptus viminalis</i>	Ribbon Gum, Manna Gum
Ericaceae	<i>Lissanthe strigosa</i>	Peach Heath
Ericaceae	<i>Melichrus urceolatus</i>	Um-Heath
Haloragaceae	<i>Gonocarpus tetragynus</i>	N/A
Goodeniaceae	<i>Goodenia hederacea</i>	forest goodenia, ivy goodenia
Araliaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort
Lomandraceae	<i>Lomandra filiformis</i> subsp. <i>coriacea</i>	N/A
Poaceae	<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping grass
Poaceae	<i>Themeda australis</i>	Kangaroo Grass
Poaceae	<i>Bothriochloa macra</i>	Red Grass, Red-leg Grass



APPENDIX 4

Riparian Area Management Plan Marulan Creek Catchment

Holcim (Australia) Pty Limited

**Lynwood Quarry
Riparian Area Management Plan
Marulan Creek Catchment Area
Revision 2**

June 2011

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APPENDICES

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1.0 Introduction

Rinker Australia Pty Limited (Readymix) was granted development consent in December 2005 by the Minister for Planning for the construction and operation of Lynwood Quarry west of Marulan in the Southern Tablelands region of NSW (refer to **Figure 1.1**). The Lynwood Quarry (along with the broader Rinker/Readymix group) was purchased in 2009 by Holcim (Australia) Pty Limited (Holcim).

The quarry has approval to operate over an initial 30 year period and will include operations in the catchments of Joarimin, Lockyersleigh and Marulan Creeks, all of which form part of the Sydney Drinking Water Catchment. Separate riparian area management plans have been prepared for each of these creeks within the project area to ensure that works associated with the construction and operation of Lynwood Quarry are undertaken in a way which reduces impacts on riparian zones.

This Riparian Area Management Plan for Marulan Creek provides a framework for the management of the Marulan Creek riparian zone that occurs within the Lynwood Quarry project area. The plan includes the management of works within 'waterfront land' as defined by the *Water Management Act 2000* (WMA) that was approved as part of the Lynwood Quarry project (DA 128-5-2005). The plan satisfies Conditions 44 and 45 in Schedule 3 of the Lynwood Quarry development consent (refer to **Section 1.2**). Revision 1 of this plan was approved by the Department of Planning (DoP) on 31 August 2006 and was used as a supporting document to the application for Controlled Activity Approval under the WMA. This approval was subsequently issued by the NSW Office of Water (NOW). This is the second revision of this plan and is being prepared following the approval of a modification to the development consent in March 2011. This plan forms part of the Rehabilitation and Landscape Management Plan required by Condition 44 in Schedule 3 of the Lynwood Quarry consent.

A controlled Activity Approval under the *Water Management Act* (2000) was granted to Lynwood Quarry (Approval No. 10 ERM 2011/0446) on 15 June 2011. The approval allows for construction works to be undertaken at specific locations within the Marulan Creek catchment (refer to **Section 4.2**).

It is noted that construction works commenced on the site in November 2010, with relevant works being undertaken in accordance with Revision 1 of this plan.

This Riparian Area Management Plan has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Holcim.

1.1 Overview of the Project

Lynwood Quarry (the project) will be located in the Goulburn Mulwaree Local Government Area approximately 160 kilometres south-west of Sydney and approximately 27 kilometres north-east of Goulburn (refer to **Figure 1.1**). The project area is bounded to the south by the Hume Highway and bisected in an east-west direction by the Main Southern Railway. It incorporates the headwaters of Joarimin, Lockyersleigh and Marulan Creeks and has historically been used primarily for agriculture, in particular grazing.

The project will provide a long-term supply of high quality construction material into the Sydney, regional and local markets. The supply to the Sydney market will replace Holcim's current production from the Penrith Lakes Scheme which is approaching closure. The project area contains a substantial, high quality hard rock resource with ready transport access to the Main Southern Railway and Hume Highway. The quarry is approved to

produce up to 5 million tonnes per annum (Mtpa) of saleable quarry product for an initial 30 year quarrying period (refer to **Figure 1.2**). The target resource has an expected life of in excess of 90 years.

1.2 Development Consent Conditions

The preparation of Riparian Area Management Plans is required by Conditions 44 and 45 in Schedule 3 of the Lynwood Quarry development consent. These conditions are outlined in **Table 1.1** with an indication of where in the plan each requirement is addressed.

Table 1.1 Development Consent Conditions

Schedule 3 – Rehabilitation and Landscape Management Plan	Relevant Section of Report
44. Within 6 months of this consent, the Applicant shall prepare (and following approval implement) a Rehabilitation and Landscape Management Plan for the development, in consultation with DECCW, NOW, and Council, and to the satisfaction of the Director-General. This plan must: ... b) include Riparian Area Management Plan/s (see condition 45) for those riparian areas to be disturbed in the next 5 years, excluding areas within quarry pits or emplacement areas as agreed with the Director-General;...	Entire document. Consultation discussed in Section 1.4
45. The Riparian Area Management Plan/s must be prepared by a suitably qualified hydrologist; whose appointment has been approved by the Director-General, and include:	Section 1.4
a) baseline surveys of creeks, providing existing bed, bank and vegetation information (including representative cross and longitudinal sections), in the areas in which the development is located, excluding the quarry pits and emplacement areas;	Sections 2.0 and 4.2
b) detailed designs of the proposed works, including any proposed stabilisation, scour protection, and / or enhancement works (including representative cross and longitudinal sections);	Section 4.2
c) a description of the measures that would be implemented in the event of flooding during construction / rehabilitation;	Section 4.3
d) details of proposed staging of the works;	Sections 3.1 and 3.2
e) completion criteria for the rehabilitation of the riparian area;	Section 4.4
f) a protocol for monitoring the performance of rehabilitation over time.	Section 5.0

1.3 Objectives of the Riparian Area Management Plan

The objectives of this Riparian Area Management Plan are to:

- describe the current condition of riparian areas in Marulan Creek Catchment that fall within the project area, including the condition of sites that require a Controlled Activity Approval under the *Water Management Act 2000*;
- provide detailed designs of the proposed works and the proposed staging of works;
- outline the management measures to be implemented at the site level, including completion criteria for the rehabilitation of riparian areas disturbed by construction of the Lynwood Quarry Project;

-
- outline the management measures to be implemented for the Marulan Creek riparian zone for works undertaken within the project area: and
 - define the monitoring and maintenance requirements for Marulan Creek, including a protocol for monitoring effectiveness of rehabilitation works over time.

1.4 Consultation

Condition 44, Schedule 3 of the development consent requires that the Rehabilitation and Landscape Management Plan, of which this plan forms part, must be prepared in consultation with the Office of Environment and Heritage (OEH) (formerly Department of Environment, Climate Change and Water (DECCW)), NSW Office of Water (NOW) and Sydney Catchment Authority (SCA).

During the preparation of Revision 1 of this plan a draft copy was provided to each of these agencies for comment prior to submission of a final draft to the then Department of Planning (DoP) for approval. Further details of agency consultation are included in the main text of the Rehabilitation and Landscape Management Plan.

The consultation process for Revision 1 of the plan also built on the extensive consultation undertaken as part of the approval process for Lynwood Quarry. This included site meeting with personnel from the then Department of Environment and Conservation and the Department of Natural Resources (DNR) personnel that included specific discussions regarding site water management and management of riparian zones.

This revision (Revision 2) of the plan was undertaken following approval of the second modification to the Lynwood Quarry development consent in March 2011.

2.0 Marulan Creek Catchment

Marulan Creek has a catchment area of approximately 2055 hectares, is a fourth order stream and drains in a south-easterly direction to the Shoalhaven River via Barbers Creek (refer to **Figure 2.1**). Land use within Marulan Creek catchment is predominantly grazing and residential with some woodland areas. A section of the town of Marulan lies within the catchment area. Generally the creek system is predominantly dry; however, some pools of permanent or semi-permanent water are present in the incised reaches.

Marulan Creek extends from its confluence with Barbers Creek approximately 7.5 kilometres due west to the Hume Highway and Marulan. There is one major dam located along a tributary of the creek located approximately 3.6 kilometres to the west of the project area. In addition there are several harvestable rights dams located within the catchment area. All of these dams are located downstream of the project area.

The catchment area has slopes varying from 1 per cent to 2 per cent in the east of the catchment to 15 per cent in the upper slopes in the west of the catchment.

Marulan Creek is an ephemeral creek system with flows only occurring in the creek during storm events or after prolonged periods of heavy rain. There is limited riparian vegetation along the upper reaches of the creek; with established riparian vegetation downstream of the Hume Highway.

Soil landscape mapping of the Marulan region has been undertaken by DNR (2003) and covers the project area. A soil survey was also undertaken within the project area for the Lynwood Quarry Environmental Impact Statement (Umwelt 2005) to confirm soil landscape

mapping and determine site specific soil properties. Three of the soil landscapes identified within the project area occur in the Marulan Creek catchment. Jaqua soils occur along the main creek channel with Marulan soils bounding either side of the main channel area. Bindook Road soils occur on the upper slopes of the northern extent of the Marulan Creek catchment area. The soil landscape mapping undertaken by DNR indicates that all three soil landscapes have gully and sheet erosion hazards.

An inspection of Marulan Creek within the project area indicates that the subsoils are dispersive. The creek channel within the project area is deeply incised (up to four metres deep) for a length of approximately 1.1 kilometres, with widening of the channel visible. Soil landscape mapping undertaken by DNR indicates that this section of the creek channel occurs at the boundary of the Marulan and Jaqua soil landscapes. Both these soil types have dispersive subsoils on the mid to lower slopes, footslopes and channels (DNR, 2003). The extent of erosion evident along Marulan Creek is not present along the creeklines located elsewhere within the project area and is likely to be due to the dispersive subsoils as the historic land use of the three catchments within the project area has been similar.

Approximately 40 hectares (2 per cent) of the catchment area of Marulan Creek lies upslope of the project area. Approximately 160 hectares (8 per cent) of the Marulan Creek catchment lies within the project area, with the remaining catchment downstream of the project area. The portion of the catchment within the project area is currently improved grazing pasture with some isolated pockets of woodland.

3.0 Development within Marulan Creek Catchment

3.1 Construction Phase

As Lynwood Quarry is a greenfields project, substantial construction works are required prior to the quarry becoming operational. The construction phase commenced in November 2010 and is expected to last approximately two years and will include construction of a permanent site access road and Hume Highway interchange in the Marulan Creek catchment with a temporary construction compound required during the interchange construction. The location of the access road, interchange and associated construction compound are shown on **Figure 3.1**.

3.2 Operational Phase

There will be no works within the Marulan Creek catchment during the operational phase of the project. The only ongoing activity during the operational phase will be the use of the access road and Hume Highway interchange.

3.3 Potential Surface Water Impacts

The potential surface water impacts due to construction of infrastructure in the Marulan Creek catchment area were assessed as part of the Lynwood Quarry EIS (Umwelt 2005). A summary of these impacts is provided below.

The peak flows, velocities and flood levels for the 20 year and 100 year Average Recurrence Interval (ARI) storm events in Marulan Creek were modelled using XP-Storm version 9.1, a one-dimensional hydrodynamic model which can be used to model stormwater flows in watercourses, culverts and street drainage systems.

Modelling of the flows for the 100 year ARI storm event indicated that a critical storm duration of nine hours at the project boundary gives a peak discharge of 10.2 m³/s. A critical storm duration of nine hours was also used for the 20 year ARI storm event and generated a peak discharge from Marulan Creek of 8.1 m³/s at the boundary.

Modelling indicates that peak velocities and peak water levels in Marulan Creek for the 100 year ARI storm event at the project boundary are reduced with the quarry infrastructure in place. However, as discussed in the EIS (Umwelt, 2005) there is a predicted localised increase in flood level upstream of the access road culvert of 1.4 metres. Modelling also indicates that peak flow rates for the 1:20 year ARI storm event with the quarry infrastructure in place will slightly increase compared to the existing scenario (8.1 m³/s to 8.3 m³/s), with peak velocities remaining unchanged. Peak flood levels for the 1:20 year ARI storm event will increase slightly at the downstream boundary of the project by up to 6mm. This increase in peak flood level will not significantly increase the flooding extent (Umwelt, 2005).

A range of control measures, including limiting the disturbed area and sediment fences, will be in place to ensure that runoff from the project area is maintained with a design maximum of 50 mg/L of suspended solids, with the aim being to prevent sediment export from the project area where possible. The water quality management measures to be implemented as part of the project are detailed in the Lynwood Quarry Water Management Plan and will ensure that oil/fuel spillages are contained on site with no impact on water quality in the downstream creek.

Further details of the predicted surface water impacts and project water management system are included in the Lynwood Quarry EIS (Umwelt, 2005) and Lynwood Quarry Water Management Plan.

4.0 Works within the Riparian Zone and Management Measures

4.1 Catchment Wide Management Measures

Construction Phase

Management measures in the Marulan Creek catchment during the construction of the project will be detailed in the Lynwood Quarry Water Management Plan and will focus on erosion and sediment control measures. Erosion and sediment control measures will be developed as part of the construction and operational plans to satisfy the following objectives:

- comply with statutory requirements, including the development consent, Environment Protection Licence (EPL) and SEPP (Sydney Drinking Water Catchment) 2011;
- carry out all construction in accordance with relevant guidelines for erosion and sediment control, including the Blue Book (Landcom, 2004 and DECC, 2008) and NSW Office of Water guidelines;
- identify and manage potential erosion and sedimentation impacts that may occur as a result of quarrying and associated operations; and
- develop effective mechanisms for monitoring and maintenance of erosion and sediment control measures.

These controls will be designed and constructed to a standard consistent with *Managing Urban Stormwater: Soils and Construction Volumes 1 and 2* (Landcom 2004) (the Blue Book) and *Guidelines for Establishing Drainage Lines on Rehabilitated Minesites (Draft)* (DLWC, 1999).

The measures to be adopted for the construction phase of the project to control the quality of runoff in the Marulan Creek catchment will include the following:

- construction and regular maintenance of silt fences to contain sediment downslope of disturbed areas;
- seeding and controlled fertilising of all disturbed areas to provide for rapid grass cover. Areas will be seeded with a grass mix specific to the needs of the area to be grassed; and
- development of an inspection, maintenance and management system to ensure that the soil and erosion control measures for the construction phase are performing adequately.

Operational Phase

Water quality controls will also be implemented for the project during the operational phase to minimise surface water impacts. In Marulan Creek catchment, these controls will include:

- regular maintenance of all erosion control works and rehabilitated areas; and
- regular inspections of access tracks/roads to ensure that drainage is working effectively and the tracks/roads are stable particularly after rain.

In addition to these controls specific to works associated with the quarry, Holcim propose to implement a program of rehabilitation works along existing drainage lines to reduce the current extent of bank and bed erosion and associated sediment transport, where possible. Rehabilitation works will initially include fencing of the third order section of Marulan Creek to prevent cattle access and allow for natural regeneration. This fenced area will be inspected annually for the first three years to assess the level of natural regeneration. If natural regeneration is not proceeding to an acceptable level by the third year of annual monitoring, then alternative regeneration measures including supplementary planting will be considered. Should supplementary planting be required, the works will be undertaken in accordance with the Rehabilitation and Landscape Management Plan.

Lynwood Quarry's Environmental Officer will inspect Marulan Creek within the project area on a quarterly basis (and after severe storm events) to identify the condition of the vegetation and any significant erosion or creek stability issues. Controls will be implemented where practical to address any new issues identified as part of these inspections.

Six monthly weed and pest inspections will also be undertaken in the riparian zone in accordance with the Rehabilitation and Landscape Management Plan, and controls will be implemented as required.

4.2 Identified Controlled Activity Locations

On 4 February 2008 the *Rivers and Foreshores Improvement Act 1948* (RFI Act) was repealed and the controlled activity provisions in the *Water Management Act 2000* (WMA) commenced. A controlled activity approval (CAA) under the WMA is now required for controlled activities carried out in, on or under waterfront land. The following definitions are provided in the WMA:

-
- **Waterfront Land** includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary.
 - **River** means:
 - (a) any watercourse, whether perennial or intermittent and whether comprising a natural channel or a natural channel artificially improved, and
 - (b) any tributary, branch or other watercourse into or from which a watercourse referred to in paragraph (a) flows, and
 - (c) anything declared by the regulations to be a river, whether or not it also forms part of a lake or estuary, but does not include anything declared by the regulations not to be a river.
 - **Controlled Activity** means:
 - (a) the erection of a building or the carrying out of a work (within the meaning of the Environmental Planning and Assessment Act 1979), or
 - (b) the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise, or
 - (c) the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise, or
 - (d) the carrying out of any other activity that affects the quantity or flow of water in a water source.

Under the WMA a creek or drainage line will generally fall within the definition of a river if it is marked on a 1:25,000 topographical map sheet produced by the Land and Property Information Centre (LPIC) and has a defined channel bed and bank. A site inspection is typically required to determine if a defined bed and bank are present.

Work sites requiring a Controlled Activity Approval have been identified from site inspections undertaken in May 2006 and assessments undertaken during preparation of the EIS (Umwelt, 2005), SEE (Umwelt, 2009) and EA (Umwelt, 2010).

Two work sites occur within the Marulan Creek catchment area and both those sites were identified as requiring a Controlled Activity Approval under the WMA (refer to **Figure 4.1**). The required approval for these works was granted on 15 June 2011 (Approval No. 10 ERM2011/0446).

4.2.1 Site M1

The access road for Lynwood Quarry will cross Marulan Creek at site M1 (refer to **Figure 4.1**). The access road will be constructed during the construction phase of the project.

Where the access road crosses Marulan Creek the creek has a defined bed and bank as shown in **Plates 1 and 2 of Appendix A**. Marulan Creek is deeply incised at site M1 with visible channel widening (refer to **Plates 1 and 2**). The creek banks at site M1 are approximately 3.7 metres high, steep (approximately 6:1 v:h) with a bed width of approximately 5.6 metres. The riparian vegetation is dominated by Riparian Gum - Box - Apple Woodland, with blackberries (*Rubus fruticosus* sp. agg.) present along the base of the creek. A typical cross-section and long-section of the creek at this location is included in **Appendix B**.

A culvert will be constructed to convey flows under the access road. The conceptual design of the culvert is a 42 metre long, 1.8 metre wide x 1.5 metre high box culvert. The 100 year ARI storm event peak discharge through the culvert has been modelled as 5.7 m³/s with a peak velocity of 4.1 m/s. The soils in the construction area will be treated with gypsum to reduce dispersibility and improve soil structure after excavation and prior to installation of the culvert. The culvert is to be placed approximately 300 millimetres deeper than the existing bed of the creek and then backfilled to original bed level with rock. Rip rap will also be placed upstream and downstream of the culvert to prevent localised scouring. This rip rap will consist of well graded rock to a depth of 300 millimetres with d₅₀ = 250 millimetres and will extend 10 metres upstream of the culvert and 20 metres downstream of the culvert. Sediment fences will be placed upstream and downstream of the work area during installation of the culvert and rip rap to prevent sediment mobilisation. The disturbed areas outside of the creek channel including waterfront land will be topsoiled and seeded with grass species to aid stability. This will assist in maintaining a natural creek bed and reducing erosion along Marulan Creek.

4.2.2 Site M2

Site M2 is the location of the access road construction compound, which is located approximately 10 metres from the top of the bank of Marulan Creek at its closest point (refer to **Figure 4.1**). This compound has been constructed and will be utilised during the construction of the interchange. After the construction phase this compound will be decommissioned, all infrastructure removed and the area rehabilitated. The compound was designed to reduce disturbance to vegetation.

Marulan Creek, adjacent to the site, has a defined bed and bank as shown in **Plates 3 and 4** of **Appendix A**. A cross-section and long-section of the site are included in **Appendix B**. Similar to Site M1, the creekline at Site M2 is deeply incised with channel widening visible, and a lateral cut forming on the eastern bank of the creek. The riparian vegetation at this site is also dominated by Riparian Gum - Box - Apple Woodland. General management measures will be undertaken at Site M2 during the construction and operational phases of the project, as described in **Section 4.1**. These management measures will include:

- clearly identifying and delineating areas required to be disturbed and ensuring that disturbance is limited to those areas, clearing as little vegetation as required and minimising machinery disturbance outside of these areas;
- construction and regular maintenance of silt fences to contain sediment downslope of disturbed areas;
- construction of drains upslope of areas to be disturbed to convey clean runoff away from disturbed areas;
- creation of a 'No-Go' zone between the compound and the creekline (i.e. no vehicle movements) to prevent impacts on the creek bank and core riparian zone (refer to **Figure 4.1**);
- progressively stripping and stockpiling topsoil for later use in rehabilitation;
- seeding and controlled fertilising of all disturbed areas to provide for rapid grass cover. Areas will be seeded with a grass mix specific to the needs of the area to be grassed;
- regular maintenance of all erosion control works and rehabilitated areas; and
- prompt revegetation of areas as soon as earthworks are complete.

4.3 Contingency Sediment and Erosion Controls during Construction

A number of sediment and erosion controls have been identified that will be implemented during the construction phase of the project to mitigate erosion and sediment export from disturbed areas during storm events. These measures include:

- where a storm event is imminent, covering disturbed areas within the creek line with geotextile fabric and securing with stakes to reduce erosion potential (where practical to do so in the available time);
- regular inspection of sediment and erosion controls during works and rectification of any damaged controls where it is safe to do so; and
- installation of additional controls such as silt fences as required.

4.4 Completion Criteria

The completion criteria for each work site are:

- practical completion of all infrastructure to be constructed;
- construction area stable;
- established vegetation on all disturbed areas; and
- removal of any temporary sediment and erosion control measures when revegetation has established on formerly disturbed areas.

5.0 Monitoring and Maintenance Requirements

During the construction phase of the project all works will be inspected on a daily basis to ensure that all required controls are in place and effective. Following the completion of construction works, the work area will be inspected weekly and after any runoff events until the completion criteria listed in **Section 4.4** are met.

During the operational phase of the project monitoring of the management measures implemented will be undertaken in accordance with the Rehabilitation and Landscape Management Plan. Monitoring will also be undertaken after major storm events for sediment and erosion control structures that may be affected by such an event. Water quality monitoring will also be undertaken as part of the project as discussed in the Lynwood Quarry Water Management Plan.

6.0 Responsibilities

The Lynwood Quarry Environmental Officer and Quarry Manager will be responsible for the implementation of the requirements of this plan and ongoing maintenance and review.

7.0 Reporting and Review

The Quarry Environmental Officer will report any significant finding regarding the implementation of this plan in the Annual Environmental Management Report (AEMR).

8.0 References

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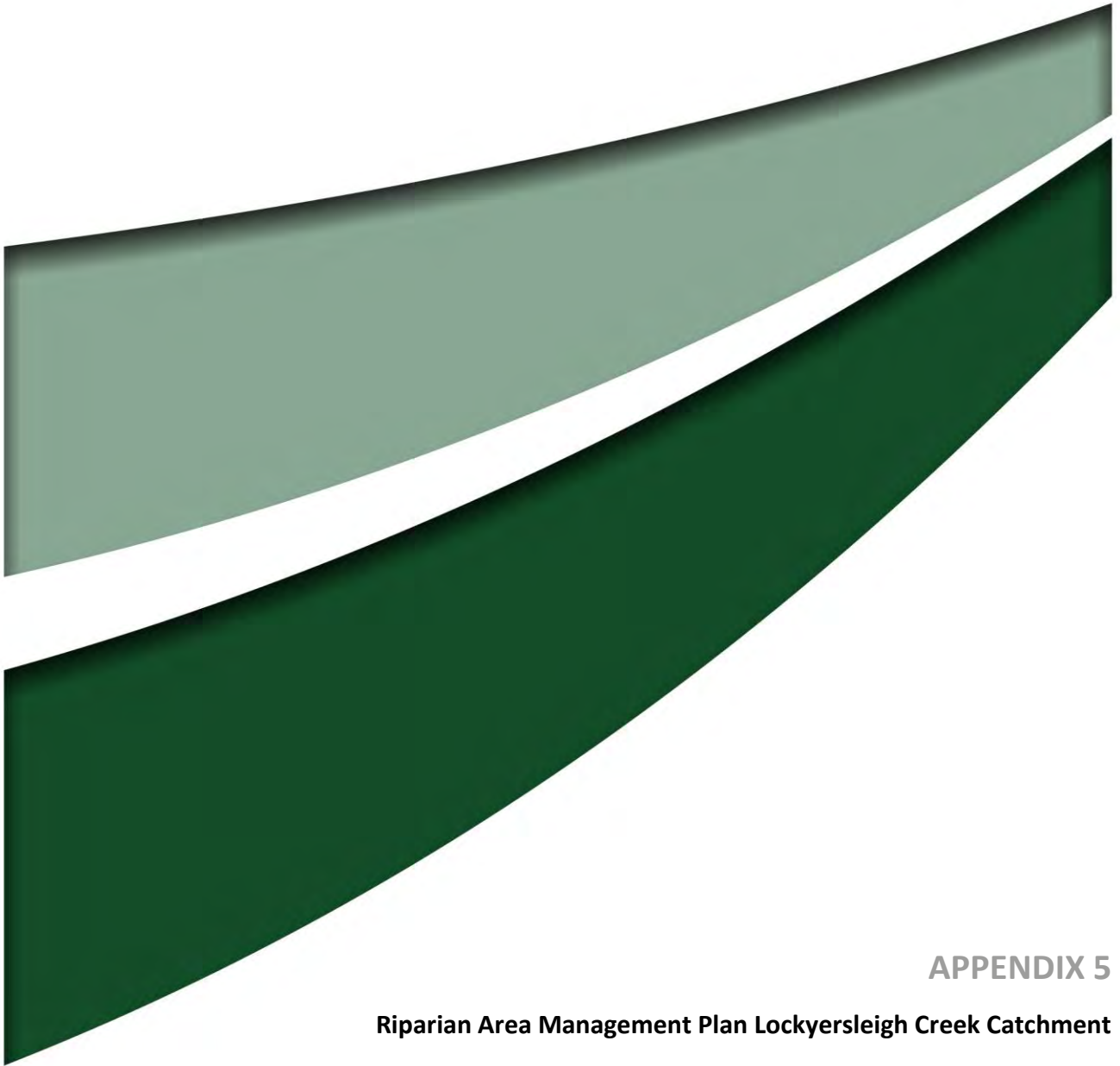
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APPENDIX 5

Riparian Area Management Plan Lockyersleigh Creek Catchment

Lynwood Quarry

Riparian Area Management Plan

Lockyersleigh Creek Catchment

May 2018





Lockyersleigh Creek Catchment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Holcim (Australia) Pty Ltd

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Report No. 3330/R37/Final
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1.0 Introduction

Holcim (Australia) Pty Lid (Holcim) was granted development consent in December 2005 (DA 128-5-2005) (Development Consent) by the then NSW Minister for Planning for the construction and operation of a hardrock quarry known as Lynwood Quarry west of Marulan in the Southern Tablelands region of NSW (refer to **Figure 1**). There have been five modifications approved to the Development Consent since 2005.

Holcim has approval to carry out quarrying operations until 1 January 2038 and will include operations in the catchments of Joarimin, Lockyersleigh and Marulan Creeks, all of which form part of the Sydney Drinking Water Catchment. Separate riparian area management plans have been prepared for the Joarimin and Lockyersleigh Creeks within the project area to ensure that works associated with the construction and operation of Lynwood Quarry are undertaken in a way which reduces impacts on riparian zones. There are no works proposed to be undertaken within the Marulan Creek catchment area. Should works be required within this catchment, a separate management plan will be developed.

This Riparian Area Management Plan (RAMP) for Lockyersleigh Creek provides a framework for the management of the Lockyersleigh Creek riparian zone that occurs within the Lynwood Quarry. This plan includes the management of works on “waterfront land” as defined by the *Water Management Act 2000* (WM Act). This plan has been developed in accordance with Conditions 44 and 45 of Schedule 3 of the Lynwood Quarry Development Consent and will be used as a supporting document to the applications for Controlled Activity Approvals (CAAs) under the WM Act. This plan forms part of the Rehabilitation and Landscape Management Plan (RLMP) as required by Condition 44 of Schedule 3 of the Development Consent.

1.1 Overview of the Project

The location and extent of the quarry pit at the completion of approved operations is shown on **Figure 1**, including the locations of overburden and excess product emplacement areas and project infrastructure.

The quarry has existing Development Consent approval to produce up to 5million tonnes per annum (Mtpa) of saleable quarry product until 1 January 2038. Some of the material extracted as part of the quarrying process is not suitable for processing and sale, consequently emplacement areas are required. The locations of these emplacement areas are shown on **Figure 1**.

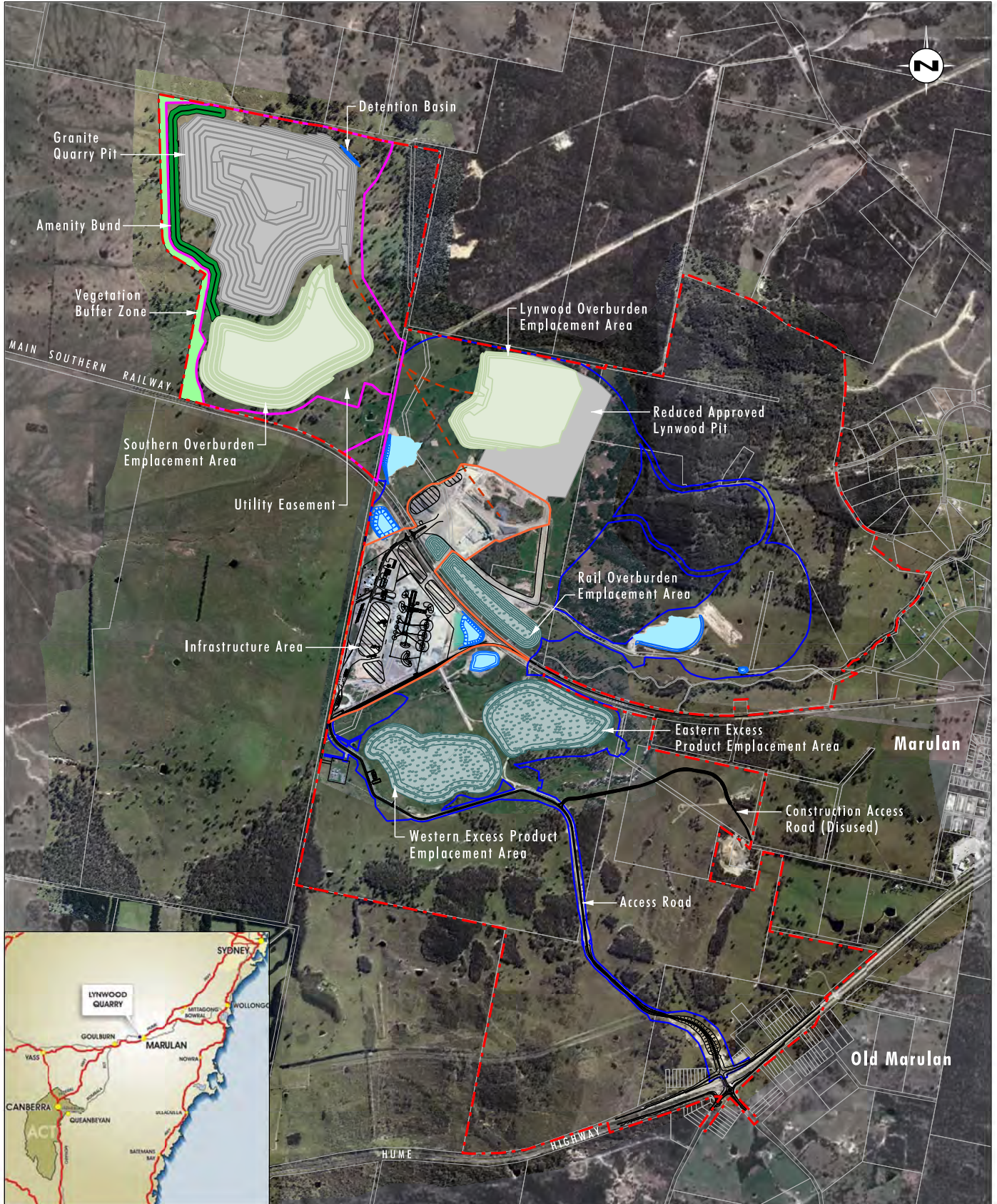


Image Source: Google Earth (2012), Holcim (2012, 2014)
 Data Source: LPI (2014), Holcim Australia (2015)

0 0.5 1.0 1.5 km
 1:30 000

Legend

- - - Approved Project Area
- - - Lynwood Infrastructure Area
- - - Approved Disturbance Footprint
- - - Granite Pit Disturbance Footprint
- - - Lynwood Infrastructure Layout
- - - Haul Road
- Quarry Pit
- Emplacement Area
- Dam
- Overburden Emplacement Area
- Vegetation Buffer Zone
- Amenity Bund

FIGURE 1
Lynwood Quarry

1.2 Development Consent Conditions

The preparation of this RAMP is required by Conditions 44 and 45 of Schedule 3 of the Development Consent. These conditions are outlined in **Table 1.1** with an indication of where in the plan each requirement is addressed.

Table 1.1 Development Consent Conditions

Schedule 3	Section
<p>Rehabilitation Landscape Management Plan</p> <p>44. Within 6 months of this consent, the Applicant must prepare (and following approval implement) a Rehabilitation and Landscape Management Plan for the development, in consultation with OEH, DPI Water and Council, and to the satisfaction of the Secretary. This plan must:</p> <p>...b) include Riparian Area Management Plan/s (see condition 45) for those riparian areas to be disturbed in the next 5 years, excluding areas within quarry pits or emplacement areas as agreed with the Secretary;...</p>	<p>Entire document.</p> <p>Consultation in Section 1.4</p>
<p>45. The Riparian Area Management Plan/s must be prepared by a suitably qualified hydrologist; whose appointment has been approved by the Secretary, and include:</p>	<p>Section 1.4</p>
<p>a) Baseline surveys of creeks, providing existing bed, bank and vegetation information (including representative cross and longitudinal sections), in the areas in which the development is located, excluding the quarry pits and emplacement areas;</p>	<p>Sections 2.0, 4.2, & 4.3</p>
<p>b) Detailed designs of the proposed works, including any proposed stabilisation, scour protection, and / or enhancement works (including representative cross and longitudinal sections);</p>	<p>Section 4.2</p>
<p>c) A description of the measures that would be implemented in the event of flooding during construction / rehabilitation;</p>	<p>Section 4.4</p>
<p>d) Details of proposed staging of the works;</p>	<p>Sections 3.1, 3.2, & 4.2</p>
<p>e) Completion criteria for the rehabilitation of the riparian area;</p>	<p>Section 4.5</p>
<p>f) A protocol for monitoring the performance of rehabilitation over time.</p>	<p>Section 5.0</p>

1.3 Objectives of the Riparian Area Management Plan

The objectives of this RAMP are to meet the development consent conditions by:

- describing the current condition of riparian areas in Lockyersleigh Creek Catchment are within the Lynwood Quarry, including the condition of sites that require a CAA under the WM Act.
- providing a detailed designs of the proposed works and the proposed staging of works
- outlining the management measures to be implemented at the site level, including completion criteria for the rehabilitation of riparian areas disturbed by the operation of Lynwood Quarry

- outlining the management measures to be implemented for the Lockyersleigh Creek riparian zone for works undertaken at Lynwood Quarry,
- defining the monitoring and maintenance requirements for Lockyersleigh Creek, including a protocol for monitoring effectiveness of rehabilitation works over time.

1.4 Consultation

Condition 44 of Schedule 3 of the Development Consent requires the RLMP, of which this plan forms part, must be prepared in consultation with the Office of Environment and Heritage (OEH), Department of Primary Industries Water (DPI Water) and Goulburn Mulwaree Council (Council). A draft copy of this plan was provided to each of these agencies for comment prior to submission of a final draft to the Department of Planning and Environment (DPE) for approval. Further details of agency consultation are included in the main text of the RLMP.

The consultation process for this plan also builds on the extensive consultation undertaken as part of the approval process for Lynwood Quarry.

2.0 Lockyersleigh Creek Catchment

Lockyersleigh Creek has a catchment area of approximately 2 629 hectares (ha), is a fourth order watercourse and drains in a north-westerly direction to the Wollondilly River. Land use within the catchment is predominantly grazing with some forested areas (refer **Figure 2**).

Lockyersleigh Creek drains generally in a northerly direction from its headwaters near the Hume Highway approximately 9.2 kilometres (km) north to the Wollondilly River. The confluence of Lockyersleigh Creek with the Wollondilly River is located approximately 9.2 km upstream of Marulan Drinking Water Supply Pumping Station.

The catchment has typical gradients varying from 2 to 3% in the northern area to 20% the southern area.

Lockyersleigh Creek is an ephemeral watercourse. Flows only occur in the creek during storm events or after prolonged periods of heavy rain. Generally the watercourse is predominantly dry, however, some pools of permanent or semi-permanent water are present in the lower, northern areas. There is little or no riparian vegetation in the upper catchment, with some established riparian vegetation in the lower catchment. There is also evidence of erosion of the creek banks throughout the catchment with notable erosion in the upper catchment where little or no riparian vegetation is present.

Approximately 160 ha (6%) of the Lockyersleigh Creek catchment area is within the Lynwood Quarry water management system. Approximately 68 ha (3%) of the catchment is upslope of the Holcim Lynwood Quarry property boundary. Approximately 332 ha (13%) is within the Holcim Lynwood Quarry property boundary.

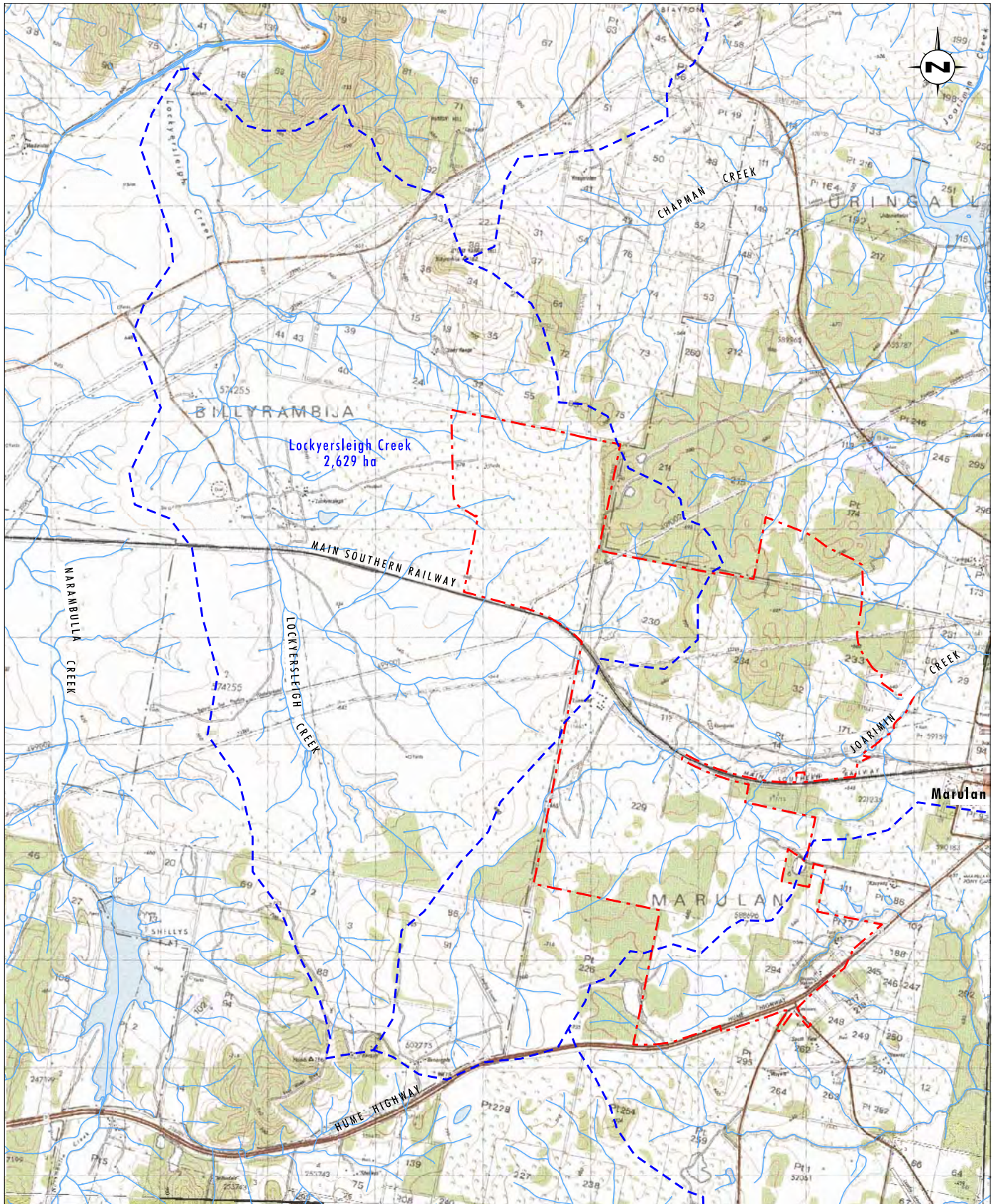


Image Source: LPI (2009)
 Data Source: LPI (2006), Holcim (2016)

0 1.0 2.0 2.5 km
 1:50 000

Legend

- Approved Project Area
- Catchment Boundary

FIGURE 2

Lockyersleigh Creek Catchment Area

3.0 Development within Lockyersleigh Creek Catchment

3.1 Construction Phase

At the time of this management plan review, construction activities required to be undertaken at Lynwood Quarry within the Lockyersleigh Creek Catchment include:

- construction of the amenity bund located along the western margin of the granite pit
- construction of the main haul road from the granite pit to the existing primary crushing plant and when backfilling commences, a haul road to the Lynwood Pit
- construction of surface water management structures in the granite pit in the Lockyersleigh Creek Catchment.

Overburden removed from the granite pit will be used to construct the amenity bund and haul roads, prior to establishment of the overburden emplacement areas. Initial clearing, topsoil stripping and overburden removal, which forms part of the Stage 1 quarry footprint, will be undertaken as part of the construction of the amenity bund and haul roads.

3.2 Operational Phase

The early stages of the granite pit will be developed and operated concurrently with extraction in the Lynwood Pit, with operations progressively transferring over to the granite pit once it is fully established.

3.3 Potential Surface Water Impacts

The potential surface water impacts due to construction and operation of the granite pit in the Lockyersleigh Creek catchment were assessed as part of the Lynwood Quarry Modification Project Environmental Assessment (Umwelt, 2015). A summary of these impacts is provided below.

The outcomes from the surface water assessment undertaken for the EA indicate the operations will not significantly alter the flow regimes or annual flow volumes in Lockyersleigh Creek including peak discharges, flood levels or peak in-stream velocities either upstream or downstream of Lynwood Quarry. As a result, the quarry is not expected to adversely impact channel stability or in-stream habitat.

The assessment also found Lynwood Quarry will not adversely impact water quality in Lockyersleigh Creek or the subsequent drainage systems.

As water use within the catchments is regulated by Water Sharing Plans and Holcim Australia's take of clean water catchment will be on average within its harvestable rights, Lynwood Quarry is not expected to have a significant impact on downstream water users.

4.0 Works within the Riparian Zone and Management Measures

4.1 Catchment Wide Management Measures

4.1.1 Construction Phase

Management measures in the Lockyersleigh Creek catchment during any construction works are detailed in the Lynwood Quarry Water Management Plan and focus on erosion and sediment control measures as well as the capture and treatment of runoff from infrastructure areas. Erosion and sediment control measures will be developed as part of the construction and operational plans to satisfy the following objectives:

- comply with appropriate statutory requirements, including the development consent and Environment Protection Licence (EPL)
- carry out all construction in accordance with relevant guidelines for erosion and sediment control, including *Managing Urban Stormwater: Soils and Construction* (Landcom 2004) (the Blue Book), DECC (2008)
- identify and manage potential erosion and sedimentation impacts that may occur as a result of quarrying and associated operations
- develop effective mechanisms for monitoring and maintenance of erosion and sediment control measures.

These controls will be designed and constructed to a standard consistent with the Blue Book and DECC (2008).

The measures to be utilised for construction activities to control the quality of runoff in Lockyersleigh Creek catchment will include but are not limited to:

- construction and regular maintenance of catch drains, silt fences and sedimentation basins to contain sediment downslope of disturbed areas
- construction of the necessary sediment dams required for the Lynwood Quarry early in the construction period and prior to any ground disturbance as per the Blue Book
- seeding and controlled fertilising of all areas to be rehabilitated to provide for rapid grass cover. Areas will be seeded with a grass mix specific to the needs of the area to be grassed
- development of an inspection, maintenance and management system to ensure the soil and erosion control measures for construction works are performing adequately
- placement of flotation curtains at the outlets of all dams until construction is completed.

4.1.2 Operational Phase

Water quality controls will also be implemented during the operation of Lynwood Quarry to minimise surface water impacts. In Lockyersleigh Creek catchment, these measures will include:

- clearly identifying and delineating areas required to be disturbed and ensuring disturbance is limited to those areas, clearing as little vegetation as required and minimising machinery disturbance outside of these areas
- limiting the number of roads and tracks established
- construction of sediment dams to capture and treat runoff from disturbed catchment areas.
- construction of drains to convey clean runoff away from disturbed areas where possible
- constructing road and earthworks cut and fill batters at slopes of 1V:3H or less, where possible, to maximise long term stability
- reshaping, topsoiling and vegetating road and cut and fill batters as soon as practical
- progressively stripping and stockpiling topsoil for later use in rehabilitation and where possible, directly
- regular maintenance of all erosion control works and rehabilitated areas
- regular inspections of access tracks/roads to ensure that drainage is working effectively and that the tracks/roads are stable, particularly after rain
- progressive rehabilitation of emplacement areas to reduce erosion
- prompt revegetation of areas as soon as earthworks are complete.

The Lynwood Quarry Senior Environment and Community Liaison will inspect Lockyersleigh Creek within the Lynwood Quarry on an annual basis (and after major storm events) to identify the condition of the riparian zone and any significant erosion or creek stability issues. Controls will be implemented where practical to address any new issues identified as part of these inspections.

Annual weed and pest inspections will also be undertaken in the riparian zone in accordance with the RLMP with controls implemented as required.

4.2 Identified Work Sites

A site inspection was undertaken by Umwelt during March 2016 to determine whether works within riparian areas required CAAs under the WM Act. In accordance with Part 3, Chapter 3 of the WM Act, a CAA is required if any of the following are to be undertaken:

- the erection of a building or the carrying out of a work (within the meaning of the *Environmental Planning and Assessment Act 1979*)
- the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise

- the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise; and the carrying out of any other activity that affects the quantity or flow of water in a water source.

The identified locations of works (sites) were inspected to determine whether they were within 40 metres (m) of a watercourse with a defined bed and bank. 11 work sites occur within the Lockyersleigh Creek catchment area, with 3 of these sites identified as requiring a CAA. These sites are shown on **Figure 3** with the works shown in the context of the Lockyersleigh catchment area shown on **Figure 4** (refer to **Appendix A** for plates).

4.2.1 Site L14 and L15 – Detention Basin 1

Site L14 and L15 are the locations where Detention Basin 1 will be constructed at the convergence of two first order tributaries of Lockyersleigh Creek. The drainage lines at these sites have defined beds and banks as shown on **Plates 15 to 18 of Appendix A** (see **Appendix B** for cross section and long section of drainage lines) with the tributary subject to erosion. At this location the channel is moderately deep ranging between 1 to 3 m and is described as having meandering channels. This area contains a riparian variant of Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (HN614) as per the OEH Vegetation Information System (VIS) database. This riparian area has been heavily modified by past and ongoing agricultural activities and contains scattered trees occurring with a predominately exotic understorey. Grazing has resulted in the fragmentation and subsequent high disturbance and degradation of native vegetation communities.

Detention Basin 1 will be constructed in the natural depression to the north-east of the granite pit where runoff will be temporarily detained and then flow via gravity/pump out to the downstream catchment.

4.2.2 Site L16 and L17 – Haul Road Crossings

Sites L16 and L17 are the locations of haul road culvert crossings connecting the granite pit to the primary crusher and the ignimbrite pit. The culverts will be constructed to convey flows under the haul roads where they cross second (L16) and third (L17) order tributaries. The creek banks at L16 and L17 are approximately 1.5 m high, relatively steep (approximately 1:2 vertical: horizontal) with a bed width of approximately three metres as shown on **Plates 19 to 20 (Appendix A)**.

This area contains a riparian variant of Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (HN614) and Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (HN570) as per the OEH VIS database. This riparian area has been heavily modified by past disturbance activities and contains scattered trees occurring with a predominately exotic understorey. The locations of L16 and L17 are also described as having rocky outcrops, with a sandy, granular bed. Representative cross sections and a long section of the creek at this location are included in **Appendix B**.

The culverts at these locations will consist of three 1.8 m (wide) x 1.2 m (high) box culverts at both haul road locations.

4.2.3 Site L18 – Diversion Drain

Site L18 is the location where a diversion drain for clean water will be constructed in order to convey upstream catchment runoff away from the granite pit into a third order tributary of Lockyersleigh Creek. The diversion drain will be constructed prior to the granite pit intercepting runoff from the clean water catchment. The watercourse at this site has a defined bed and bank as shown on **Plates 21 to 22 (Appendix A)**. The location is described as having rocky outcrops, with a sandy, granular bed and blackberry bushes growing in the creek. Rabbit holes and water ponding were present in the area. This area predominately contains exotic pastures with surrounding Yellow Box - Blakely's Red Gum grassy woodland on the tablelands, South Eastern Highlands Bioregion (HN614) as per the OEH VIS database. This riparian area has been heavily modified by past and ongoing agricultural which has resulted in the fragmentation and subsequent high disturbance and degradation of native vegetation communities. Representative cross sections and a long section of the creek at this location are included in **Appendix B**.

The diversion drain at the site will be approximately 400 metres long with a base width of 1.5 m, channel depth of 1.2 m, batter slopes 1:0.5 (vertical : horizontal) and an average grade of 0.8 %. Two 1-m drop structures will be constructed within the diversion channel to assist in minimising peak velocities.

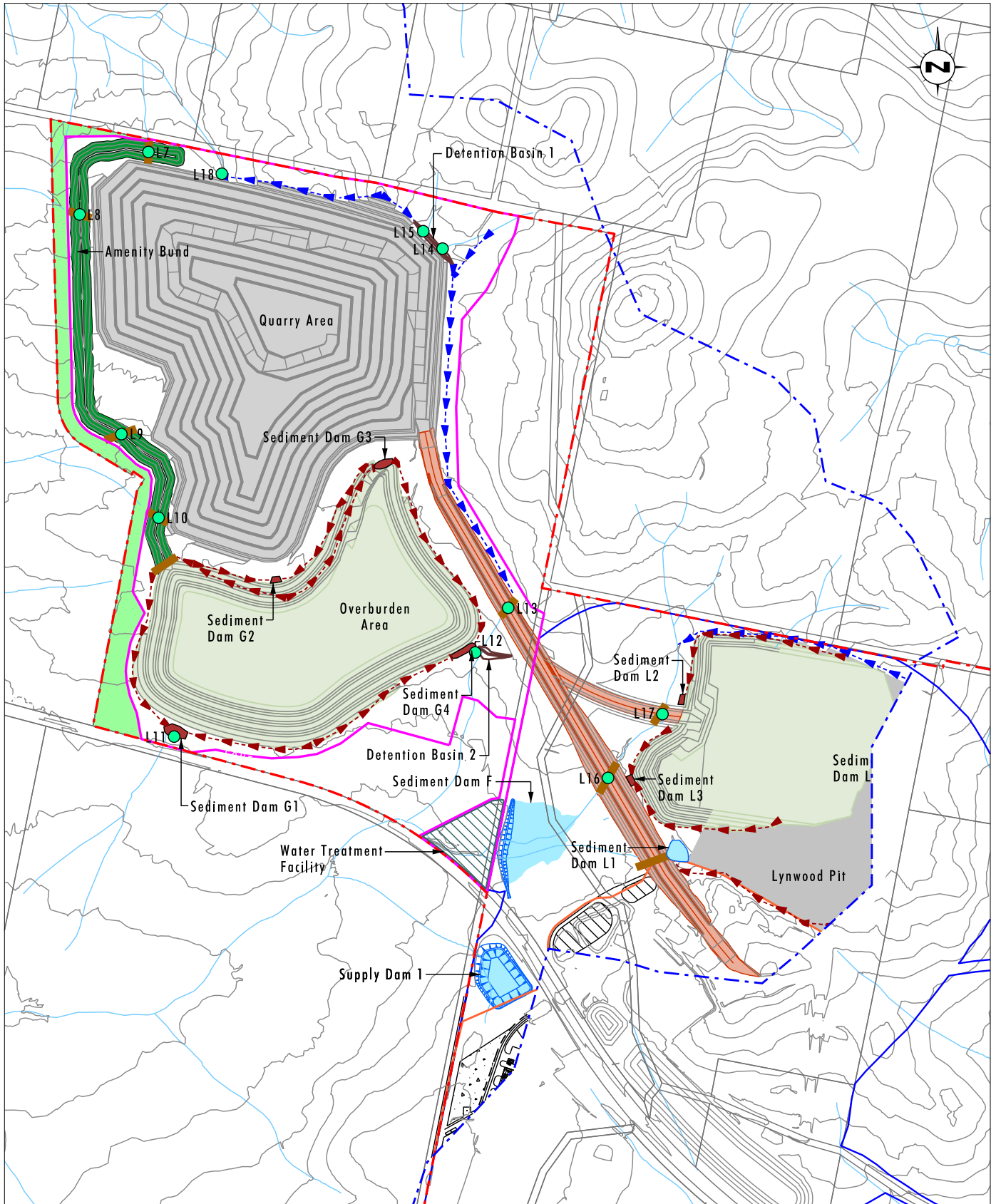
The soils in the construction area of the diversion drain will be treated with gypsum to reduce dispersibility and improve soil structure during construction. Sediment fences will be placed upstream and downstream of the work areas during construction, with controls also placed throughout the construction area to prevent sediment mobilisation. The disturbed areas including the diversion channel (excluding the trafficable area of the haul road) will be topsoiled and seeded with grass species to aid stability. This will assist in reducing erosion potential along the diversion drain and at the re-entry structures into the third order tributary.

4.3 Other works within Riparian Zone

4.3.1 Site L7, L8, L9, L10

Site L7, L8, L9, and L10 are the locations where the amenity bund proposed for the western extent of the granite pit crosses first order tributaries of Lockyersleigh Creek where flows will be conveyed through or under the amenity bund. These sites have no defined beds and banks as shown on **Plates 1 to 8 of Appendix A**. Therefore CAAs are not required for these works.

Sediment fences will be placed upstream and downstream of the work areas prior to construction to prevent sediment mobilisation off site. The disturbed areas available for rehabilitation will be topsoiled and seeded with grass species to aid stability once construction is finished. This will assist in reducing erosion and sediment transport potential.



Data Source: LPI (2009), Holcim Australia (2014)
 Notes: 5m Contour Interval. Conceptual only and subject to detailed design.

0 250 500 750 m
 1:15 000

Legend

- | | | |
|-----------------------------------|------------------------|--------------------|
| Approved Project Area | Vegetation Buffer Zone | Catchment Boundary |
| Lynwood Infrastructure Area | Amenity Bund | Work Site |
| Disturbance Footprint | Haul Road | |
| Granite Pit Disturbance Footprint | Clean Dam | |
| Lynwood Infrastructure Layout | Diversion Drain | |
| Quarry Pit | Sediment Dam | |
| Existing Dam | Dirty Drain | |
| Overburden Emplacement Area | Culvert | |

FIGURE 3

Proposed Work Sites within
 Lockyersleigh Catchment

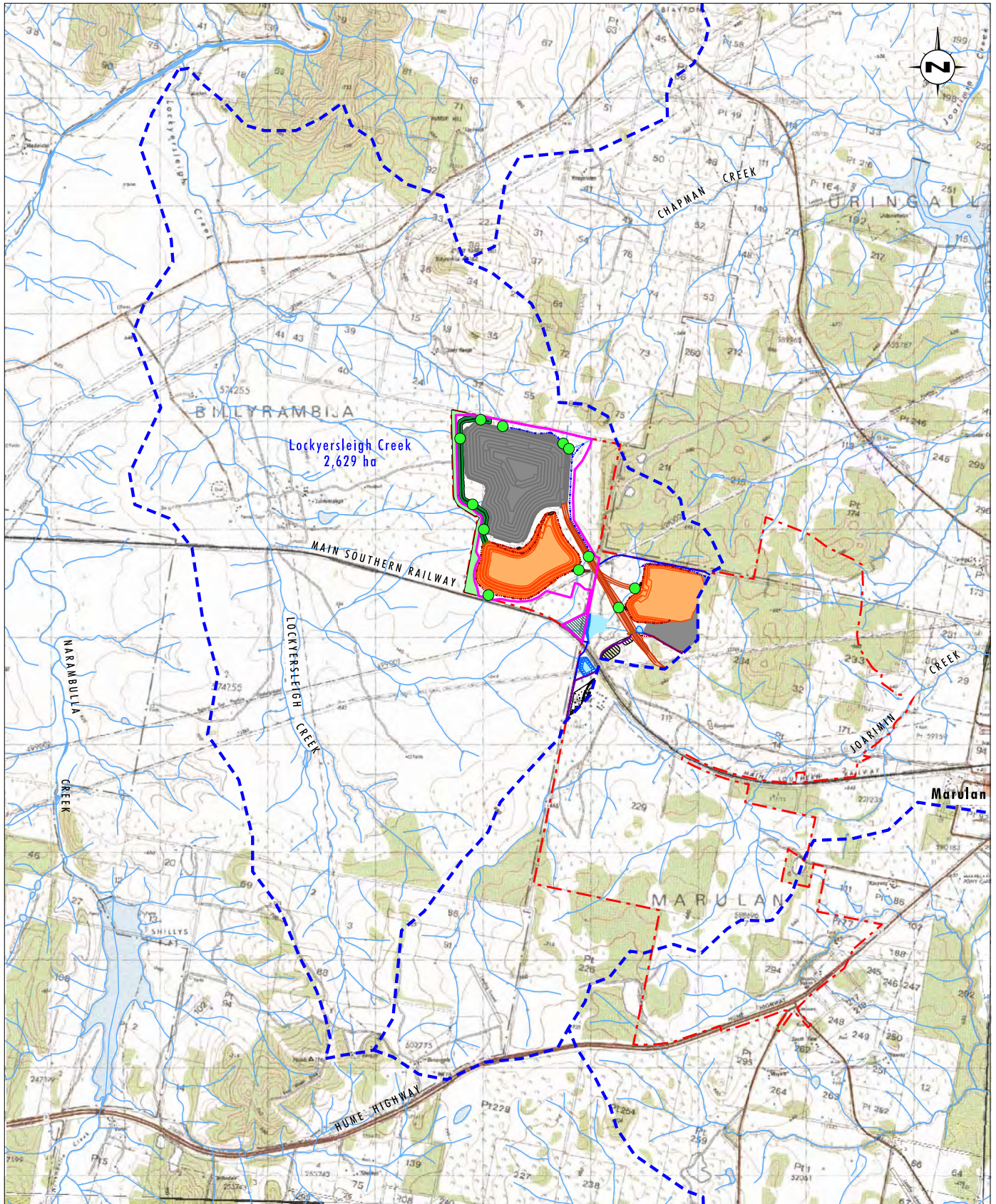


Image Source: LPI (2009)
 Data Source: LPI (2006), Holcim (2016)

0 1.0 2.0 2.5 km
 1:50 000

Legend

- | | | |
|-----------------------------------|-----------------------------|-------------|
| Approved Project Area | Overburden Emplacement Area | Dirty Drain |
| Catchment Boundary | Vegetation Buffer Zone | Culvert |
| Lynwood Infrastructure Area | Amenity Bund | Work Site |
| Disturbance Footprint | Haul Road | |
| Granite Pit Disturbance Footprint | Clean Dam | |
| Lynwood Infrastructure Layout | Diversion Drain | |
| Quarry Pit | Sediment Dam | |
| Existing Dam | Water Treatment Facility | |

FIGURE 4

Lockyersleigh Creek Catchment Area
 and Project Work Sites
 Within Catchment Area

4.3.1 Site L11 – Sediment Dam G1

Site L11 is the location of the proposed Sediment Dam G1 at an existing second order tributary of Lockyersleigh Creek.

The site has no defined beds and banks as shown on **Plates 9 to 10 (Appendix A)**. Therefore a CAA is not required for these works. Sediment Dam G1 is proposed to be constructed for the purposes of capturing dirty water runoff from disturbed areas and those areas being rehabilitated associated with the overburden emplacement area. It will have an approximate volume of 3.9 ML. Rip rap will be placed along the length of the spillway to prevent scouring. This rip rap will consist of well graded rock to a depth of 300 mm with $d_{50} = 100$ mm (being 100 mm average diameter) and will extend 20 m downstream of the end of the spillway. Sediment fences will be placed upstream and downstream of the work area prior to construction to prevent sediment mobilisation. The disturbed areas available for rehabilitation will be topsoiled and seeded with grass species to aid in soil stability outside of the dam storage area. This will assist in reducing erosion and sediment transport potential.

4.3.2 Site L12 – Detention Basin 2

Site L12 is the location where the proposed Detention Basin 2 is located on a first order tributary. The site has no defined beds and banks as shown on **Plates 11 to 12 (Appendix A)**. Therefore a CAA is not required for these works.

4.3.3 Site L13 - Haul Road Crossings

Site L13 is the location where a first order tributary of Lockyersleigh Creek is crossed by the haul road on the north eastern side of the future overburden area (refer to **Figures 3 and 4**). A culvert will be constructed to convey flows under the haul road. Site L13 does not have a defined bed or bank as shown on **Plates 13 to 14 (Appendix A)**. A CAA is not required for these works.

4.4 Contingency Erosion and Sediment Controls during Construction

A number of erosion and sediment controls have been identified that will be implemented to mitigate erosion and sediment export from disturbed areas during storm events. These measures include:

- where a storm event is imminent, covering disturbed areas within the creek line with geotextile fabric and securing with stakes to reduce erosion potential (where practical to do so in the available time)
- regular inspection of erosion and sediment controls during works and rectification of any damaged controls where it is safe to do so
- installation of additional controls such as sediment fences as required
- construction of sediment and erosion controls designed to manage sediment within a catchment area prior to disturbing the area for quarry development/construction requirements.

4.5 Completion criteria

The preliminary completion criteria for each construction work site and riparian area are detailed in **Table 4.1**.

Table 4.1 Construction Phase Preliminary Completion Criteria for each Construction Work Site

Objective / Performance Indicator	Preliminary Completion Criteria	Timing
Practical completion of the diversion drain, sediment dam and all drainage infrastructure	Diversion drain, sediment dam and all other drainage infrastructure adequately stabilised with ground cover of 70%. All drains reporting to designated catchments.	12 months from completion of construction or when monitoring indicates revegetation has established on disturbed areas and has reached more than 70% groundcover.
Construction areas stable	Areas of exposed soils are revegetated to achieve cohesive ground cover using a native plant species mix compatible with the surrounding environment.	12 months from completion of construction or when disturbed areas have reached more than 70% groundcover.
Removal of any temporary erosion and sediment control measures when revegetation has established on formerly disturbed areas.	Temporary erosion and sediment control measures are removed following successful establishment of ground cover species.	12 months from completion of construction or when disturbed areas have reached more than 70% groundcover.

Table 4.2 Riparian Area Preliminary Rehabilitation Completion Criteria for the Lockyersleigh Catchment Area

Objective / Performance Indicator	Preliminary Completion Criteria	Timing
The riparian corridor has been fenced to exclude cattle where required.	Installation of fencing around the perimeter of the corridor to exclude cattle	Within 6 months of implementing the Rehabilitation and Landscape Management Plan
The site is managing significant weed or feral animal infestations with a demonstrable reduction pre construction.	Weed and pest inspections show No increase in weed population and monitoring indicates the absence of or decline in weed species.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years.

5.0 Monitoring and Maintenance Requirements

During the construction a permitting process as per the EMS will be implemented and works will be inspected regularly to ensure required controls are in place and effective. Following the completion of construction works, the work area will be inspected and reviewed against the completion criteria listed in Section 4.5.

During operations, monitoring of the management measures implemented will be undertaken in accordance with the RLMP. Monitoring will also be undertaken after major storm events for erosion and sediment control structures potentially affected. Water quality monitoring will also be undertaken as discussed in the Lynwood Quarry Water Management Plan.

6.0 Responsibilities

The Lynwood Quarry Senior Environment and Community Liaison and Quarry Manager will be responsible for the implementation of the requirements of this plan.

7.0 Reporting and Review

The Lynwood Quarry Senior Environment and Community Liaison will report any significant findings regarding the implementation of this plan in Lynwood Quarry Annual Review.

8.0 References

Asset Geotechnical 2005. *Proposed Hard Rock Quarry Marulan –Report on Geotechnical Investigation*. Prepared for Umwelt (Australia) Pty Limited.

Department of Natural Resources, 2003. *Soil Landscapes of the Goulburn Region 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.

Umwelt (Australia) Pty Limited 2005. *Environmental Impact Statement. Readymix Holdings Pty Ltd. Proposed Lynwood Quarry, Marulan*.



APPENDIX A

Plates



PLATE 1
Looking upstream of Site L7



PLATE 2
Looking downstream of Site L7



PLATE 3
Looking upstream of Site L8



PLATE 4
Looking downstream of Site L8



PLATE 5
Looking upstream of Site L9



PLATE 6
Looking downstream of Site L9



PLATE 7
Looking upstream of Site L10



PLATE 8
Looking downstream of Site L10



PLATE 9
Looking upstream of Site L11



PLATE 10
Looking downstream of Site L11



PLATE 11
Looking upstream of Site L12



PLATE 12
Looking downstream of Site L12



PLATE 13
Looking upstream of Site L13



PLATE 14
Looking downstream of Site L13



PLATE 15
Looking upstream of Site L14



PLATE 16
Looking downstream of Site L14



PLATE 17
Looking upstream of Site L15

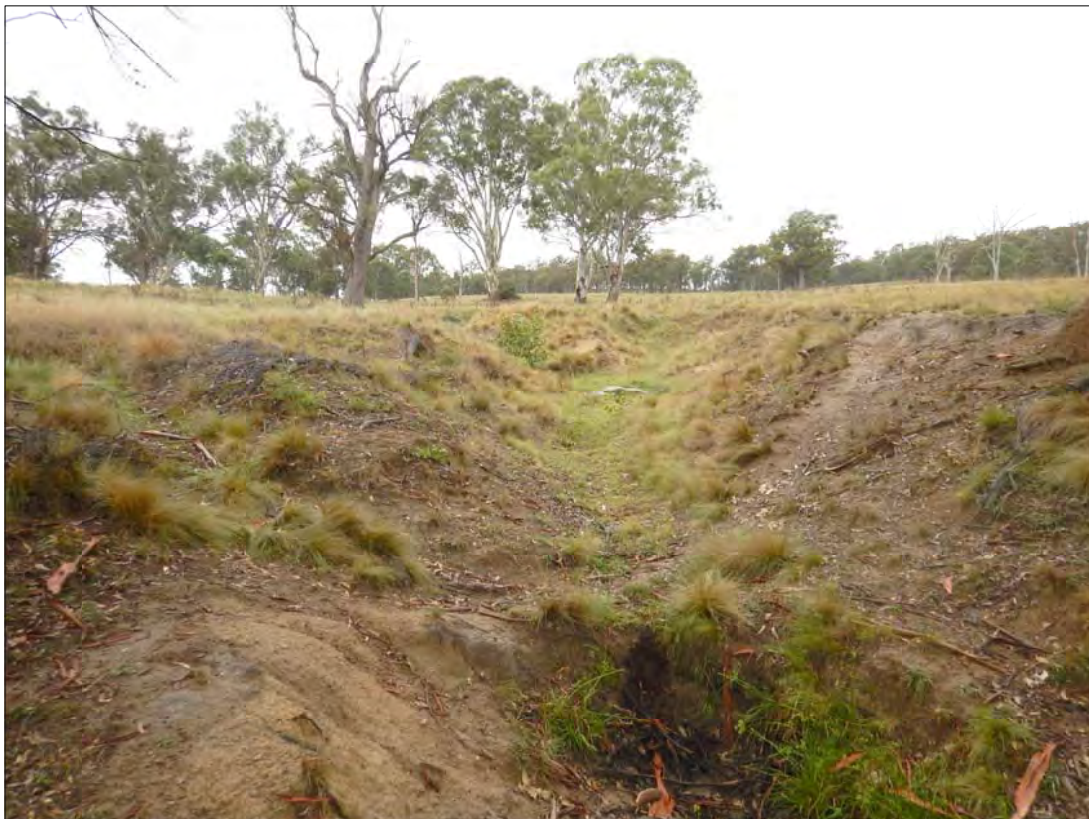


PLATE 18
Looking downstream of Site L15



PLATE 19
Looking upstream of Site L16



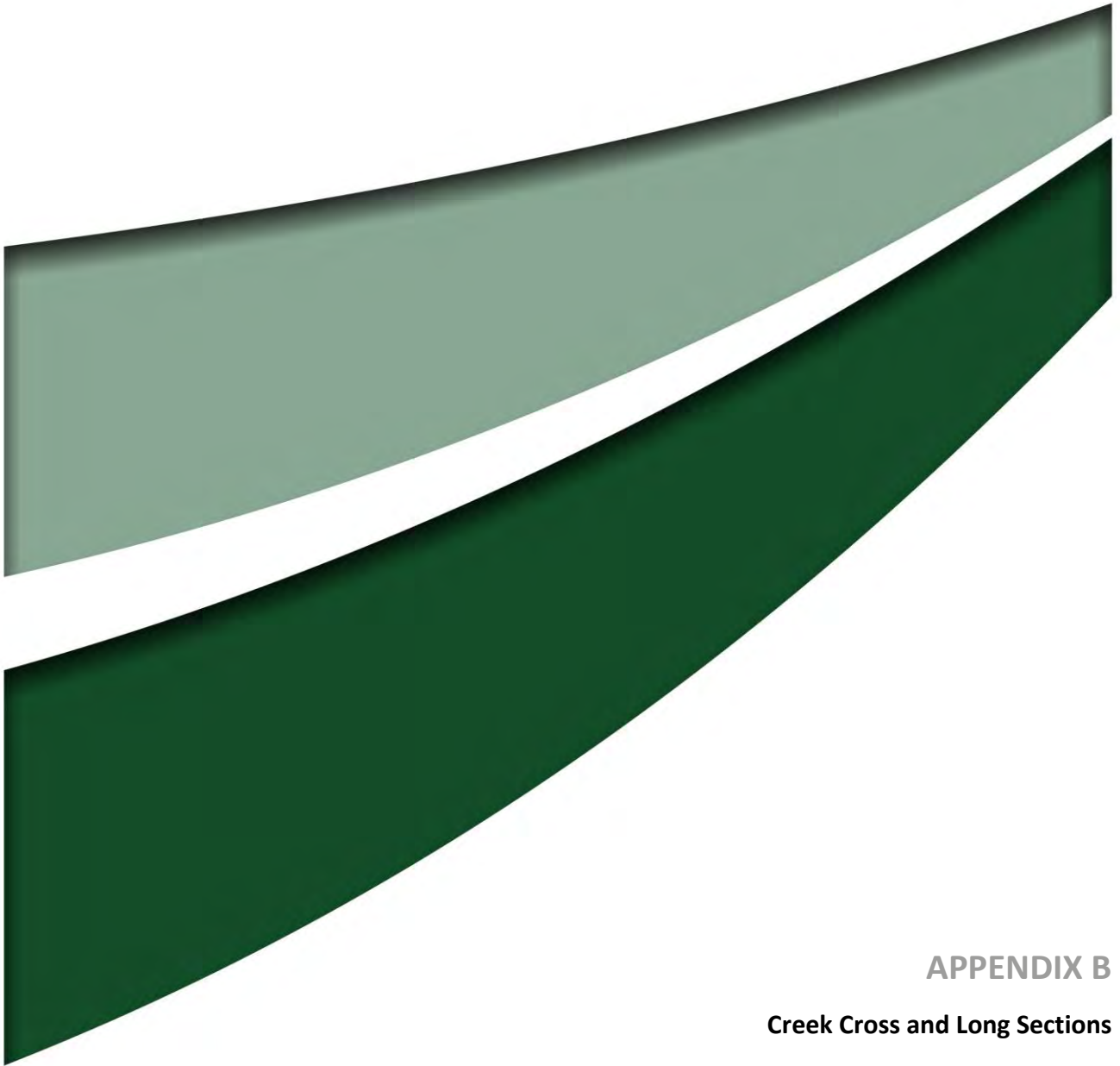
PLATE 20
Looking downstream of Site L16



PLATE 21
Looking upstream of Site L18

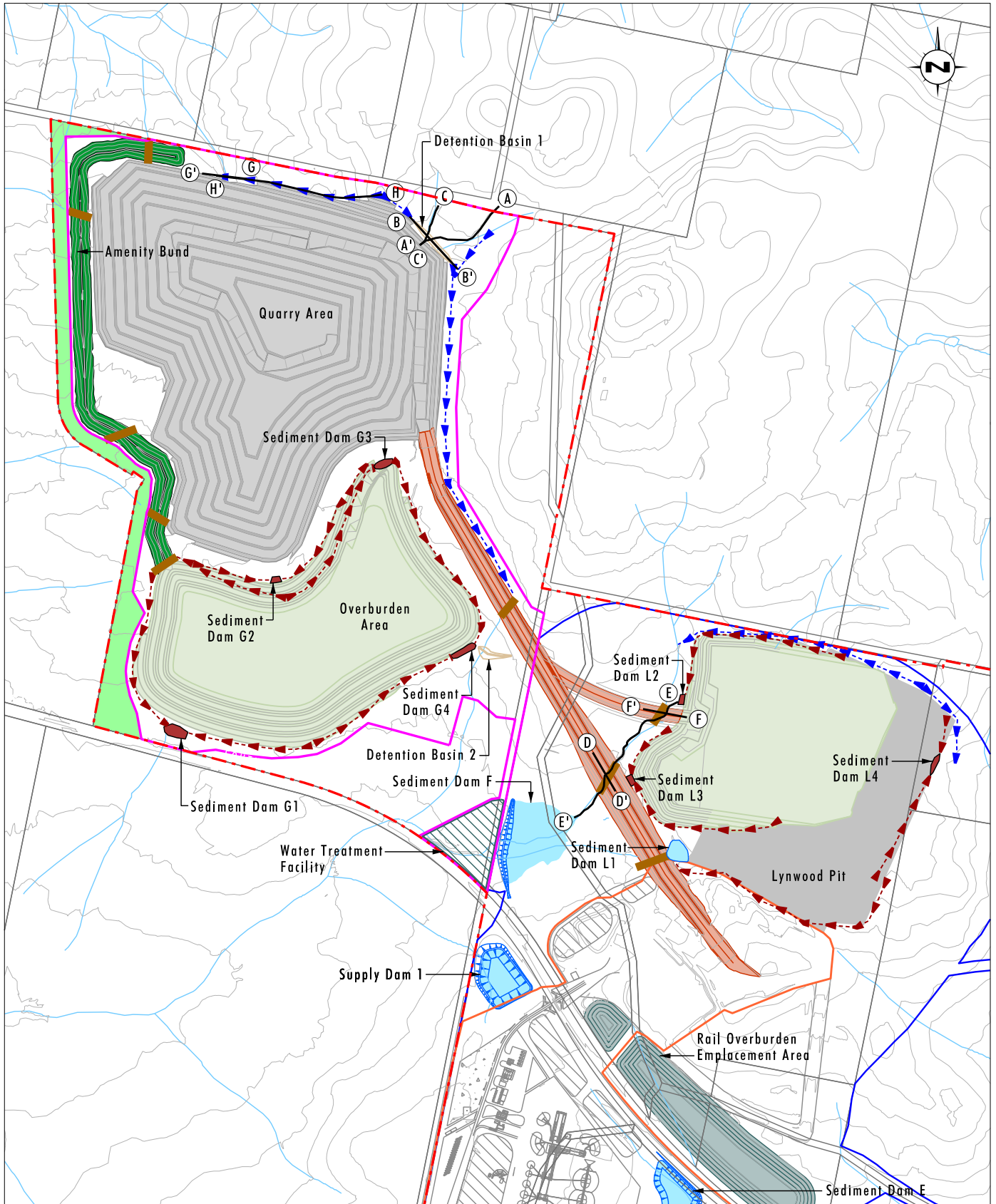


PLATE 22
Looking downstream of Site L18



APPENDIX B

Creek Cross and Long Sections



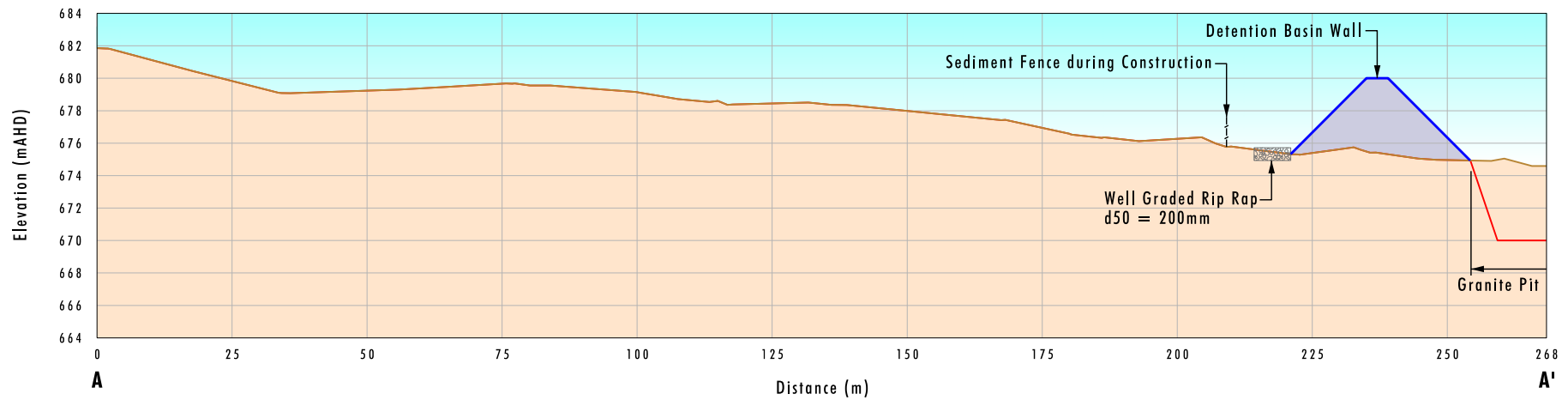
Data Source: LPI (2009), Holcim Australia (2014)
 Notes: 5m Contour Interval. Conceptual only and subject to detailed design.

Legend

- | | | |
|-----------------------------------|-----------------------------|---------------|
| Approved Project Area | Overburden Emplacement Area | Culvert |
| Lynwood Infrastructure Area | Vegetation Buffer Zone | Section Lines |
| Disturbance Footprint | Amenity Bund | |
| Granite Pit Disturbance Footprint | Haul Road | |
| Lynwood Infrastructure Layout | Clean Dam | |
| Quarry Pit | Diversion Drain | |
| Emplacement Area | Sediment Dam | |
| Existing Dam | Dirty Drain | |

FIGURE B1

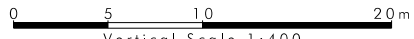
Cross Section Locations



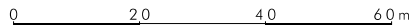
Legend

- Natural Surface
- Proposed Infrastructure/Earthworks
- ▭ Detention Basin Wall
- Sediment Fence

Note: Vertical Exaggeration 3:1

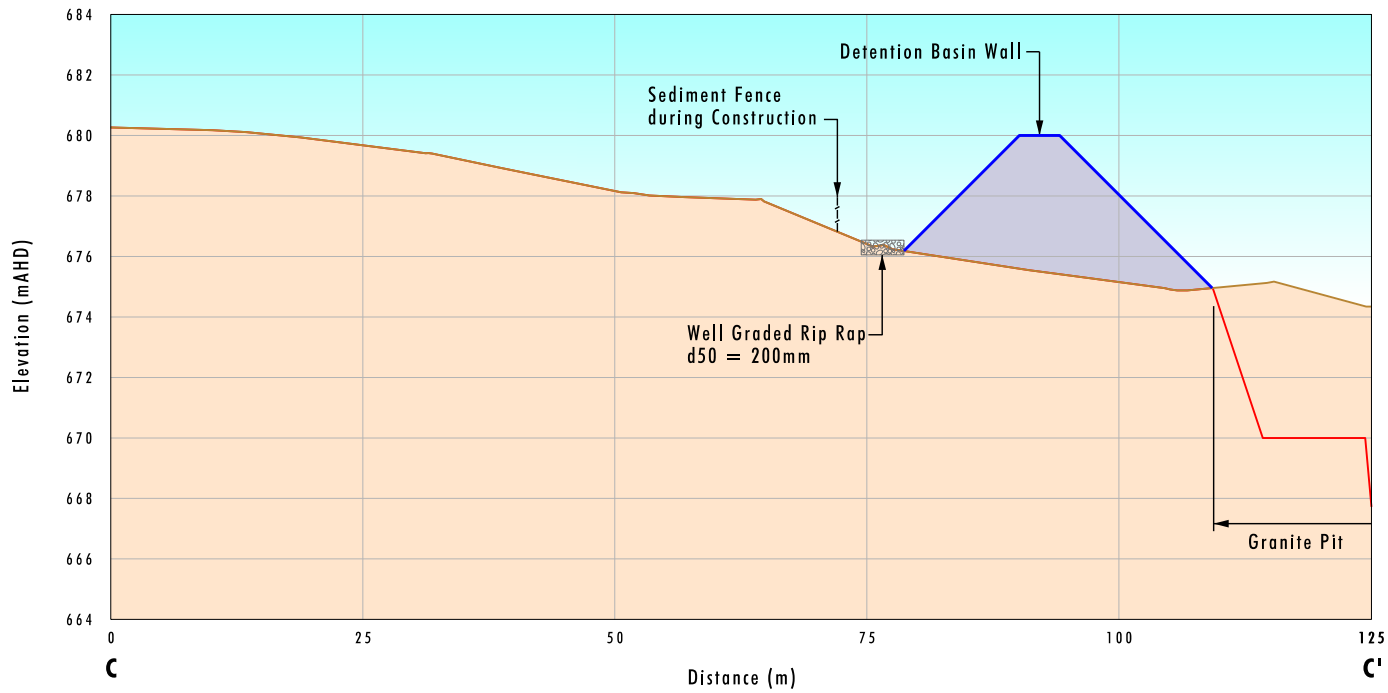


Vertical Scale 1:400



Horizontal Scale 1:1 200

FIGURE B2
L14 Long Section A-A'



Legend

- Natural Surface
- Proposed Infrastructure/Earthworks
- ▭ Detention Basin Wall
- ▨ Sediment Fence

Note: Vertical Exaggeration 3:1

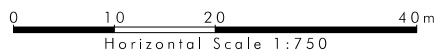
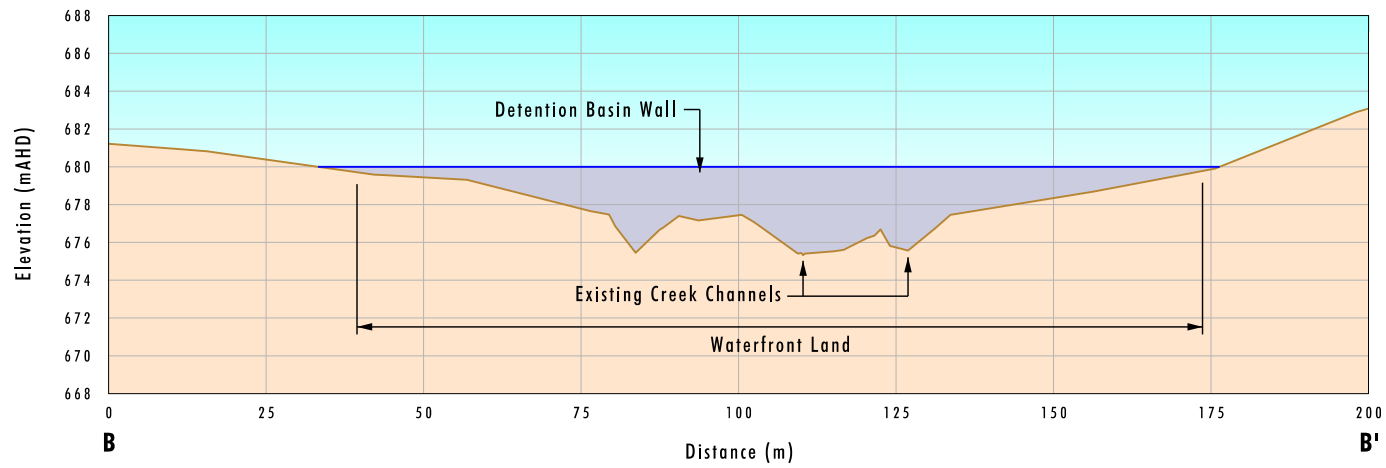


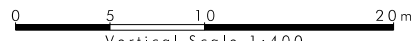
FIGURE B3
L15 Long Section C-C'



Legend

- Natural Surface
- Detention Basin Wall

Note: Vertical Exaggeration 3:1

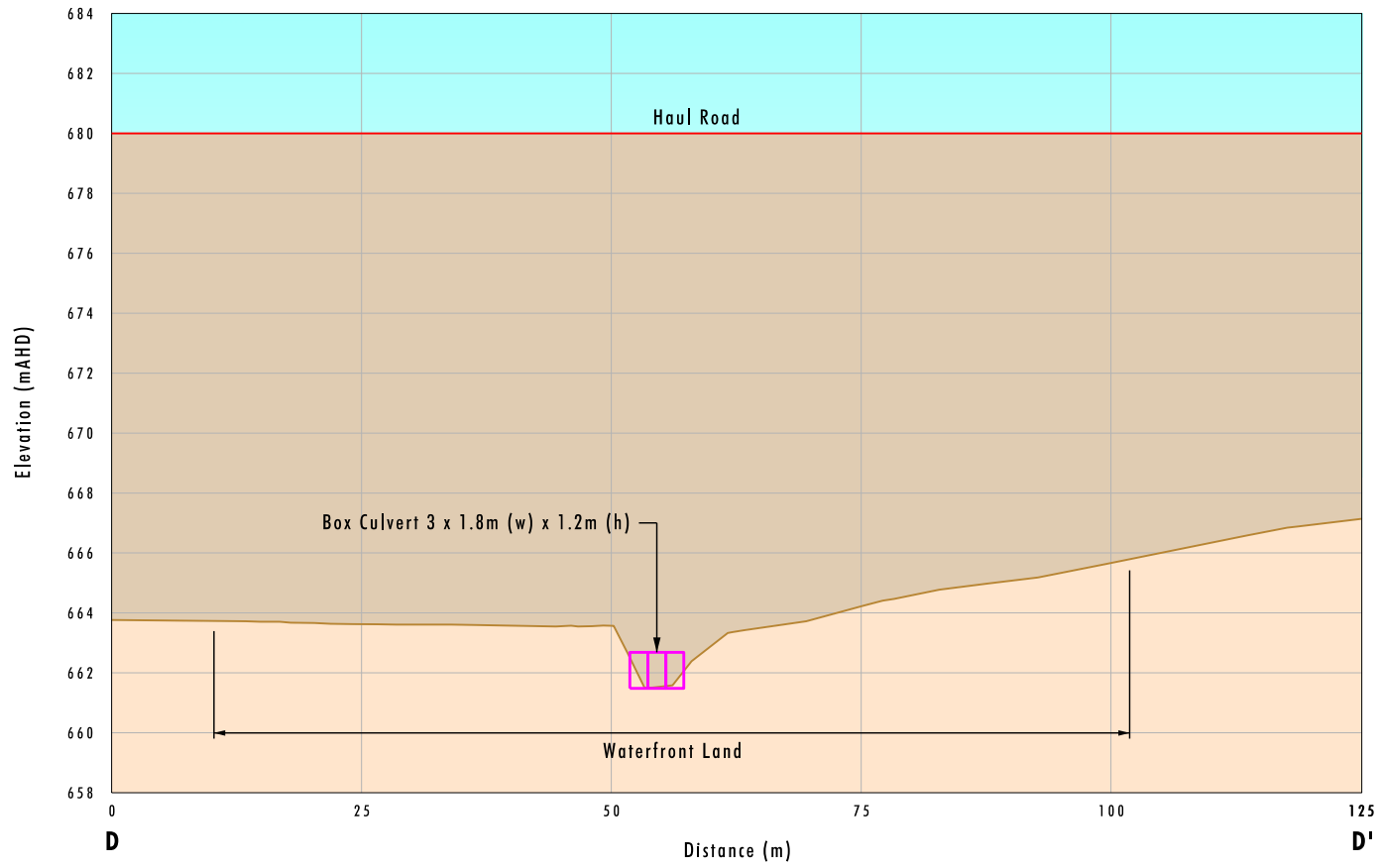


Vertical Scale 1:400



Horizontal Scale 1:1 200

FIGURE B4
L14/L15 Cross Section B-B'



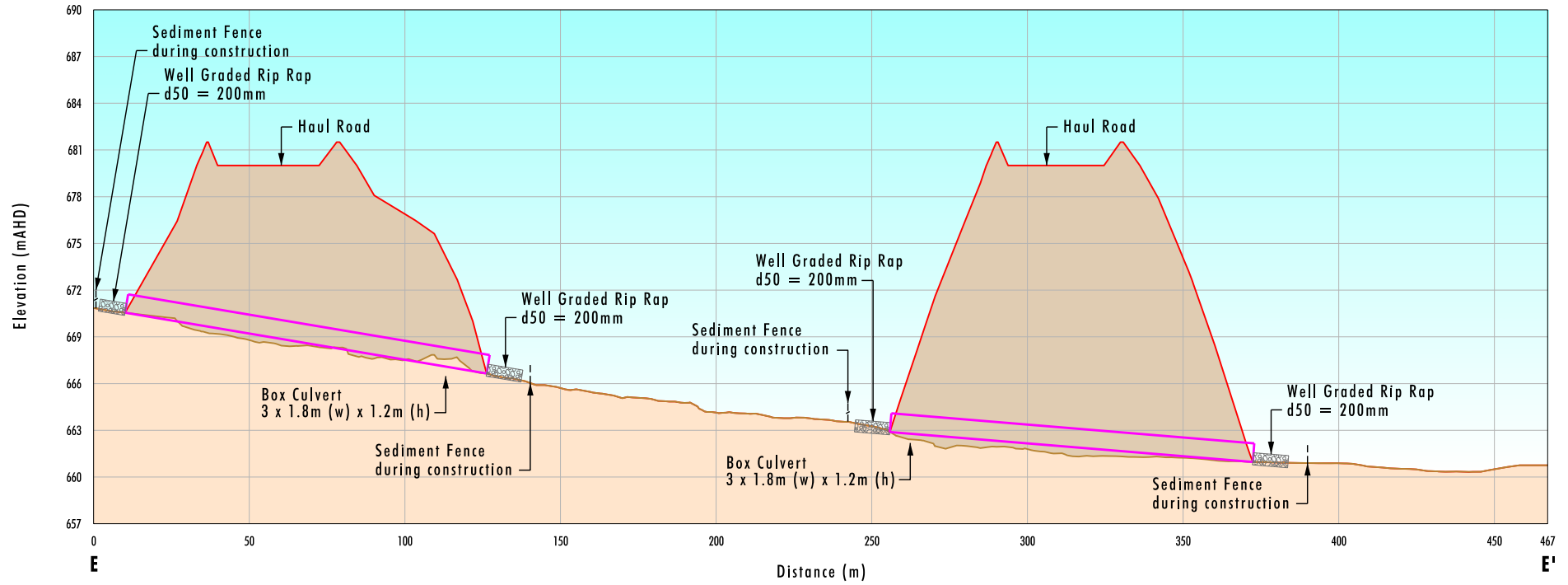
Legend

- Natural Surface
- Infrastructure/Earthworks
- Box Culvert
- Haul Road Batter

Note: Vertical Exaggeration 3:1



FIGURE B5
L16 Cross Section D-D'



- Legend**
- Natural Surface
 - Infrastructure/Earthworks
 - Box Culvert
 - Haul Road
 - - - Sediment Fence

Note: Vertical Exaggeration 5:1

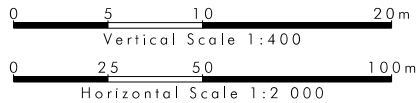
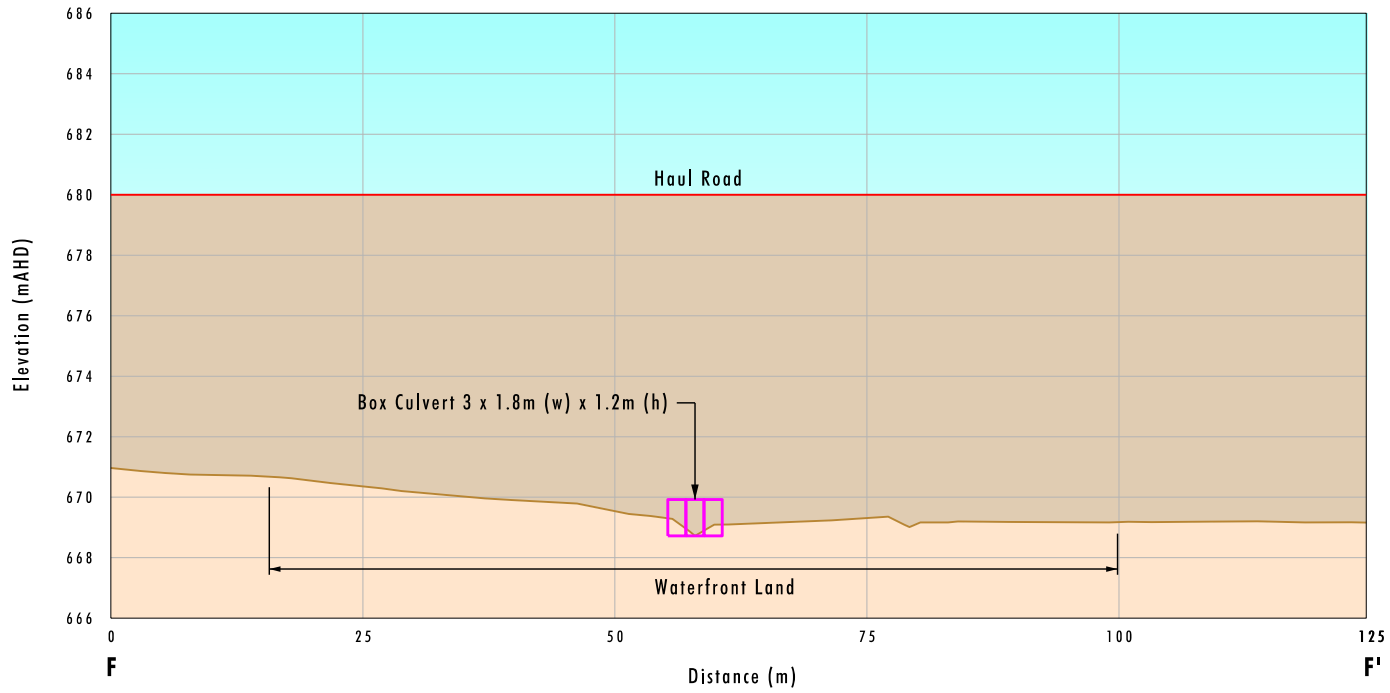


FIGURE B6
L16/L17 Long Section E-E'



Legend

- Natural Surface
- Infrastructure/Earthworks
- Box Culvert
- Haul Road Batter

Note: Vertical Exaggeration 3:1

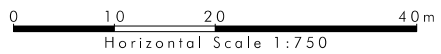
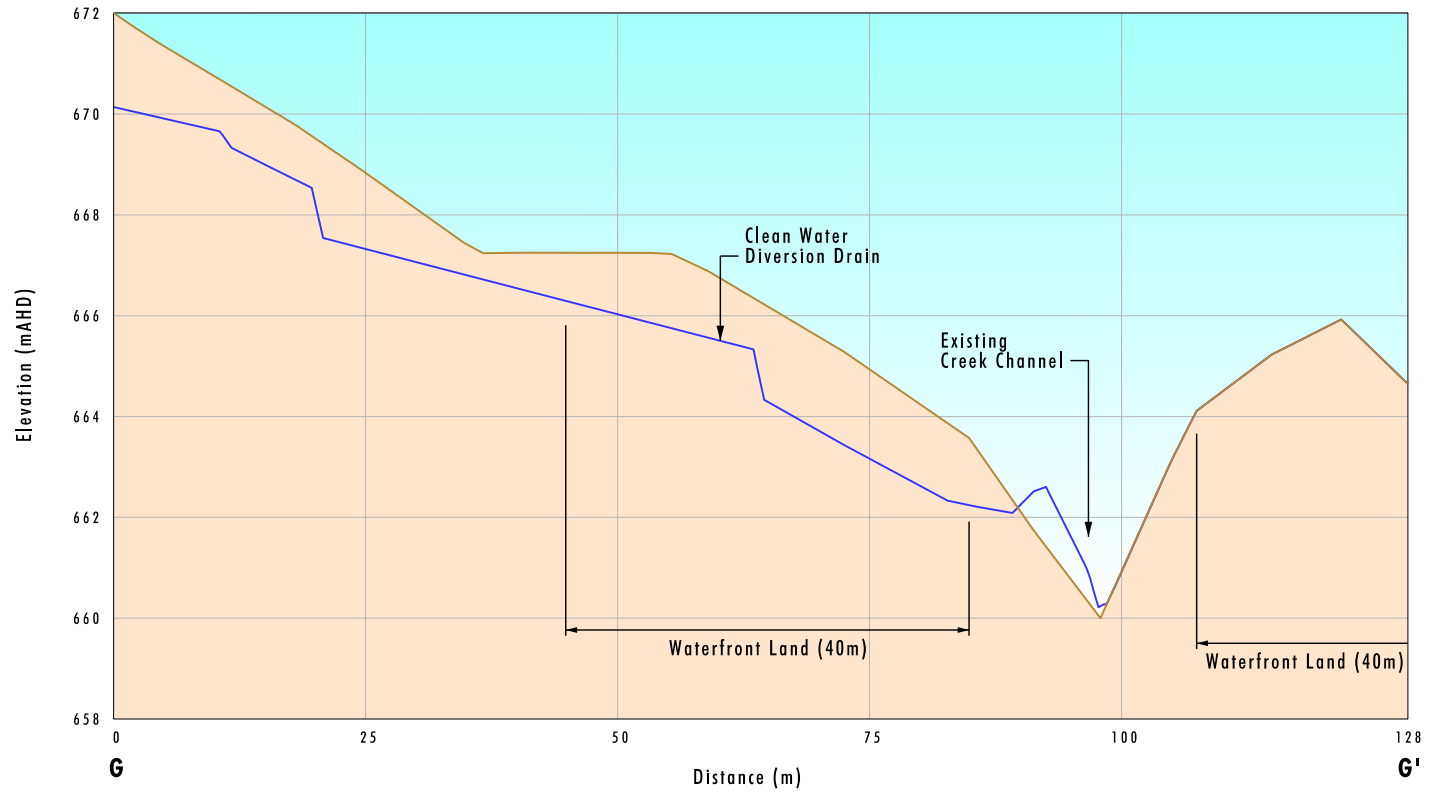


FIGURE B7
L17 Cross Section F-F'



Legend

- Natural Surface
- Diversion Drain

Note: Vertical Exaggeration 5:1

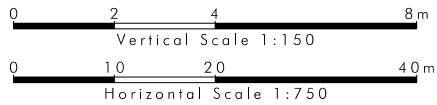
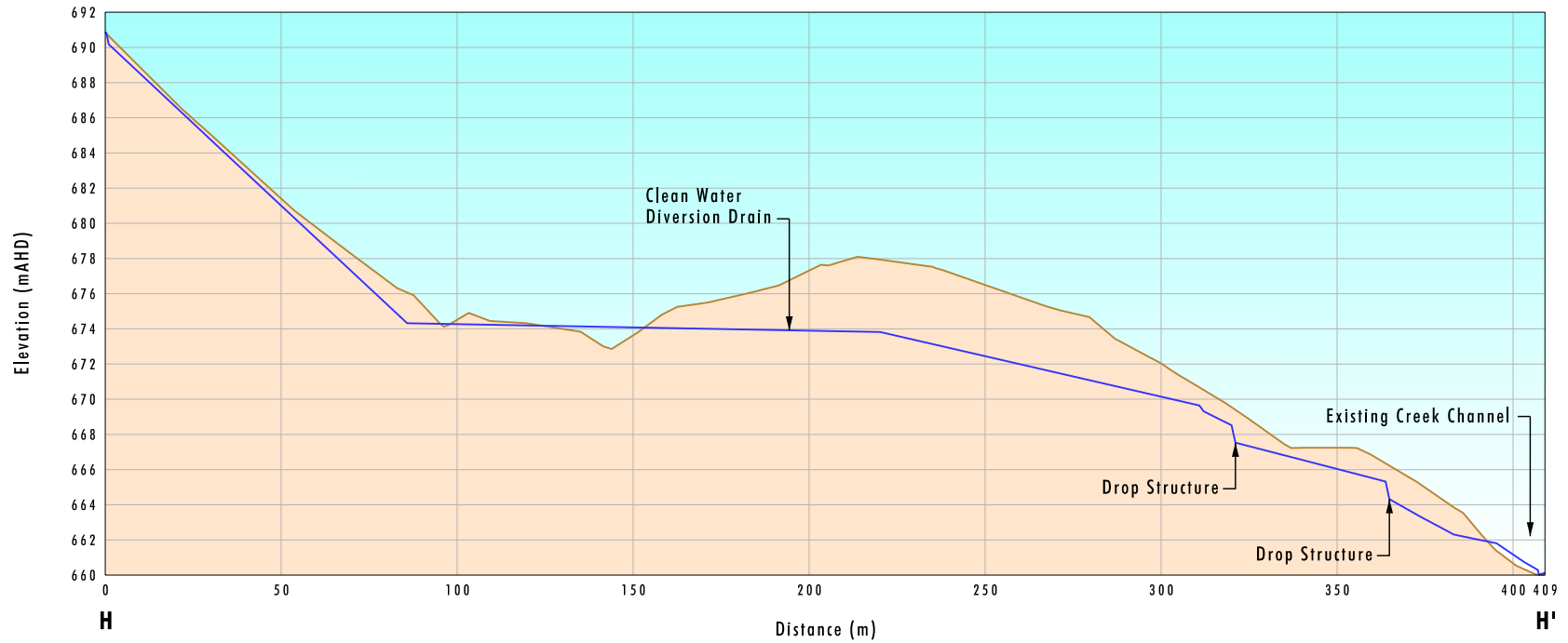


FIGURE B8
L18 Creek Cross Section G-G'



Legend

- Natural Surface
- Diversion Drain

Note: Vertical Exaggeration 5:1

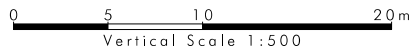


FIGURE B9
L18 Diversion Drain Long Section H-H'



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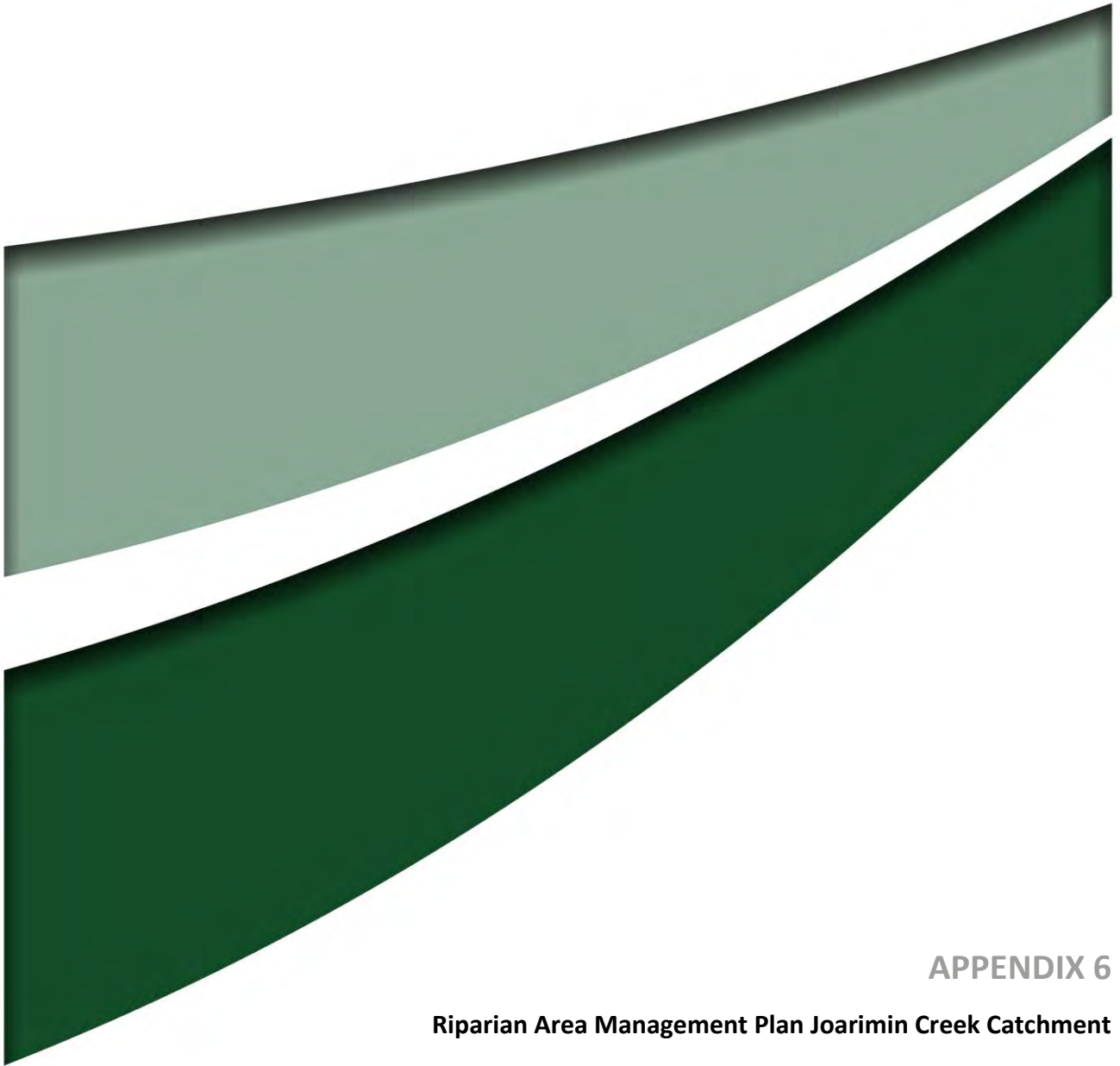
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APPENDIX 6

Riparian Area Management Plan Joarimin Creek Catchment

Lynwood Quarry

Riparian Area Management Plan

Joarimin Creek Catchment

May 2018





LYNWOOD QUARRY RIPARIAN AREA MANAGEMENT PLAN

Joarimin Creek Catchment

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Holcim (Australia) Pty Ltd

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Report No. 3330/R36/Final
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Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
1	Umwelt (Australia)	September 2016	Umwelt (Australia)	September 2016
2	Susan Shield – Engeny Water Management	April 2018	Umwelt (Australia)	May 2018

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1.0 Introduction

Holcim (Australia) Pty Lid (Holcim) was granted development consent in December 2005 (DA 128-5-2005) (Development Consent) by the then NSW Minister for Planning for the construction and operation of a hardrock quarry known as Lynwood Quarry west of Marulan in the Southern Tablelands region of NSW (refer to **Figure 1**). There have been five modifications approved to the Development Consent since 2005.

Holcim has approval to carry out quarrying operations until 1 January 2038 and will include operations in the catchments of Joarimin, Lockyersleigh and Marulan Creeks, all of which form part of the Sydney Drinking Water Catchment. Separate riparian area management plans have been prepared the Joarimin and Lockyersleigh Creeks within the project area to ensure works associated with the construction and operation of Lynwood Quarry are undertaken in a way which reduces impacts on riparian zones. There are no works proposed to be undertaken within the Marulan Creek catchment area. Should works be required within this catchment, a separate management plan will be developed.

This Riparian Area Management Plan (RAMP) for Joarimin Creek provides a framework for the management of the Joarimin Creek riparian zone that occurs within Lynwood Quarry. This plan includes the management of works on “waterfront land” as defined by the *Water Management Act 2000* (WM Act). This plan has been developed in accordance with Conditions 44 and 45 of Schedule 3 of the Lynwood Quarry Development Consent. This plan forms part of the Rehabilitation and Landscape Management Plan (RLMP) as required by Condition 44 of Schedule 3 of the Development Consent.

1.1 Overview of the Project

The location and extent of the quarry pit is shown on **Figure 1**, including the locations of overburden and excess product emplacement areas and project infrastructure.

Lynwood Quarry has existing Development Consent approval to produce up to 5 million tonnes per annum (Mtpa) of saleable quarry product until 1 January 2038. Some of the material extracted as part of the quarrying process is not suitable for processing and sale, consequently emplacement areas are required. The locations of these emplacement areas are shown on **Figure 1**.

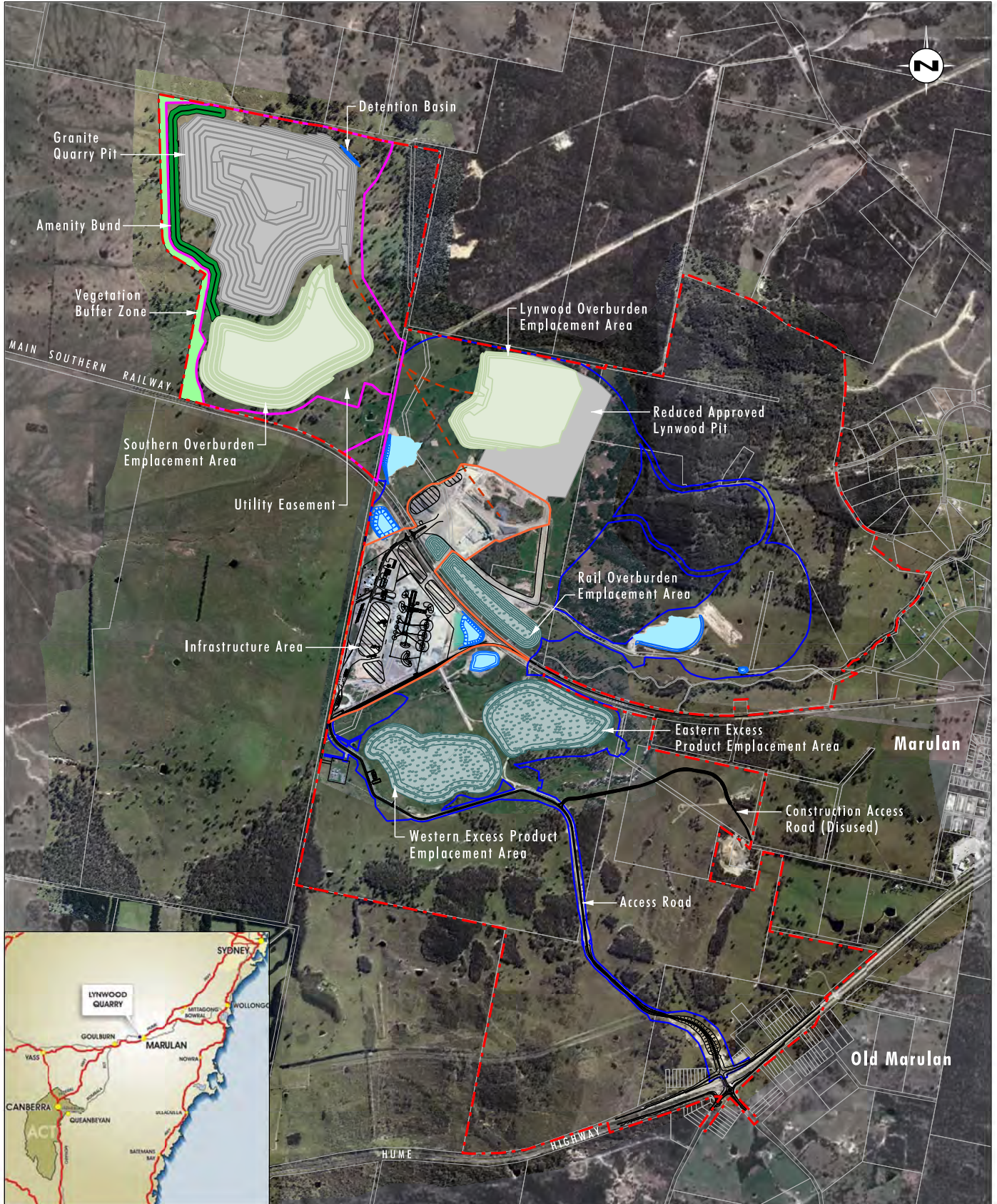


Image Source: Google Earth (2012), Holcim (2012, 2014)
 Data Source: LPI (2014), Holcim Australia (2015)

0 0.5 1.0 1.5 km
 1:30 000

Legend

- | | |
|---|---|
| - - - Approved Project Area | Quarry Pit |
| Lynwood Infrastructure Area | Emplacement Area |
| Approved Disturbance Footprint | Dam |
| Granite Pit Disturbance Footprint | Overburden Emplacement Area |
| Lynwood Infrastructure Layout | Vegetation Buffer Zone |
| Haul Road | Amenity Bund |

FIGURE 1
Lynwood Quarry

1.2 Development Conditions

The preparation of this RAMP is required by Conditions 44 and 45 of Schedule 3 of the Development Consent. These conditions are outlined in **Table 1.1** with an indication of where in the plan each requirement is addressed.

Table 1.1 Development Consent Conditions

Schedule 3	Section
<p>Rehabilitation Landscape Management Plan</p> <p>44. Within 6 months of this consent, the Applicant must prepare (and following approval implement) a Rehabilitation and Landscape Management Plan for the development, in consultation with OEH, DPI Water and Council, and to the satisfaction of the Secretary. This plan must:</p> <p>...b) include Riparian Area Management Plan/s (see condition 45) for those riparian areas to be disturbed in the next 5 years, excluding areas within quarry pits or emplacement areas as agreed with the Secretary;...</p>	<p>Entire document.</p> <p>Consultation in Section 1.4</p>
<p>45. The Riparian Area Management Plan/s must be prepared by a suitably qualified hydrologist; whose appointment has been approved by the Secretary, and include:</p>	<p>Section 1.4</p>
<p>a) Baseline surveys of creeks, providing existing bed, bank and vegetation information (including representative cross and longitudinal sections), in the areas in which the development is located, excluding the quarry pits and emplacement areas;</p>	<p>Sections 2.0, 4.2, and 4.3</p>
<p>b) Detailed designs of the proposed works, including any proposed stabilisation, scour protection, and / or enhancement works (including representative cross and longitudinal sections);</p>	<p>Section 4.2</p>
<p>c) A description of the measures that would be implemented in the event of flooding during construction / rehabilitation;</p>	<p>Section 4.4</p>
<p>d) Details of proposed staging of the works;</p>	<p>Sections 3.1, 3.2, and 4.2</p>
<p>e) Completion criteria for the rehabilitation of the riparian area;</p>	<p>Section 4.5</p>
<p>f) A protocol for monitoring the performance of rehabilitation over time.</p>	<p>Section 5.0</p>

1.3 Objectives of the Riparian Area Management Plan

The objectives of this RAMP are to meet the development consent conditions by:

- describing the current condition of riparian areas in Joarimin Creek catchment that are within the Lynwood Quarry
- providing a detailed design of the proposed works and the proposed staging of works

- outlining the management measures to be implemented at the site level, including completion criteria for the rehabilitation of riparian areas disturbed by the operation of Lynwood Quarry
- outlining the management measures to be implemented for the Joarimin Creek riparian zone for works undertaken at Lynwood Quarry, and
- defining the monitoring and maintenance requirements for Joarimin Creek, including a protocol for monitoring effectiveness of rehabilitation works over time.

1.4 Consultation

Condition 44 of Schedule 3 of the Development Consent requires the RLMP, of which this plan forms part, must be prepared in consultation with the Office of Environment and Heritage (OEH), Department of Primary Industries Water (DPI Water) and Goulburn Mulwaree Council (Council). A draft copy of this plan was provided to each of these agencies for comment prior to submission of a final draft to the Department of Planning and Environment (DPE) for approval. Further details of agency consultation are included in the main text of the RLMP.

The consultation process for this plan also builds on the extensive consultation undertaken as part of the approval process for Lynwood Quarry.

2.0 Joarimin Creek Catchment

Joarimin Creek has a catchment area of approximately 5 440 hectares (ha), is a fifth order stream and drains in a north-easterly direction to the Wollondilly River. Land use within the catchment is predominantly grazing and residential with some forested areas. A large proportion of the Marulan Township lies within the catchment area.

Joarimin Creek extends from the Hume Highway approximately 12 kilometres (km) north to its confluence with the Wollondilly River. The confluence is located approximately 6.2 km downstream of Marulan Drinking Water Supply Pumping Station on the Wollondilly River. There is one major dam (Johnniefields Dam) located along the creek approximately 6.4 km downstream of Lynwood Quarry. Johnniefields Dam is estimated to have a capacity of 550 ML and supplies water for irrigation, domestic, stock and industrial use. Holcim has access to 80 ML per year of supply from Johnniefields Dam for use at the Lynwood Quarry.

The catchment has typical gradients varying from 2 to 3% in the north-east and up to 25% in the upper slopes to the west.

Joarimin Creek is an ephemeral creek system with flows only occurring in the creek during storm events or after prolonged periods of heavy rain. Generally the creek system is predominantly dry, however, some pools of permanent or semi-permanent water are present in the lower catchment. There is little or no riparian vegetation in the upper catchment (upstream of the Main Southern Railway), with a thin line of well-established riparian vegetation, dominated by Gum-Box-Apple Woodland, downstream. There is evidence of creek bank erosion throughout the catchment.

Approximately 295 ha (5%) of the Joarimin Creek catchment is within the Lynwood Quarry water management system. Approximately 373 ha (7%) is upstream of Lynwood Quarry. Approximately 748 ha (14%) is within the Holcim Lynwood Quarry property boundary.

A proportion of the presently constructed Lynwood Quarry infrastructure footprint is within the Joarimin Creek catchment. A water harvesting dam and several sediment dams, have or will be constructed within the Joarimin Creek catchment. A portion of the ignimbrite pit also lies within the catchment area.

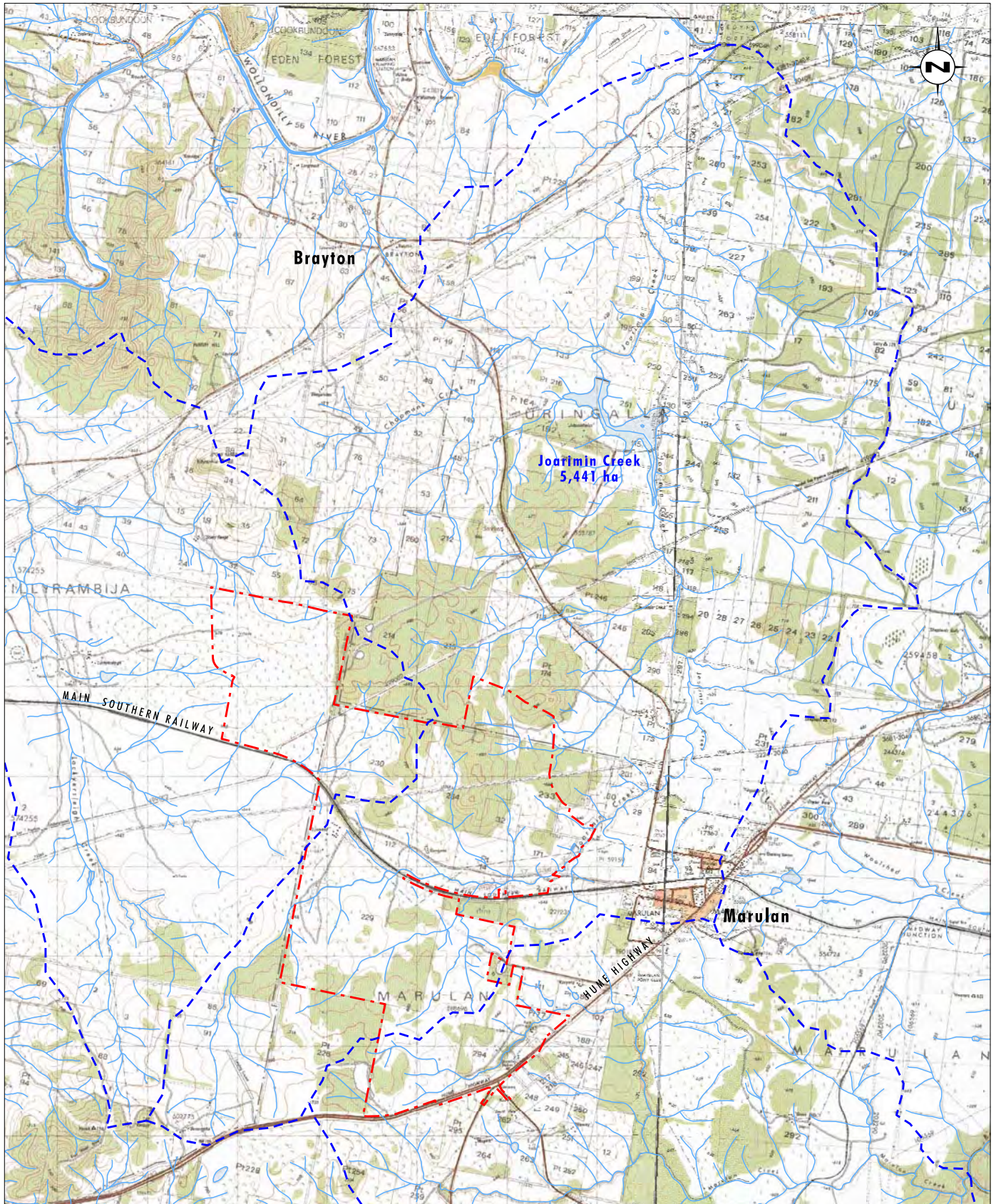


Image Source: 1:25 000 Topographic Maps LPI NSW 2000

0 1.0 2.0 3.0 km
1:60 000

Legend

- ▭ Approved Project Area
- ▭ Catchment Boundary

FIGURE 2

Joarimin Creek Catchment Area

3.0 Development within Joarimin Creek Catchment

3.1 Construction Phase

At the time of this management plan review, construction activities to be undertaken at Lynwood Quarry within the Joarimin Creek Catchment include culverts, sediment dams and catch drains associated with the quarry pit and the to be developed overburden and product emplacement areas.

3.2 Operational Phase

The ignimbrite pit, which is currently under development, will continue to operate, with operations progressively transferring over to the granite pit once it is fully established.

3.3 Potential Surface Water Impacts

The potential surface water impacts due to construction and operation of Lynwood Quarry within the Joarimin Creek catchment were assessed as part of the Lynwood Quarry Modification Project Environmental Assessment (Umwelt, 2015). A summary of these impacts is provided below.

The outcomes from the surface water assessment undertaken for the EA indicate the Lynwood Quarry operations will not significantly alter the flow regimes or annual flow volumes in Joarimin Creek in terms of peak discharges, flood levels or peak in-stream velocities either upstream or downstream of Lynwood Quarry. As a result, the quarry is not expected to adversely impact on channel stability or in-stream habitat.

The assessment also found that Lynwood Quarry will not adversely impact water quality in Joarimin Creek or the subsequent drainage systems.

As water use within the catchments is regulated by Water Sharing Plans, and Holcim's take of clean water catchment will be on average within its harvestable rights, Lynwood Quarry is not expected to have a significant impact on downstream water users.

4.0 Works within the Riparian Zone and Management Measures

4.1 Catchment Wide Management Measures

4.1.1 Construction Phase

Management measures in the Joarimin Creek catchment for construction activities will focus on erosion and sediment control measures as well as the capture and treatment of runoff from disturbed areas. Erosion and sediment control measures will be developed as part of construction and operational plans to satisfy the following objectives:

- comply with appropriate statutory requirements, including the development consent and Environment Protection Licence (EPL)
- carry out all construction in accordance with relevant guidelines for erosion and sediment control, including Landcom (2004) and DECC (2008) guidelines
- identify and manage potential erosion and sedimentation impacts that may occur as a result of quarrying and associated operations, and
- develop effective mechanisms for monitoring and maintenance of erosion and sediment control measures.

These controls will be designed and constructed to a standard consistent with *Managing Urban Stormwater: Soils and Construction* (the Blue Book) Volumes 1 and 2E (Landcom, 2004 and DECC, 2008).

The measures to be adopted during construction activities to control the quality of runoff in Joarimin Creek catchment will include but are not limited to:

- construction and regular maintenance of catch drains, sediment fences and sedimentation dams (as required) to contain sediment downslope of disturbed areas
- construction of all sediment dams required for the development early in the construction period and prior to ground disturbance as per the Blue Book
- seeding and controlled fertilising of all disturbed areas are to be rehabilitated to provide for rapid grass cover. Areas will be seeded with a grass mix specific to the needs of the area to be grassed, and
- development of an inspection, maintenance and management system to ensure the erosion and sediment control measures for the construction phase are performing adequately.

4.1.2 Operational Phase

Water quality controls will also be implemented during quarry operations to minimise surface water impacts. In Joarimin Creek catchment, these measures will include:

- clearly identifying and delineating areas required to be disturbed and ensuring disturbance is limited to those areas, clearing as little vegetation as required and minimising machinery disturbance outside of these areas to prevent soil compaction and contamination

- limiting the number of roads and tracks established
- construction of sediment dams to capture and treat runoff from disturbed catchment areas.
- construction of drains to convey clean runoff away from disturbed areas and prevent clean runoff contamination where possible
- constructing road and earthworks cut and fill batters at slopes of 1V:3H or less, where possible, to maximise long term stability
- reshaping, topsoiling and vegetating road and cut and fill batters as soon as practical
- progressively stripping and stockpiling topsoil for later use in rehabilitation and where possible, direct application
- regular maintenance of all erosion control works and rehabilitated areas
- regular inspections of access tracks/roads to ensure drainage is working effectively and that the tracks/roads are stable, particularly after rain
- progressive rehabilitation of emplacement areas to reduce erosion, and
- prompt revegetation of areas as soon as earthworks are complete.

The Lynwood Quarry Senior Environment and Community Liaison will inspect Joarimin Creek within the project area on an annual basis (and after major storm events) to identify the condition of the riparian zone and any significant erosion or creek stability issues. Controls will be implemented where practical to address any new issues identified as part of these inspections.

Annual weed and pest inspections will also be undertaken in the riparian zone in accordance with the RLMP (Umwelt, 2016), with controls implemented as required.

4.2 Identified Work Sites

Construction of the original work sites identified in the Joarimin Creek RAMP (Umwelt, 2006), is mostly complete. Some sites are not required as a result of the recent modifications to the project.

In accordance with Part 3, Chapter 3 of the WM Act, a CAA is required if any of the following are to be undertaken within Waterfront land:

- the erection of a building or the carrying out of a work (within the meaning of the *Environmental Planning and Assessment Act 1979*)
- the removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise,
- the deposition of material (whether or not extractive material) on land, whether by way of landfill operations or otherwise; and the carrying out of any other activity that affects the quantity or flow of water in a water source.

There are currently no identified work sites within the Joarimin Creek catchment that will require a CAA. All works within waterfront land of the Joarimin Creek catchment area have been constructed.

Other works to be undertaken within the riparian zone are described in **Section 4.3**.

4.3 Works within Riparian Zone

Sites J4, J6, and J10 are works locations within riparian zones based on creek lines as shown on the topographic map series where there are no defined beds or banks as shown in **Appendix A**, and therefore a CAA is not required for these sites. These sites are shown on Figure 3 with the works shown in the context of the Joarimin catchment area shown on **Figure 4**.

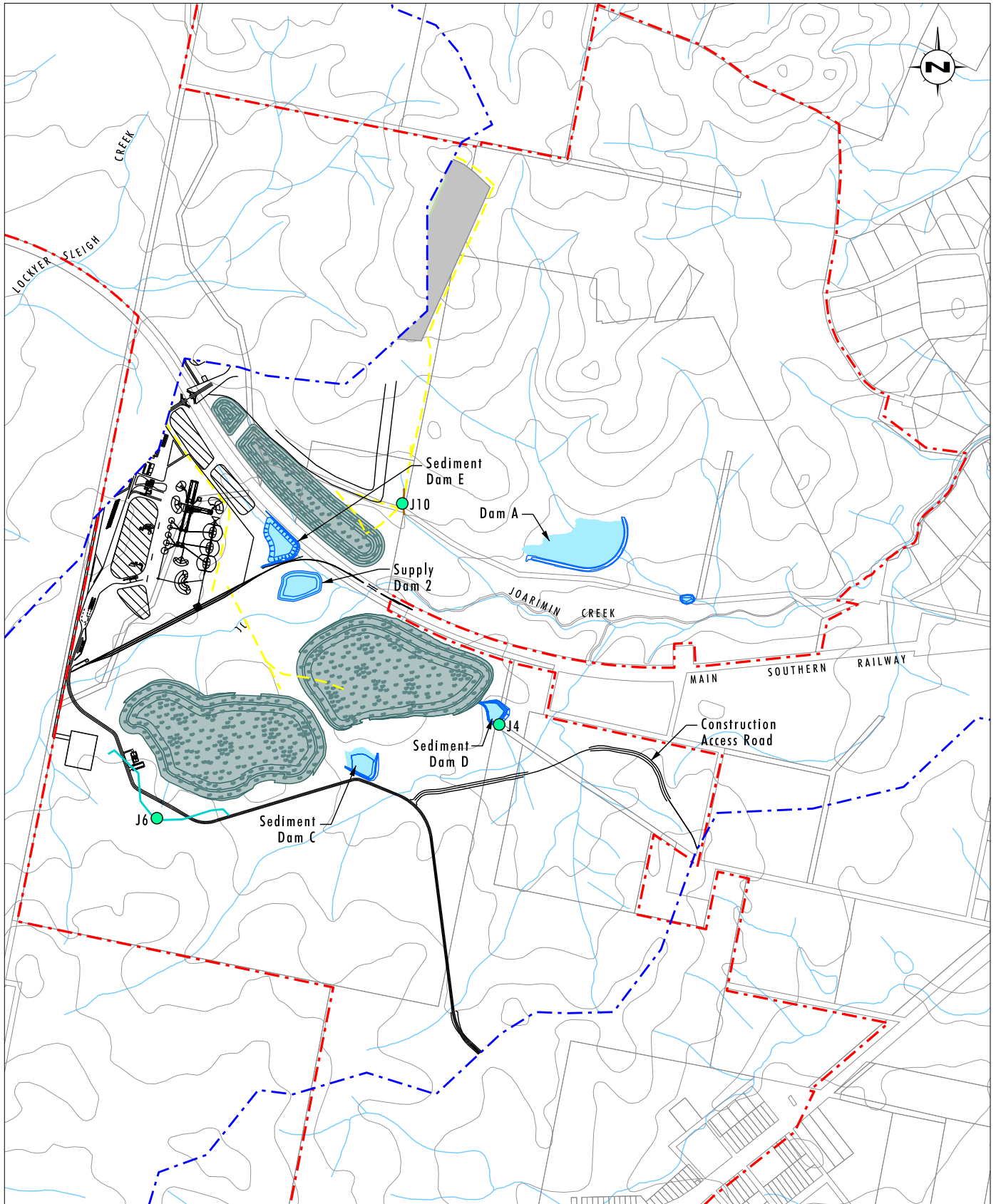
4.3.1 Site J4

Site J4 is the location for Sediment Dam D (refer to Figure 3 and Figure 4). The sediment dam will be constructed prior to development of the Eastern Product Emplacement Area. The Site is shown in **Plates 1 and 2 of Appendix A**.

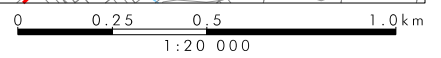
Sediment Dam D will capture runoff from the Eastern Product Emplacement Area and have a capacity of 7.8 ML. The soils in the dam construction area will be treated with gypsum to reduce dispersibility and improve soil structure after excavation. Rip rap will be placed along the length of the spillway to prevent scouring. This rip rap will consist of well graded rock to a depth of 300 mm with $d_{50} = 100$ mm and will extend 20 m downstream of the end of the spillway. Sediment fences will be placed upstream and downstream of the work area during construction to minimise sediment laden run-off. The disturbed areas will be topsoiled and seeded with grass species to aid stability. This will assist in reducing erosion and sediment transport potential.

4.3.2 Site J6

Site J6 is located between two catchment drains to the south of the Western Product Emplacement Area (refer to **Figures 3 and 4**). The drains will be constructed as part of the construction of the Western Product Emplacement Area. The Site is shown in **Plate 3 of Appendix A**. Sediment fences will be placed upstream and downstream of the work area during construction to minimise sediment laden run-off. The disturbed areas will be topsoiled and seeded with grass species to aid stability. This will assist in reducing erosion and sediment transport potential.



Data Source: LPI (2009), Holcim



Legend

- - - Approved Project Area
- Quarry Pit
- Emplacement Area
- Dam
- Overburden Emplacement Area
- Culvert
- Haul Road
- Catchment Boundary
- Work Site

FIGURE 3

Proposed Work Sites within Joarimin Creek Catchment

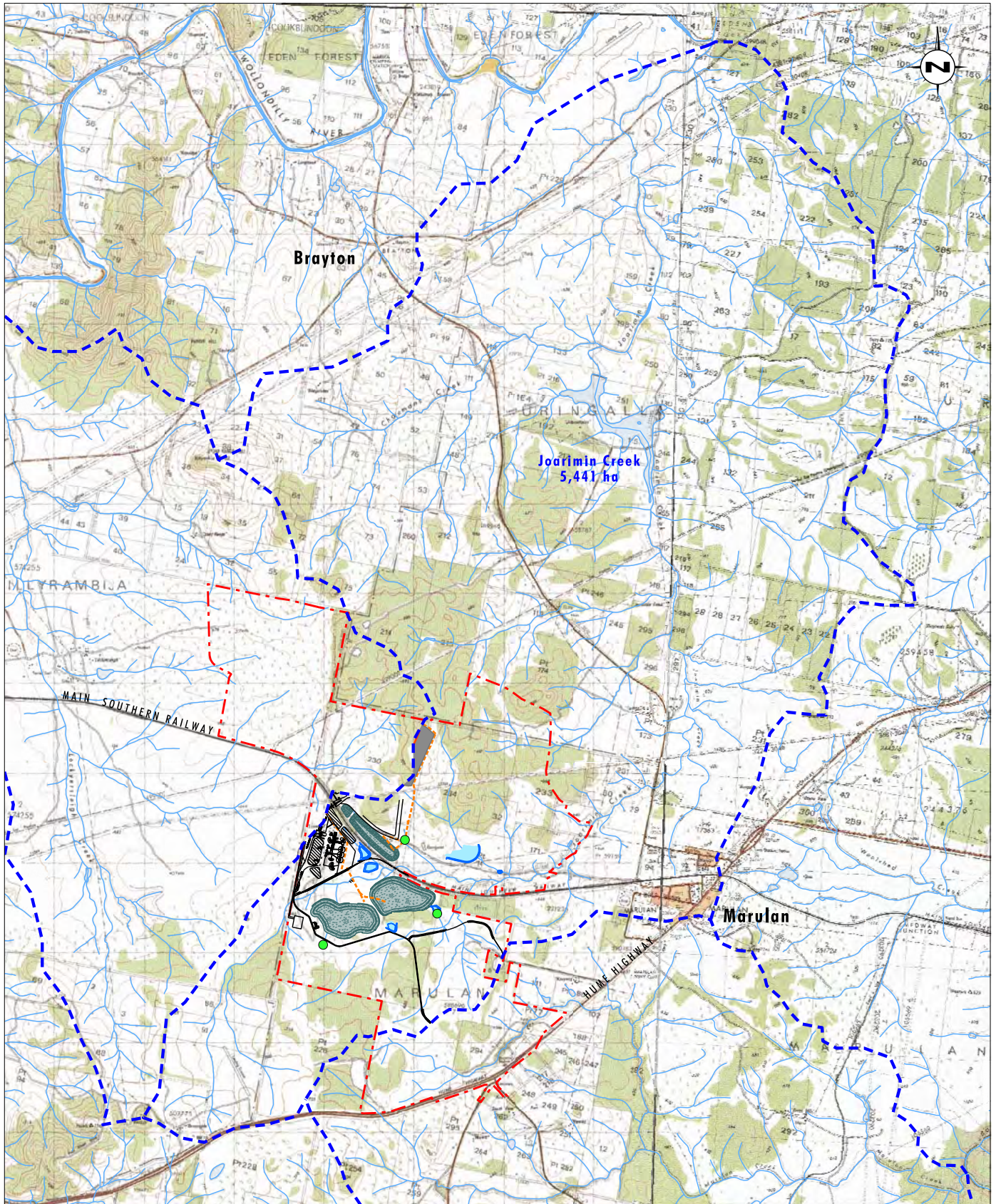


Image Source: 1:25 000 Topographic Maps LPI NSW 2000

0 1.0 2.0 3.0 km
1:60 000

Legend

- - - Approved Project Area
- - - Catchment Boundary
- Quarry Pit
- Emplacement Area
- Dam
- Overburden Emplacement Area
- Culvert
- - - Haul Road
- Work Site

FIGURE 4

Joarimin Creek Catchment Area
and Proposed Work Sites
Within Catchment Area

4.3.3 Site J10

Site J10 is on a tributary of Joarimin Creek adjacent to a proposed haul road running to the north of the Rail Overburden Emplacement Area (refer to **Figures 3 and 4**). Two culverts will be installed in this area as part of the construction of the haul road (refer to **Figures 3 and 4**). The culverts will each consist of 24 m long twin 675mm pipes of $d_{50} = 200\text{mm}$ well graded rip rap will be placed ten metres upstream and 20 m downstream of the culvert to prevent localised scouring. The Site is shown in **Plate 4 of Appendix A**. Sediment fences will be placed upstream and downstream of the work area during construction to minimise sediment laden run-off. The disturbed areas will be topsoiled and seeded with grass species to aid stability. This will assist in reducing erosion and sediment transport potential.

4.4 Contingency Sediment and Erosion Controls during Construction

A number of erosion and sediment controls have been identified that will be implemented to mitigate erosion and sediment export from disturbed areas during storm events. These measures include:

- where a storm event is imminent, covering disturbed areas within the creek line with geotextile fabric and securing with stakes to reduce erosion potential (where practical to do so in the available time)
- regular inspection of erosion and sediment controls during works and rectification of any damaged controls where it is safe to do so
- installation of additional controls such as sediment fences as required
- construction of erosion and sediment controls within a catchment area prior to disturbing the area for quarry development/construction requirements.

Further erosion and sediment control measures are outlined in the Water Management Plan (Umwelt, 2016) prepared in accordance with Condition 22 in Schedule 3 of the Lynwood Quarry development consent.

4.5 Completion criteria

The preliminary completion criteria for the Joarimin Catchment Area is detailed in **Table 4.1**.

Table 4.1 Riparian Area Preliminary Rehabilitation Completion Criteria for the Joarimin Catchment Area

Objective / Performance Indicator	Preliminary Completion Criteria	Timing
The riparian corridor has been fenced to exclude cattle where required.	Installation of fencing around the perimeter of the corridor to exclude cattle	Within 6 months of implementing the Rehabilitation and Landscape Management Plan
Revegetation works have occurred along Joarimin Creek south of the Main Southern Railway.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing.	When monitoring indicates revegetation has established on disturbed areas and stratum has reached more than 56% established, healthy trees (1.5 to 2m in height) or approximately 10 years from planting.
Nest boxes along Joarimin Creek have been established, monitored and are being maintained.	Nest boxes are being utilised or show signs of use by native species. Each nest box installed should be in good structural condition and functioning in the landscape	Completed within 5 years of clearing activities

Objective / Performance Indicator	Preliminary Completion Criteria	Timing
The site is managing significant weed or feral animal infestations with a demonstrable reduction pre construction.	Weed and pest inspections show No increase in weed population and monitoring indicates the absence of or decline in weed species.	Annual weed monitoring. When monitoring indicates weeds comprise no more than 15% monitoring can be amended to every 3 years. Every 7 years feral animal monitoring is undertaken.
Monitoring has indicated that natural regeneration is occurring.	Signs of recruitment in all stratum or evidence to demonstrate that the ecosystem will progress towards recruitment. More than 56% of trees are healthy and growing and are recognisable as PCT 1330.	When monitoring indicates any revegetation has established and stratum has reached more than 56% establishment or approximately 10 years from any revegetation works.

5.0 Monitoring and Maintenance Requirements

During construction, a permitting process will be implemented as per the EMS and works will be inspected regularly to ensure all required controls are in place and effective. Following the completion of construction works, the work area will be inspected and reviewed against the completion criteria listed in Section 4.5.

During operations, monitoring of the management measures implemented will be undertaken in accordance with the RLMP. Monitoring will also be undertaken after major storm events for erosion and sediment control structures potentially affected. Water quality monitoring will also be undertaken as discussed in the Lynwood Quarry Water Management Plan.

6.0 Responsibilities

The Lynwood Quarry Senior Environment and Community Liaison and Lynwood Quarry Manager will be responsible for the implementation of the requirements of this plan.

7.0 Reporting and Review

The Lynwood Quarry Senior Environment and Community Liaison will report any significant finding regarding the implementation of this plan in Lynwood Quarry Annual Review.

8.0 References

Asset Geotechnical 2005. *Proposed Hard Rock Quarry Marulan –Report on Geotechnical Investigation*. Prepared for Umwelt (Australia) Pty Limited.

Department of Natural Resources, 2003. *Soil Landscapes of the Goulburn Region 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.

Umwelt (Australia) Pty Limited 2005. *Environmental Impact Statement. Readymix Holdings Pty Ltd. Proposed Lynwood Quarry, Marulan*.

Umwelt (Australia) Pty Limited, 2006. *Lynwood Quarry Riparian Management Plan – Joarimin Creek Catchment Area*.

Umwelt (Australia) Pty Limited, 2015. *Lynwood Quarry Modification Project Environmental Assessment*.



APPENDIX A

Plates



PLATE 1
Looking upstream of Site J4



PLATE 2
Looking downstream of Site J4



PLATE 3
Looking downstream of Site J6



PLATE 4
Looking upstream to Site J10



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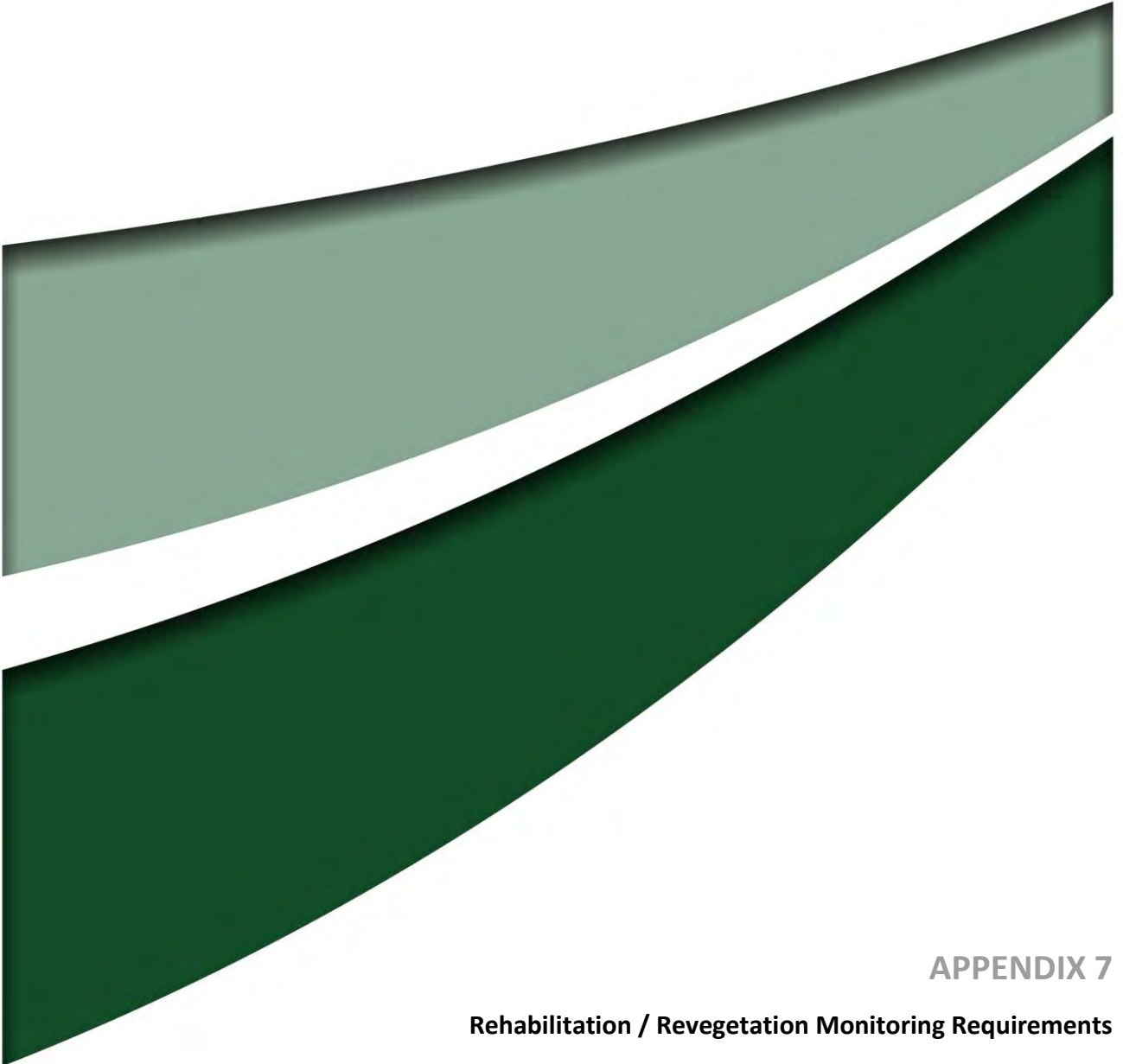
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Brisbane

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APPENDIX 7

Rehabilitation / Revegetation Monitoring Requirements

Annual Monitoring of Rehabilitated Areas

Specifically, the monitoring inspections will assess:

- the extent of the vegetative cover and species diversity, and any requirement for additional revegetation works to be undertaken
- the general health of the vegetation
- any occurrences of weed species in the revegetation area and any requirements for weed control activities
- feral animals and the need for control
- erosion and the need for repair of eroded areas
- fire management
- any signs of disturbance, either by animals or humans
- the success of any management programs implemented following previous monitoring inspections.

The Senior Environment and Community Liaison will inspect the revegetated areas annually for four years from the start of the project. This inspection will include:

- the general health of the vegetation and the need for fertilisation
- the growth of the vegetation and the need to replace any dead plants
- any erosion and the need for sediment and erosion controls to be implemented
- any occurrences of weed species in the revegetation area and any requirements for weed control activities
- signs of disturbance and the need to access controls.

Monitoring of Retained Vegetation

The condition of retained vegetation will be monitored by a suitably qualified and experienced ecologist to identify any change in habitat quality (either deterioration or improvement). As part of the monitoring program, permanent vegetation plots will be established in three different areas:

- Area 1 – within the HMA
- Area 2 – along Joarimin Creek north of the Main Southern Railway
- Area 3 – in the Cultural Heritage Management Zone.

At each monitoring site a permanent 400 m² vegetation plot will be established and marked with metal stakes at each corner to assist in the repeatability of the monitoring. The monitoring inspections will assess the following vegetation characteristics and will be recorded on a standard recording sheet:

- general health of vegetation

- evidence of natural regeneration
- occurrence and abundance of weed species
- signs of disturbance, either by stock or humans
- evidence of feral animals
- any observable impacts of the operations, such as the effectiveness of sediment and erosion control structures.

At each vegetation plot species diversity and structural composition of the vegetation will be recorded. This will allow a comparison of flora species and abundance over time. Photo monitoring will be taken from established photo monitoring points at each monitoring site. This will assist in recording observable changes to the sites over time. The monitoring site locations will be selected and surveyed during the first year of monitoring. Monitoring will be undertaken in the first year of the project and then every three years in accordance with this plan.

Monitoring of Revegetated Areas

Following revegetation works, monitoring will be undertaken by the Lynwood Senior Environment and Community Liaison every six months for three years to assess the progress of the revegetation program with the aim of monitoring plant health and the need for implementation of management works or replacement planting or seeding.

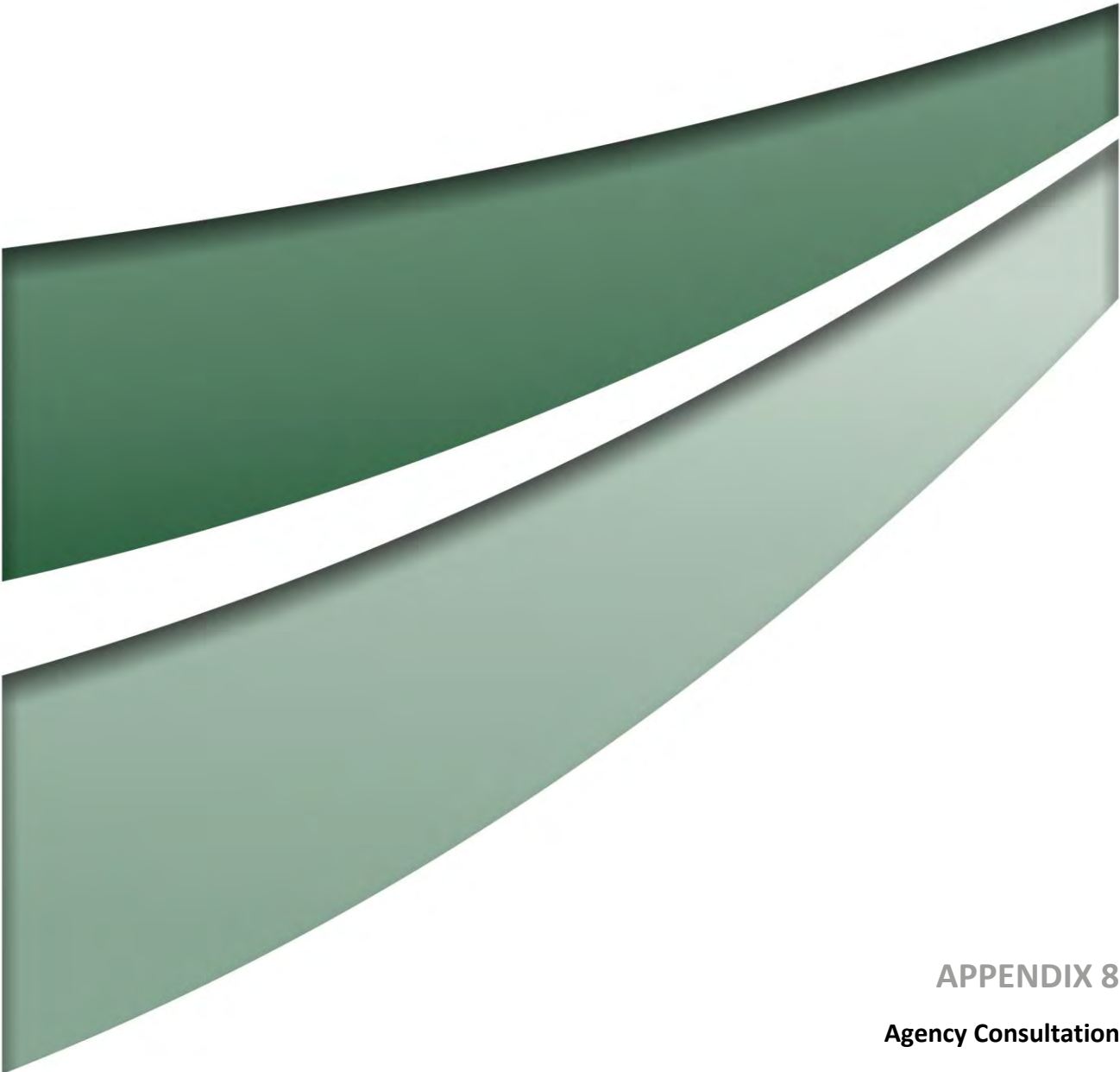
Fauna Monitoring

At each of the monitoring areas (refer to **Section 4.0**) a range of fauna survey techniques will be employed to determine ongoing fauna use of habitat within the project area, particularly focusing on the ongoing presence of threatened species. Monitoring will be undertaken in the first year of the project and then every three years in accordance with this plan.

At each of the monitoring sites the following monitoring work will be completed:

- two hours of spotlighting over two nights
- two diurnal bird census points
- two diurnal herpetological survey areas
- two nocturnal herpetological surveys in appropriate habitat areas
- two Anabat surveys
- hair funnel transects to target ground and arboreal fauna.

In the event that further threatened species are identified within the project area the monitoring program will be reviewed to ensure it adequately monitors these species.



APPENDIX 8
Agency Consultation



Planning Services

Resource Assessments

Name: Margaret Kirton

Phone: 02 9274 6289

Email: margaret.kirton@planning.nsw.gov.au

Ms Alana White
Senior Environment & Community Liaison
Holcim (Australia) Pty Ltd
PO Box 76
Marulan NSW 2579

Alana

Dear Ms White

**Lynwood Quarry (DA 128-5-2005)
Environmental Management Strategy, Water Management Plan and Rehabilitation and
Landscape Management Plan**

Thank you for submitting the abovementioned strategy and plans to the Department.

The Department has reviewed these documents and you are advised that the Secretary has approved the Environmental Management Strategy.

However, the Department considers that the Water Management Plan and the Rehabilitation and Landscape Management Plan need to be revised. Comments on these plans are provided in the attached table.

The Department notes that DPI Fisheries has requested an opportunity to undertake a second review of the draft Water Management Plan. The Department supports this request.

With regards to the Rehabilitation and Landscape Management Plan, the Department has asked OEH's Regional Operations Group- South to review the draft plan and refer any comments directly to Holcim.

Once comments are received from agencies, please revise the draft plans and resubmit to the Department at your earliest convenience.

Should you have any questions about this letter, please contact Colin Phillips on 9274-6483.

Yours sincerely

Howard Reed

Howard Reed

Director

Resource Assessments

As the Secretary's nominee

21.2.17

Attachment

Lynwood Quarry Water Management Plan – prepared by Umwelt (September 2016)

Water Management Plan	Satisfactory (Yes/No)	Comments	Action Required
20. The Applicant must prepare a Water Management Plan for the development to the satisfaction of the Secretary. In addition to the standard requirements for management plans (see condition 2 of Schedule 5) this plan must:			
(a) be prepared in consultation with the EPA, WaterNSW, DPI Water and DPI Fisheries;	No	Agencies have provided detailed comments on the WMP, particularly with regard to water quality criteria. DPI – Fisheries has asked that it be given an opportunity to review the draft plan (once amended) in response to its comments.	Holcim should provide the revised WMP to agencies, as well as the table showing the consolidated agency comments and Holcim's response to each.
(b) be submitted to the Secretary for approval by 30 November 2016, unless otherwise agreed by the Secretary;	Yes	The WMP was submitted 19 Oct 2016	
(c) include a Water Balance;	Yes, included in 3.1 to 3.4, but see comments for Condition 21 below		
(d) include an Erosion and Sediment Control Plan;	Yes, included in Section 4		
(e) include a Surface Water Monitoring Program;	Yes, included as Appendix 2, but see comments for condition 23 below		
(f) include a Ground Water Monitoring Program; and	Yes, included as Appendix 3		
(g) include a Surface and Ground Water Response Plan to address any potential adverse impacts associated with the development.	Yes, included in Section 6		
21. The Water Balance must: (a) include details of all water extracted (including water make), dewatered, transferred, used and/or discharged by quarry; and	No	Please check the second dot point on page 13 as it doesn't make sense – not sure if it is meant to be two or more dot points.	Please amend plan appropriately

<p>(b) describe measures to minimise water use by the development.</p>		<p>In section 3.5, non-committal expressions such as “where practical” and “where appropriate” should be deleted and replaced with clear commitments.</p>	
<p>22. The Erosion and Sediment Control Plan must: (a) be consistent with the requirements of the Landcom’s <i>Managing Urban Stormwater: Soils and Construction</i> manual; (b) identify activities that could cause soil erosion and generate sediment; (c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters; (d) describe the location, function, and capacity of erosion and sediment control structures; and (e) describe what measures would be implemented to maintain (and if necessary decommission) the structures over time.</p>	<p>Yes</p>		
<p>23. The Surface Water Monitoring Program must include: (a) detailed baseline data on surface water flows and quality in Joarimin Creek, Lockyersleigh Creek, and Marulan Creek; (b) surface water impact assessment criteria; (c) a program to monitor surface water flows and quality; (d) a protocol for the investigation of identified exceedances of the surface water impact assessment criteria; and (e) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.</p>	<p>No</p>	<p>Section 4 of this document should refer to the water discharge limits in the consent, particularly for pH, noting that condition 17 of Schedule 3 states that “except as may be expressly provided by a Licence,” the water discharge limits in condition 17 must be complied with. It is not clear how the trigger values for pH in Table 4.1 relate to the limits in the consent. Please reconsider the last paragraph in Section 5.0. Once the WMP is approved by the Secretary, any amendments (such as discontinuing the monitoring of some parameters) need to be approved by the Secretary (following consultation with agencies).</p>	<p>Please amend plan appropriately.</p>
<p>24. The Ground Water Monitoring Program must include: (a) detailed baseline data on ground water levels, flows, and quality, based on statistical analysis; (b) groundwater impact assessment criteria for monitoring bores; (c) a program to monitor regional ground water levels and quality; and (d) a protocol for the investigation of identified exceedances of the groundwater impact assessment criteria.</p> <p>Note: The surface and ground water monitoring programs must be consistent with the current version of <i>Approved</i></p>	<p>Yes</p>		

<i>Methods for the Sampling and Analysis of Water Pollutants in New South Wales (OEH).</i>			
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General comments:

- Please search for and remove references to the quarry being approved for a “30 year” period. It would be clearer to state that Holcim has approval to carry out quarrying operations until 1 January 2038*
- Please include a document control table at the front of this document. During the drafting process, this would provide a useful record of when agencies were consulted and when the document was updated in response*
- Please include an Appendix detailing the agency consultation undertake. Copies of correspondence from agencies should be included.*

Lynwood Quarry Rehabilitation and Landscape Management Plan – prepared by Umwelt (September 2016)

	Satisfactory (Yes/No)	Comment	Action Required
44. Within 6 months of this consent, the Applicant must prepare (and following approval implement) a Rehabilitation and Landscape Management Plan for the development, in consultation with OEH, DPI Water and Council,			
		DPE has contacted OEH (Alison Treweek) who has advised that OEH can provide comments on the draft RLMP. DPE has referred the draft RLMP and a copy of this table to OEH.	Holcim should consider any comments provided by OEH and amend plan appropriately.
(a) describe in general the short, medium, and long-term measures that would be implemented to: <ul style="list-style-type: none"> rehabilitate the site; implement the Habitat Management Area (shown conceptually in Appendix 9), unless this area is incorporated into a conservation area subject to a BioBanking agreement; replace cleared hollow-bearing trees with durable and appropriate nest boxes that reflect the type, size, usability and condition of the hollows to be cleared; manage the remnant vegetation and habitat on the site; and landscape the site to mitigate any visual impacts of the development; 	No	Although the document contains a significant amount of detailed and descriptive information on the actions that will be undertaken to rehabilitate the site and manage the remnant vegetation, it would be significantly improved by the inclusion of specific short, medium and long-term measures as required by this condition. The Department is looking for a description of specific measurable actions and the timeframes in which they will be undertaken. For example, for the HMA, "Barbed wire will be progressively removed from the fences around the HMA. Approx. x m will be removed each year. By xxxx, all barbed wire will be removed"	Please amend plan appropriately.
(b) include Riparian Area Management Plan/s (see condition 45) for those riparian areas to be disturbed in the next 5 years, excluding areas within quarry pits or emplacement areas as agreed with the Secretary;	Yes, but see comments against condition 45 below		
(c) describe in detail the measures that would be implemented over the next 5 years to rehabilitate and manage the landscape on the site;	Yes		
(d) describe how the performance of these measures would be monitored over time	Yes		
(e) set completion criteria for the rehabilitation of the site.	No	The completion criteria in the draft RLMP are not specific. These criteria need to be specific so that in the future it is possible to make a decision on whether or not the	Please amend plan appropriately.

		completion criteria for the rehabilitation of the site have been met and whether the bond can be returned. For example, under HMA, the completion criteria in the draft plan (such as “monitoring has indicated that natural regeneration is occurring” and “the site managing significant weed or feral animal infestations...”) are very vague. Please include clear and measureable completion criteria.	
45.	The Riparian Area Management Plan/s must be prepared by a suitably qualified hydrologist; whose appointment has been approved by the Secretary, and include: <ul style="list-style-type: none"> (a) baseline surveys of creeks, providing existing bed, bank and vegetation information (including representative cross and longitudinal sections), in the areas in which the development is located, excluding the quarry pits and emplacement areas; (b) detailed designs of the proposed works, including any proposed stabilisation, scour protection, and/or enhancement works (including representative cross and longitudinal sections); (c) a description of the measures that would be implemented in the event of flooding during construction/rehabilitation. (d) details of proposed staging of the works; (e) completion criteria for the rehabilitation of the riparian area; (f) a protocol for monitoring the performance of the rehabilitation over time. 	Please update these plans to ensure they reflect the wording of current conditions. Also, in line with the comments above, please reconsider the wording of the completion criteria. Currently, in Section 4.5, the completion criteria relate to construction rather than rehabilitation of riparian areas	Please amend plan appropriately.
<p><i>General comments:</i></p> <ul style="list-style-type: none"> • <i>Please include a conceptual rehabilitation plan that shows the final land use for the various parts of the site. Eg Figure 3.4 should be amended to show which areas are intended to be used for grazing purposes (the emplacements and infrastructure area?) and which will be protected for their biodiversity values when the site is rehabilitated.</i> • <i>The document refers to a Weed Management Plan and a Wildlife Management Plan. Are these meant to be included as appendices to this document?</i> • <i>Please include a document control table at the front of this document. During the drafting process, this would provide a useful record of when agencies were consulted and when the document was updated in response</i> • <i>Please include an Appendix detailing the agency consultation undertake. Copies of correspondence from agencies should be included.</i> 			

----- Forwarded message -----

From: **Michelle Hughes** <Michelle.Hughes@goulburn.nsw.gov.au>

Date: Thu, Aug 11, 2016 at 4:52 PM

Subject: Goulburn Mulwaree Council Comments - Lynwood Quarry Draft Rehabilitation and Landscape Management Plan

To: "alana.white@lafargeholcim.com" <alana.white@lafargeholcim.com>

Good afternoon Alana

Thank you for the opportunity to comment on the Lynwood Quarry Rehabilitation and Landscape Management Plan (July 2016).

Generally, Council considers the document to be a comprehensive assessment and captures the main issues that are necessary for a Rehabilitation and Landscape Management Plan. We would like to provide the following observations:

- The document is not as detailed as expected in terms of the works required to meet the rehabilitation objectives i.e. specific details on planting and/or assisted regeneration techniques that are to be employed in each area.
- It is difficult to assess how the plan responds to site conditions as the plan lacks this detail e.g. are there threatened species or communities that need to be considered and how will rehabilitation/regeneration occur in these areas and what are the rehabilitation priority areas and why?
- The use of swales and drainage areas are supported within the rehabilitated landscape as it more closely mirrors the minor variations in topography expected of an undisturbed site.
- As a general comment the existing riparian plans (appended to this draft plan) are very generic and arguably not detailed enough to inform strategic regeneration works in the long term.

Other observations include:

- There are some inconsistencies in the numbering of the Figures in the text which make it unclear to identify some of the points being raised.
- The reference to grasses and vegetation are frequently general in nature. It may provide clarity to reference particular species outlined in the Appendix as relevant.
- Reporting on the Actions should be extended to include *all* Actions as a summary of achievements for the community.
- The wording around the removal and rehabilitation of the haul roads was unclear - we assume the plan is not referring to the construction of the sealed road from the Quarry to the interchange and in fact refers to internal haul roads within the site.

Should you wish to discuss these points please contact me directly.

Kind regards

Louise

Louise Wakefield
Director Growth Strategy & Culture


P: 02 4823 4480 | **F:** 02 4822 7999

Goulburn Mulwaree Council | Locked Bag 22 Goulburn NSW 2580

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----- Forwarded message -----

From: **Alana White** <alana.white@lafargeholcim.com>

Date: Thu, Jul 28, 2016 at 7:52 PM

Subject: Draft Rehabilitation and Landscape Management Plan

To: warrick.bennett@goulburn.nsw.gov.au

Cc: scott.martin@goulburn.nsw.gov.au, Ian Shenton <ian.shenton@lafargeholcim.com>,

Guy Sibenaler <guy.sibenaler@holcim.com>, Stewart Lloyd

<stewart.lloyd@goulburn.nsw.gov.au>

Hi Warrick,

Please see below a link to the draft Lynwood quarry the rehabilitation and landscape management plan updated as a result of the approved modification DA 128-5-2005 for our grantie pit development.

https://www.dropbox.com/s/xmfgyrwlii2h0o7/3330_R22_Rehabilitation%20and%20Landscape%20Management%20Plan_DRAFT.pdf?dl=0

We're looking forward to Goulburn Mulwaree Councils input and would appreciate feedback by COB 10th August 2016. If you require more time, please let me know.

Hope this finds you well

Warm regards

Alana White

Senior Environment and Community Liaison
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“The 2030 Plan” The LafargeHolcim Sustainability Strategy - Click [HERE](#) for details of the Plan



DOC17/148412
Email: 21/2/17

Ms Margaret Kirton
Senior Planner – Resource Assessments
Department of Planning & Environment
Margaret.Kirton@Planning.nsw.gov.au

Dear Ms Kirton

RE: Lynwood Rehabilitation and Landscape Management Plan

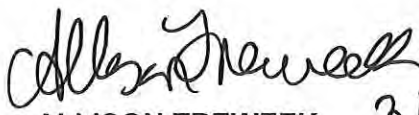
The Office of Environment and Heritage (OEH) has reviewed the draft Rehabilitation and Landscape Management Plan. Detailed comments can be found in Attachment 1. These comments relate to the following:

- The need for mapping to be clear and consistent
- The use of habitat management areas and revegetation areas for the creation of Squirrel Glider species credits under Biobanking
- The addition of feed tree species to the revegetation species list
- The need for clear targets to show success for revegetation and habitat restoration.

We welcome the opportunity to work with Holcim on the incorporation of these comments into the final draft of the Rehabilitation and Landscape Management Plan. We also note that the consent for Mod 4 includes the preparation of a biodiversity offset strategy and the purchase and retirement of biobanking credits to offset the first 5 years of impacts by 31 May 2017. Please contact us if you need any help applying the Framework for Biodiversity Assessment or the Biobanking Assessment Method.

Should you wish to discuss the contents of this letter, please contact Tobi Edmonds on (02) 6229 7094 or by email at tobi.edmonds@environment.nsw.gov.au.

Yours sincerely


ALLISON TREWEEK 31/3/17
Senior Team Leader - Planning
Regional Operations - South East

Enclosure: Attachment 1 - Detailed comments on draft Rehabilitation and Landscape Management Plan; Attachment 2 – Nest Box Design Structure and Attachment by Narawan Williams – Proceedings of the Hollows for Habitat Forum, Sydney, May 2015

ATTACHMENT 1 – Detailed comments on draft Rehabilitation and Landscape Management Plan

Figures 3.1–3.4

These maps should be redrawn to clarify the location of the Ignimbrite Pit and the Granite Pit. The existing offset areas for Mod 3 need to be differentiated from those required for Mod 4.

Figures 3.1–3.3 should show a time sequence of works so that the reader can see what works will be done where and when.

3.3.1 Quarry Pit Rehabilitation

If the quarry pit rehabilitation is expected to be at the end of the 30 years, structuring Section 3.3 in the sequential order of rehabilitation works would make the process easier to understand.

3.3.2 Emplacement Area and Amenity Bund Rehabilitation

A map should be included in Section 3.3, showing which areas will be rehabilitated and to what Plant community types.

3.8.1 Maintenance of Habitat Management Areas

Figure 3.5 seems to include another offset area that was not included in the other maps.

The riparian species to be established along the creek line should include *Acacia mearnsii* and *A. dealbata* as a food source for Squirrel Gliders who would be expected to move through the habitat management areas.

3.8.2 Enhancement of Arboreal Habitat

This is part of the Biodiversity Offset Strategy required to fulfil the credit requirement of the Framework for Biodiversity Assessment (FBA). OEH Regional Operations South East, have consulted with the Biobanking team from OEH's Environmental Programs Branch and have developed the following method which may create biobanking species credits for Squirrel Gliders:

1. Almost all of Potential On-site Offset is PCT 1093 (Red Stringybark - Brittle Gum - Inland Scribbly Gum dry open forest of the tablelands, South Eastern Highlands Bioregion (HN570)), which is identified in the TSPD as being Habitat for Squirrel Glider.
2. The NSW Scientific Committee – Review of Current Information in NSW states “*that Mean home range is 3-9 ha in coastal habitats and 3-4 ha in productive inland habitat fragments. Interspecific aggression toward Sugar Gliders occurs, but does not fully exclude the smaller species from Squirrel Glider territories.*” Given that PCT 1093 normally occurs in low productivity landscapes we could be generous and say that a home range might be closer to 9 ha and round up to 10.
3. A Squirrel Glider group will use up to 20 hollows per home range.
4. Therefore in order to generate species credits we would want to see a hollow density of 20 hollows per 10 ha. A survey is needed establish the presence of Squirrel Gliders on site or to establish if there are more than one in the creek line and where they are moving through the landscape. Any hollows greater than 2.5 cm in diameter can be considered to be usable by Squirrel Gliders.
5. Figure 1 (below) shows the potential offset area with 2 assessment/management options
 - a. Split the existing remnant veg (Green) into roughly 10 ha areas (square/blocky lines) and survey each one to determine if there are at least 20 hollows in each. Once you reach 20 hollows in a given area you move on to the next one. The areas that have 20 hollows can be mapped as Squirrel Glider habitat. The ones that don't will need to have a management action included for that area which will require the addition of hollows¹. The number of hollows will vary depending on the existing resource. Any

¹ Installation of hollows can be in the form of hollow branches with access holes and cavities which will meet the needs of squirrel gliders, habitat pruning, or the installation of hollow bearing trees taken from the impact site and imbedded in concrete. Nest boxes should only be used if they can be built to last up to 15 years and provide thermal and habitat conditions similar to those of natural hollows. There will need to be a species management plan written into the Biobanking Agreement which specifies how the needs of Squirrel Gliders will be met by the installation program.

installation of hollows would need to be designed as a long-term program (until natural hollows form). An annual monitoring program would be needed to check each installed hollow and replace any that have been damaged or are overtaken with feral bees. Attachment 2 contains the design and construction requirements of any nest box program.

- b. The mostly grassland (Native and exotic) areas shown in orange on Figure 1 will need to have management actions which require revegetation with feed resource species and the addition of hollows to meet the 20 hollows/10ha requirement.

Please note that Figure 3.5 shows an area hatched in yellow as being an 'Existing Approved Habitat Management Area'. That area cannot be used to generate Squirrel Glider species credits required as part of the Mod 4 consent.

5.0 Completion Criteria

Third dot point at both 'Revegetated Areas' and 'Habitat management Area' needs to clarify the target for successful management. We suggest the following:

The site has a minimum impact from feral herbivores. Weeds comprise no more than 10% cover

Appendix 2

Need to include *Acacia dealbata* as a feed tree source for Squirrel Gliders

Appendix 4

There needs to be a map at the start of each Appendix which clearly shows the Sites listed to give a context for work.

4.2.2 Site M2

There is no Figure 4.1 if one is put in, it needs to show the 'no go' zone.

Sixth dot point, No fertilizer is to be used and only native grasses planted.

4.3 Contingency sediment and erosion controls during construction

Need to ensure that this section is consistent with and references the 'Blue Book' (*Managing Urban Stormwater: Soils and Construction Volumes 1 and 2* (Landcom 2004))

Appendix 7

This section needs to include a map showing each rehabilitation/revegetation area, the plant communities that will be planted there and the staging of the planting.

Need to include a detailed monitoring schedule and targets by which to assess success (e.g 80% survival rates in trees and shrubs).

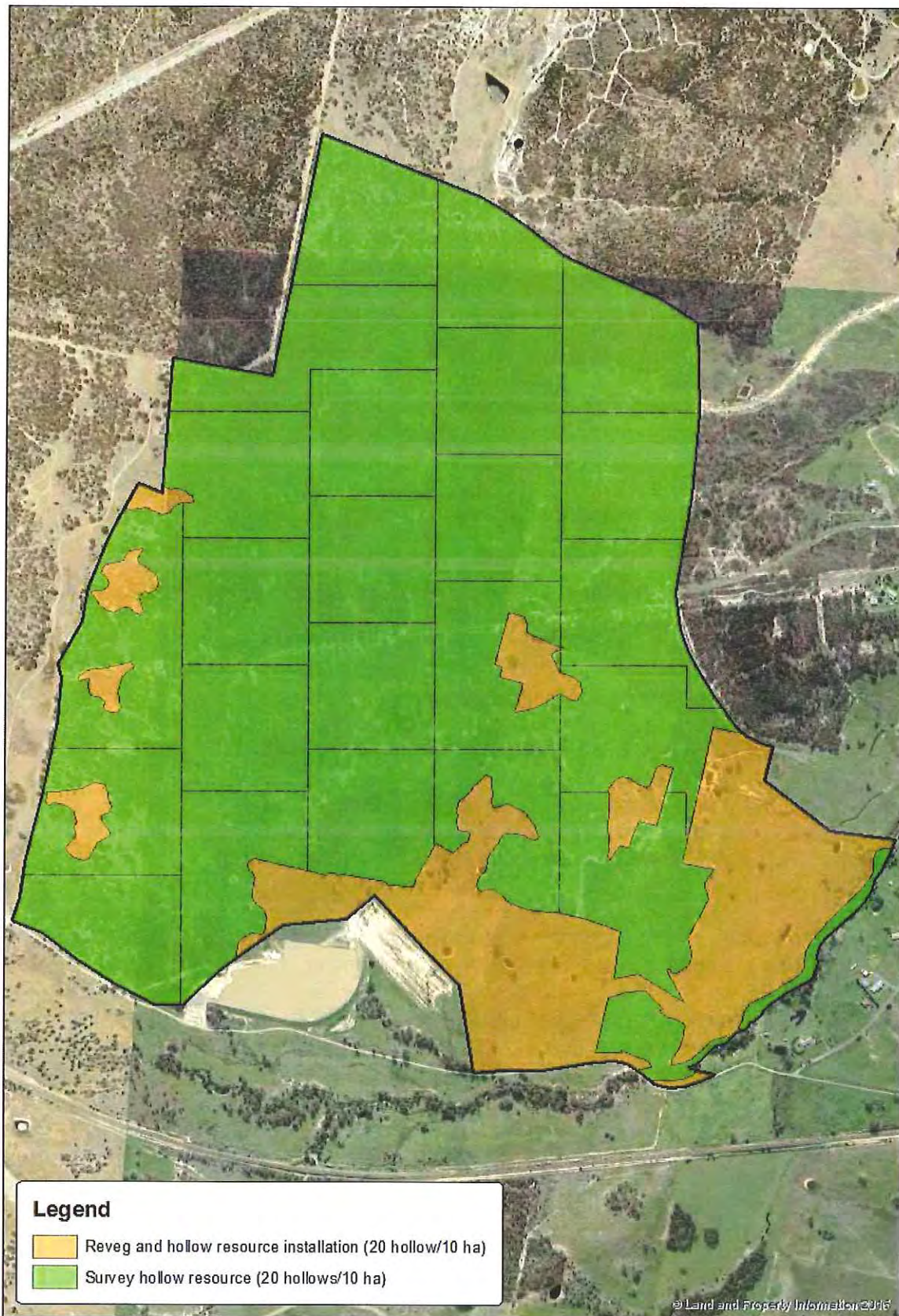


Figure 1. Survey cells for establishing Squirrel Glider Credits

**ATTACHMENT 2 – Nest Box Design Structure and Attachment by Narawan Williams –
Proceedings of the Hollows for Habitat Forum, Sydney, May 2015**



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